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Integrating Musi River as Local Wisdom with the SETS Approach: Evaluating the Effectiveness of a Physics E-Module on High School Student Test Performance

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Abstract: The integration of local wisdom with the approach of science, environment, technology and society (SETS) in the development of e-modules of physics presents significant progression in educational methodologies. The research was conducted on students of SMAN 16 Palembang class XI. The instruments used in the research are documentation, walkthroughs, questionnaires and tests. The research results were obtained based on an expert review that the e-module developed was declared very valid with an average of 4.34 in terms of material, media and language aspects. At the One-to-One stage, an average of 4.17 was obtained in the practical category. At the Small Group stage, an average of 3.81 was obtained in the practical category. In the Field Test phase, it has an n-gain score of 0.72 which is in the high category and a percentage of 71.96% in the quite effective category. In conclusion, to evaluate the effectiveness of an e-modules of physics that integrates local wisdom and setting sets clarifies a promising methodology for contemporary education. The intersection of local wisdom and scientific education thus portrays a convincing view for future pedagogical approaches in high schools, defending the learning that is significant and impactful.

Keywords: musi river, local wisdom, e-module

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1. Introduction

Local education based on wisdom plays a crucial role in preserving the regional cultural identity, with significant contributions from the government, society and young people. The integration of local cultural values in education promotes a sense of pride and belonging among students, thus strengthening their cultural identity (Mulyana, 2024). Governments are decisive in the formulation of policies that promote local wisdom in the curricula, ensuring that these values are systematically incorporated into educational paintings (Sabani & Purnewan, 2023). In addition, social support is vital, since community members can share traditional knowledge with educational institutions, filling the gap between cultural heritage and formal education (Arsal, Setyowati and Hardati, 2023). The involvement of students is also essential in this process. Students act as cultural ambassadors who, through local education based on wisdom, can revitalize traditions and practices that otherwise could be lost (Anwar, Aziz and Susanti, 2020). For example, ethno-pedagogy as an approach promotes local wisdom within education to the character, making learning more relevant for the cultural contexts of the students (Sakti, Endraswara and Rohman, 2024). Furthermore, embracing local wisdom not only helps in the development of the character, but also promotes sustainability in the conservation of cultural heritage (Lusianawati et al., 2023). Collectively, these efforts contribute to a cohesive society, facilitating peace and understanding in multicultural environments (Harefa, 2024; Hasanah, Hefniy and Backpacks, 2023).

The integration of local wisdom in scientific education is crucial to improve scientific literacy in Indonesia and face the challenges highlighted by the results of Pisa. The relevance of local contexts in learning improves involvement and understanding, as highlighted by Verawati and Wahyudi (2024) and Setyorini et al. (2022), who noticed significant gains in scientific literacy through the local integration of wisdom. Arrafi et al. (2023) have shown that a learning model based on problems based on local wisdom effectively improves students' abilities. In addition, Nazhifah et al. (2022) underlined the potential of technology to evaluate these skills. According to Rubini et al. (2022), local assessments based on wisdom can improve literacy, further supported by Hastuti et al. (2020) and Nurvitasari et al. which identify the needs for custom learning media. Agustinaningrum and Deta (2025) have highlighted the learning methods of successful physics that incorporate local elements, while Jumriani and Prasetyo (2022) have outlined the importance of powerful local resources. Finally, Suryanti et al. (2020) have provided insights on effective educational materials, underlining the need for local wisdom to promote scientific literacy and, ultimately, improve educational results in Indonesia.

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The integration of local wisdom with science and technology in physical education at high school students significantly improves the involvement of students and cultural relevance. This approach promotes a holistic learning experience by connecting traditional knowledge with modern scientific principles. Yuliana et al. (2023) They underline the importance of developing educational materials that are rooted in the local context, suggesting that culturally relevant contents can improve the motivation of students. Also, Nabila et al. (2023) show that incorporating local wisdom into the scientific modules allows students to see the applications of the real world of their learning. Using local examples of Palembang, such as the traditional house Limas, Melinia and Yusup (2024) have discovered that students develop better cognitive skills. In addition, Nadia et al. (2024) highlight how the activities of physical education infused of local cultural practices can improve collaboration between students. Overall, the integration of local wisdom contributes significantly to the creation of an engaging and simultaneously relevant educational experience (Yuliana et al., 2021).

Local wisdom around Musi River enhances significantly the understanding of fundamental concepts of physics, such as speed, acceleration and strength, particularly in the context of boat navigation and the dynamics of the river. For example, local fishermen employ the traditional knowledge of river currents to optimize their travel speed, incorporating the concept of speed (Rizkina et al., 2024). Observations on changing water levels and flow dynamics inform their understanding of acceleration as they adjust their navigation strategies (Zulirfan et al., 2023). In addition, the force exerted by water in boats exemplifies Newton's laws in real -world applications (Marianus & Damaris, 2021). This integration of physics and cultural practices provides profound information about the relationship between natural phenomena and community practices, emphasizing the relevance of ethnoscience in education (Pryke, 2023; Pastore, 2023). The principles of physics are not only theoretical, but are intertwined with the lived experiences of local communities (Bader, 2021; Guillen, 2021). The study of these interactions illuminates the application of scientific principles in various contexts, providing a richer understanding of cultural traditions and physical science.

The integration of local wisdom in educational resources, in particular through e-modules, has gained traction in improving students' learning experiences. This study explores the development, practicality and effectiveness of an e-module of physics based on local wisdom that uses the scientific, environmental, technological and society approach (SETS) for high school students. The research shows the process of validating the e-module, underlining its alignment with local culture and relevance for the daily life of the students.

2. Method

The Rowntree model, initially established in educational contexts, demonstrated significant applicability in the field of book product development, facilitating a structured approach to content creation and student involvement. Model concepts include clear goals, systematic development processes and iterative feedback mechanisms (Chrystal, 2021). In emphasizing these principles, the model supports the creation of educational resources that meet the student's effectively needs (Marlina & Yusup, 2025; Pratita & Djahir, 2021).

The benefits of employing the Rowntree model in the editorial industry are multiple. It allows the generation of high quality materials that improve understanding and retention (Sangadji & Sangadji, 2022). In addition, developers can create versatile learning tools, such as electronic modules and interactive digital content, adapted to various learning environments, as highlighted in several studies (Saidah & Damariswara, 2021; Wahidah et al., 2021). In addition, the impact of the Rowntree model extends to the adaptation of traditional publication practices to incorporate technological advances. As evidenced during COVID-19 pandemic, the model facilitated the development of hypertext-based materials and digital leaflets that promote active learning (Arini & Aryadi, 2022; Nurvita et al., 2022). Overall, the Rowntree model presents a robust structure for the evolution of book product development, promoting innovative and responsive educational resources (Sadly & Akhsan, 2023; Sangadji et al., 2024).

The development model used is the Rowntree model. This model is used because it focuses on product development. Below is a picture of the Rowntree model.

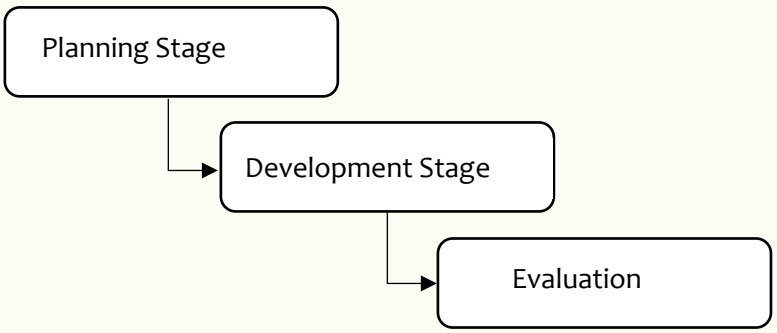

Figure 1. Research Stages

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Based on the picture above, the Rowntree model has three stages, namely planning, development and evaluation. The evaluation stage uses formative evaluation from Tessmer which consists of self-evaluation, expert review, one to one, small group, and field test.

The subjects of this research were students of SMA Negeri 16 Palembang. The class used in this research is class XI. The data collection techniques are as follows: (a) Documentation is used to collect research support sources; (b) Walkthrough is used at the expert review stage; (c) Questionnaires are used at the small group stage; (d) Tests used at the field test stage are pre-test and post-test.

The Walkthrough data analysis technique uses qualitative descriptive data analysis to see the validity of the e-module. The scores obtained are calculated as the average value. Next, the averages obtained are categorized based on the following table.

Table 1. Validation Level Categories

Average Score Answers	Classification
4,21 - 5,00	Highly Valid (HV)
3,41 - 4,20	Valid (V)
2,61 - 3,40	Sufficiently Valid (QV)
1,81 - 2,60	Invalid (I)
1,00 - 1,80	Strictly Invalid (SI)

The questionnaire uses qualitative descriptive data analysis techniques to see the practicality of e-modules. The scores obtained are calculated as the average value. Next, the averages obtained are categorized based on the following table.

Table 2. Practicality Level Categories

Average Answer Score	Practicality Classification
4,21 - 5,00	Very Practical (VP)
3,41 - 4,20	Practical (P)
2,61 - 3,40	Quite Practical (QP)
1,81 - 2,60	Inpractical (I)
1,00 - 1,80	Strictly Inpractical (SI)

The tests are pre-test and post-test using quantitative descriptive data analysis techniques to see the effectiveness of the e-module on student test results. Next, the pre-test and post-test results are calculated using the Average Normality Gain Test. Normalized gain formula according to Hake R.R (Hake, 1999).

$$< g >= \frac{S_f - S_i}{S_m - S_i}$$

Then the normalized gain value <g> obtained is analyzed according to the following categories.

Table 3. Distribution of Gain Scores

N-Gain Value	Category
g > 0,7	High
0,3 ≤ g ≤ 0,7	Medium
g < 0,3	Low

Then the percentage of normalized gain value <g> obtained is analyzed according to the following categories.

Table 4. Distribution of Gain Scores Based on Percentage

Percentage (%)	**Interpretation**
< 40	Ineffective
40 - 55	Less Effective
56 - 75	Quite Effective
> 76	Effective

3. Result and Discussion

Planning Stage

The planning stage begins with a needs analysis aimed at collecting data and information as a supporting basis for this research, such as the target students who are the objects of this research are students in class XI, the teaching material used is dynamics material in class

The supporting sources in making the e-module being developed are as follows: (a) A class XI physics book published by Yrama Widya written by Marthen Kangian and Adrian Pasca and a physics book published by the Ministry of Education, Culture, Research and Technology for class XI; (b) The journal used is a journal related to the local wisdom of the Musi River, South Sumatra; (c) YouTube sources are used to display videos related to the phenomenon of Newton's Law in an effort to create e-modules that are interesting and not watched; (d) Videos and pictures taken directly at the Musi River location in an effort to increase students' understanding of local wisdom and study physical phenomena from these pictures and videos; and (e) The Flipbook website is really needed to make electronic teaching modules efficient and practical to use.

Development Stage

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The development stage in this research begins with creating a teaching module or lesson plan. After that, prepare the research instrument by making a validation questionnaire, one to one questionnaire, small group questionnaire and pretest and posttest questions. The next process is to create an e-module script which then becomes a reference in creating the e-module

The process of creating e-modules requires supporting media, namely videos and images which can be taken directly or sourced on the internet. The e-module format used is in accordance with commonly used writing rules. The teaching modules that were developed were then made in electronic form with the help of the Flibbook website.

Evaluation Stage

Self-Evaluation

This stage begins with a re-examination of the Newton's Laws e-module that has been developed, then revisions are made to the learning objectives, learning indicators, images used, and design. If there is a mistake, do it yourself.

This stage is a validation stage carried out by the validator. This validation stage is a continuation stage of the self-evaluation stage. At this stage the e-module is given to experts for validation. The assessment stage includes three aspects, namely material, media and language. The following are the validation results from three material experts on the e-module developed.

Table 5. Material Expert Validation Results

Validator	Amount	Average	Category
Validator 1	29	4,14	Valid
Validator 2	30	4,29	Very Valid
Validator 3	31	4,43	Very Valid
Amount	90	4,29	Very Valid

Based on the table above obtained from material experts, the result is 4.29 and is in the very valid category.

The following are the validation results from three media experts on the e-module developed.

Table 6. Media Expert Validation

Validator	Amount	Average	Category
Validator 1	21	4,20	Valid
Validator 2	22	4,40	Very Valid
Validator 3	23	4,60	Very Valid
Amount	66	4,40	Very Valid

Based on the table above obtained from media experts, the result is 4.40 and is in the very valid category.

The following are the validation results from three linguists regarding the e-module developed.

Table 7. Linguistic Validation

Validator	Amount	Average	Category
Validator 1	27	4,50	Very Valid
Validator 2	26	4,33	Very Valid
Validator 3	25	4,17	Valid
Amount	78	4,33	Very Valid

Based on the table above obtained from linguists, the result was 4.33 and is in the very valid category.

From the table, the validation results of material experts, media experts and language experts can be summarized as in the table below:

Table 8. Material, Media and Language Validation Results

Validator	Average	Category
Material Expert V1	4,14	Valid
Material Expert V2	4,29	Very Valid
Material Expert V3	4,43	Very Valid
Media Expert V1	4,20	Valid
Media Expert V2	4,40	Very Valid
Media Expert V3	4,60	Very Valid
Linguistic Expert V1	4,50	Very Valid
Linguistic Expert V2	4,33	Very Valid
Linguistic Expert V3	4,17	Valid
Average amount	**4,34**	**Very Valid**

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Based on the table above, it can be seen that the expert research results have an average of 4.34 with a very valid category. It can be concluded that the development of the e-module studied is worthy of testing with revisions according to suggestions.

One-to-One Evaluation

This evaluation stage begins with selecting three class XI students. Three students were selected by the physics teacher at SMA Negeri 16 Palembang. The selection of students is based on varying abilities. The product at the one-to-one evaluation stage is called prototype 1. The results of the practicality questionnaire at the one-to-one stage can be seen in the following table:

Table 9. Practicality Questionnaire Results at the one-to-one Stage

Respondent	Amount	Average	Category
Respondent 1	43	4,30	Very Practical
Respondent 2	42	4,20	Practical
Respondent 3	40	4,00	Practical
Amount	125	4,17	Practical

Based on the table above, it can be seen that the assessment results of the three students have an average of 4.17 in the practical category

Small Group

This stage was carried out after prototype 1 was revised. This stage involved nine students with varying levels of ability. The results of the practicality questionnaire at the small group stage can be seen in the following table:

Table 10. Results of the Practicality Questionnaire at the Small Group Stage

Respondent	Amount	Average	Category
Respondent 1	36	3,60	Practical
Respondent 2	38	3,80	Practical
Respondent 3	43	4,30	Very Practical
Respondent 4	35	3,50	Practical
Respondent 5	38	3,80	Practical
Respondent 6	41	4,10	Practical
Respondent 7	38	3,80	Practical
Respondent 8	34	3,40	Quite Practical

Respondent	Amount	Average	Category
Respondent 9	40	4,00	Practical
Amount	343	3,81	Practical

Based on the table above, it can be seen that the assessment results of nine students have an average of 3.81 in the practical category.

Field Test

In the final stage, prototype 2 has been revised and produced a product in the form of a valid and practical e-module. The e-module is applied to classes with a total of 35 students. Before implementing the e-module, researchers measured the extent of students' ability to master the material by distributing pre-test questions. Next, wisdom-based e-modules are applied in class. After that, the researchers distributed post-test questions to measure the effectiveness of using local wisdom-based e-modules on student learning outcomes. The pre-test and post-test results can be seen in the following table:

Table 11. Pre-test and Post-test Results at the Field Test Stage

	Score		Post-Pre	Ideal Score (100) - Pre	N-Gain Score	N-Gain Score Percent (%)
	Pre	Post				
Average	25	79	54	75	**0,72**	**71,96**
Category/Interpretation					**High**	**Quite Effective**

Based on the table above, the results of the field test by 35 students had an n-gain score of 0.72 which was in the high category and a percentage of 71.96% in the quite effective category. The graph of the average value of the pre-test and post-test results can be seen in the following graphic image:

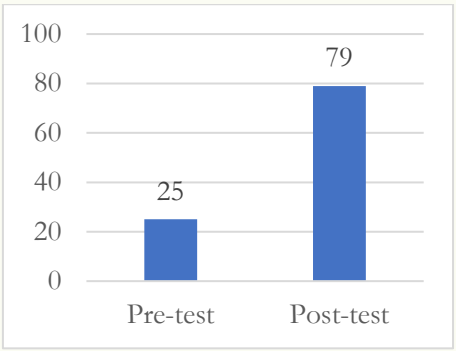

Figure 2. Graph of the Average Value of Pre-Test and Post-Test Results

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Based on the picture above, you can see the average value of the pre-test and post-test results. The average value of the pre-test results is 25 while the average value of the post-test results is 79. Thus, the average value of the post-test results has increased by 54 from the average value of the pre-test results.

The graph of the n-gain score results based on category can be seen in the following graphic image:

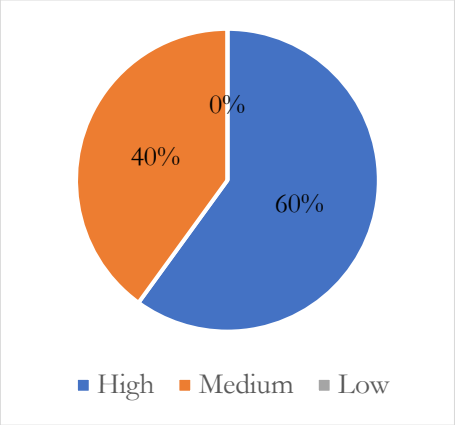

Figure 3. Values Based on N-Gain Score Category

Based on the image above, you can see the n-gain score results based on category. The N-gain score in the high category is 60%, the medium category is 40%, and the low category is 0%.

Discussion

This research produces a product in the form of a physics e-module based on local wisdom integrated with the SETS approach which is valid, practical and effective on student test results. The material created in the e-module is Newton's Laws class XI. The local wisdom used in the e-module is the Musi River.

At the expert review stage, for the material aspect an average result of 4.29 was obtained in the very valid category. In the media aspect, the average result was 4.40 and was included in the very valid category. In the language aspect, the average result was 4.33 and was included in the very valid category. Overall, based on expert reviews, the validity level was obtained showing an average of 4.34 with a very valid category. So it can be said that the physics e-module based on local wisdom integrated with the SETS approach developed is categorized as very valid.

The self-evaluation stage is the first step in evaluating the e-module before proceeding to the validation stage by experts. This stage aims to check and improve the module independently so that it meets quality criteria in the aspects of learning objectives, learning indicators, visual design and supporting materials. This process begins with a re-examination of the module to identify any deficiencies. Some of the problems found include visual design that is too busy, such as borders that make the display uncomfortable to look at, a mismatch between learning outcomes and the material presented, as well as examples of questions that are not relevant to the application of Newton's Laws in everyday life. After these deficiencies are identified, the module developer carries out independent revisions. The visual design of the module has been improved by simplifying the outline to make it more comfortable to look at. Learning outcomes and learning objectives are adjusted to the material being taught, thereby supporting students' understanding better. Apart from that, irrelevant questions were revised to be more contextual, especially in connecting the concept of Newton's Law with the local wisdom of the Musi River. The result of this self-evaluation is that the e-module becomes more structured, relevant and interesting, both in terms of design and content. This stage is an important foundation in ensuring the module is ready for further validation by experts, thereby producing a quality learning product that is suitable for use.

The one-to-one evaluation stage is used to see the practicality of the product. This stage was carried out by three students with varying abilities. The results of the one-on-one evaluation stage showed a figure of 4.17 in the practical category in using e-modules. There were no comments or suggestions from the three students. From the results of the expert review and one-to-one evaluation, prototype 2 was produced. After the product was revised based on suggestions, it continued to the next stage.

The small group evaluation stage was also used to see the practicality of the product and was carried out by nine students with varying abilities. At this stage, students are asked to use prototype 2 then students are asked to fill out a questionnaire. The small group evaluation results showed a figure of 3.81 in the practical category. Several students provided suggestions and comments so that the e-module was revised according to the suggestions and comments. Then produce prototype 3 in the form of a valid and practical e-module. From the results of the one-to-one evaluation and small group evaluation, it can be said that the physics e-module based on local wisdom integrated with the SETS approach developed can be categorized as practical.

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The final stage, namely the field test, aims to determine the effectiveness of using the local wisdom-based physics e-module integrated with the SETS approach on test results. Field tests were carried out, namely pre-test and post-test. The pre-test was carried out with the aim of finding out students' abilities before implementing the e-module. After implementing the e-module, students are asked to take a post-test which aims to determine the effectiveness of implementing the e-module based on local wisdom. The field test was carried out by 35 class XI.4 students of SMA Negeri 16 Palembang. The results of the field test show an n-gain score of 0.72 which is in the high category and a percentage of 71.96% in the quite effective category. Thus, it can be said that the physics e-module based on local wisdom integrated with the SETS approach developed has sufficient effectiveness on student test results.

Using e-modules in learning has several advantages. Students can learn independently using e-modules (Sari, F. A., Suseno, & Riswanto, 2019). Apart from that, e-modules have characteristics, namely self-instruction (has clear instructions), self-contained (complete material), stand-alone (not dependent on other teaching materials), adaptive (has the ability to adapt to developments in science and technology) and user friendly (friendly or helpful to e-module users) (Wulansari et al., 2018).

The SETS approach used in e-modules can help students understand real science concepts that are linked to the environment, technology and society (Yusro, 2015). Thus, the use of e-modules with the SETS approach can be said to be able to improve students' thinking abilities (Purwandari et al., 2014). The use of e-modules based on the local wisdom of the Musi River can help students understand the importance of local wisdom while preserving local wisdom (Rusilowati et al., 2015).

The integration of local wisdom in educational structures drew significant attention, particularly in the context of sets (science, environment, technology and society). These electronic modules can improve the understanding of students' scientific concepts, promoting technological integration and promoting social awareness of cultural heritage. Winangun et al. (2024) demonstrate that e-modules centered on local wisdom can effectively improve students' learning results in animal diversity, thus highlighting the potential of culturally relevant pedagogy in the science curriculum. Similarly, Yevira (2023) shows evidence that they define electronic modules based on environmental pollution not only increase students' interest, but also improve critical thinking skills, emphasizing the role of local environmental issues in STEM education.

In this research, local wisdom of the Musi River is used which is contextual to the lives of students. Students can understand scientific concepts in the local wisdom of the Musi River, such as Newton's Laws. Students can also connect scientific concepts with the use of existing technology in activities in the Musi River environment such as boats crossing the Musi River which is an application of Newton's Law. Apart from that, students also understand the importance of applying scientific concepts to society. In the context of Musi River, the use of local traditions in educational materials helps in understanding the concepts of static fluids among high school students, as shown by Utami and Wiyono (2024). By contextualizing scientific theories within local heritage, students can develop a deeper understanding of scientific concepts and their surrounding cultural narratives. Fitonia et al. (2024) extend this idea, suggesting that the incorporation of local issues, such as Kemplang Panggang production and salty electronic fish in physics, can improve creative thinking skills among students, demonstrating the direct connection between local knowledge and scientific research.

The integration of Malaysian ethnostience as a structure for the development of educational modules promotes holistic learning (Aulia et al., 2023). This approach not only encourages the preservation of cultural heritage, but also prepares students to be informed citizens of their society. Thus, e- modules serve as a transformative tool in education, combining scientific understanding with sociocultural consciousness, as stated by Jumiarni et al. (2023). By leveraging local wisdom, educators can promote an inclusive learning environment that respects and defends cultural heritage and increasing scientific literacy.

4. Conclusion

Based on the results of the research that has been carried out, the following conclusions can be obtained: (a) Based on the results of the expert review, the physics e-module based on local wisdom integrated with the SETS approach in high school that was developed is categorized as very valid with an average of 4.34. From the material aspect, an average of 4.29 was obtained (very valid category), the media aspect obtained an average of 4.40 (very valid category), and the language aspect obtained an average of 4.33 (very valid category); (b) The physics e-module based on local wisdom integrated with the SETS approach in high school which was developed is categorized as practical. The one-to-one evaluation results obtained an average of 4.17 in the practical category and the small group evaluation results obtained an average of 3.81 in the practical category; (c) Based on the results of the field test, the physics e-module based on local wisdom integrated with the SETS approach in high

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school that was developed has sufficient effectiveness on student test results. Where the n-gain score obtained was 0.72 which was in the high category and the percentage was 71.96% in the quite effective category. The suggestions that can be given based on the conclusions from the research results are as follows: (a) Use a computer/laptop/cellphone to open the e-module. (b) To make it easier to operate the e-module, supporting devices such as a mouse can be prepared; (c) Similar research can be carried out by varying the material in the e-module according to needs.

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