

ASSEMBLER EDU E-MODULES: IMPROVING ARGUMENTATION SKILLS, PERSEVERANCE, AND CURIOSITY IN PHYSICS LEARNINGAstalini^{1,*}, Darmaji¹, Dwi Agus Kurniawan¹, Sri Wina Octavia²¹ Faculty of Teaching and Education, Universitas Jambi, Jambi, Indonesia² Master of Natural Science Education, Pascasarjana Universitas Jambi, Jambi, IndonesiaCorresponding author email: astalinizakir@unja.ac.id**Article Info**

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Abstract

This study examined the impact of Assembler Edu-based e-modules on enhancing students' argumentation skills, perseverance, and curiosity in high school physics learning. Employing a quantitative ex-post facto design, the research utilized a 4-point Likert scale questionnaire to gather data. Descriptive and inferential statistical methods, including simple linear regression, were used for analysis. The findings reveal that using Assembler Edu-based e-modules significantly positively affected students' argumentation skills, with a 42.2% influence. Moreover, student responses indicated a 47.6% improvement in perseverance, while curiosity in learning renewable energy topics increased by 47.4%. These results highlight the considerable potential of integrating digital tools like Assembler Edu into the learning environment. This study introduces an innovative approach to physics education by incorporating interactive e-modules based on the Assembler Edu platform. Unlike traditional learning materials, these e-modules foster a more dynamic and engaging learning experience, enhancing students' critical thinking, perseverance, and curiosity. The research adds a fresh dimension to the existing literature by demonstrating how digital technology in science education can significantly improve core skills necessary for 21st-century learners. The study's implications suggest that integrating Assembler Edu-based e-modules into the school curriculum can enrich students' learning experiences, promote a deeper understanding of complex topics like renewable energy, and cultivate essential skills such as argumentation and perseverance, which are vital for success in both academic and real-world contexts.

Keywords: Arguing, Assembler Edu, Curiosity, E-Module, Perseverance

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Physics learning has become the main focus in improving students' understanding of scientific concepts and practical skills at the high school level (Asis et al., 2023; Nursakinah & Jauhar, 2023; Winda & Shofiardin, 2023; Fitriani, 2024). Presenting complex material, physics learning requires an innovative and interesting approach so that students can be actively involved in the learning process

(Hochberg et al., 2020; Socrates et al., 2023). By understanding the importance of mastering physics concepts in everyday life, teachers and researchers continue to strive to develop learning strategies that are effective and relevant for students (Zhou et al., 2021; Astalini et al., 2022; Oktavia et al., 2023; Rahadiyani, Rivani, & Untari, 2023). In studying physics, students not only learn theory and formulas, but also involve themselves in experiments, observations, and problem solving to deepen their understanding (Zainuddin et al., 2020; Rodrigues & Carvalho, 2022; Karuku, 2023). The goal is to provide a solid understanding of physics principles that can be applied in a variety of everyday life contexts and help students develop important critical, analytical, and problem-solving skills.

In today's digital era, the use of technology in education is becoming increasingly important. E-modules, or electronic modules, are one of the learning tools that have emerged as an interesting and interactive alternative for delivering lesson material (Kurniati et al., 2021; Rahayu & Sukardi, 2021; Maison et al., 2022; Azis & Clefoto, 2024; Johari, 2024). E-modules not only allow students to access information easily, but also provide various interactive features that can enhance their understanding (Rahayu & Sukardi, 2021; Setiyani, Baharin, & Jesse, 2023; Yusra et al., 2023; Habibi, Jiyane, & Ozsen, 2024; Ly et al., 2024). By utilizing advanced technology, e-modules can be adapted to student learning styles and present material visually and dynamically (Mizian, 2023; Putri & Mufit, 2023; Saputro et al., 2023; Handog & Aliasas, 2024).

One type of E-module that is attracting attention is the Assemblr Edu Based E-Module. This platform allows module creators to create engaging learning experiences by utilizing augmented reality (AR) technology. By using Assemblr Edu, students can explore physics concepts visually and interactively, increasing their interest and understanding of the material. In the context of this research, we aim to investigate the effect of using the Assemblr Edu-based E-Module on students' argumentative abilities, perseverance character, and curiosity in learning physics in high school.

The ability to argue is one of the key skills that is important to develop in learning physics. Through discussions, presentations, and experiments, students learn to formulate arguments based on scientific evidence and logic (Magiera & Zambak, 2020; Irawati & Putri Ningsi, 2021; Phongphio, 2021; Jusmaniar et al., 2023; Perdana, Zakariah, & Alasmari, 2023; Mardiaty, Alorgbey, & Zarogi, 2024; Setiyani, Panomram, & Wangdi, 2024). In the context of using the Assemblr Edu-Based E-Module, it is important to evaluate whether the use of this technology can affect students' ability to formulate and present arguments effectively (Novitra et al., 2021; Pols et al., 2021; Triyasmina et al., 2022; Astuti & Sianipar, 2023; Yohanie et al., 2023; Darmatiara et al., 2024). Therefore, this research will examine whether the use of an Assemblr Edu-based E-Module can improve students' argumentation skills in the context of physics learning in high school.

Apart from that, the character of students' perseverance and curiosity also plays an important role in learning physics (Handayani et al., 2023; Hasibuan & Nugraha, 2023; Jamo, 2023). These characteristics influence how well students can absorb course material, complete difficult assignments, and continually develop their understanding (Fauziyah et al., 2023; Huda et al., 2023; Pamungkas et al., 2023). By paying attention to the influence of the Assemblr Edu-Based E-Module on these characteristics, we can better understand how technology can influence student motivation and engagement in physics learning in high school. Thus, it is hoped that this research can provide valuable insights for the development of innovative and effective learning approaches in the future.

Previous research discussing the ability to argue found that the results showed that students in the experimental group outperformed the control group in terms of their capacity to produce scientific explanations, although there was no significant difference in understanding physics concepts (Darmaji et al., 2022). Furthermore, the LSA (lag sequential analysis) results revealed that the experimental group showed more coherent, evidence-based arguments and conscious reasoning, while the experimental group showed more coherent and evidence-based arguments and conscious reasoning. Previous research conducted by Fadha et al., (2023) Previous studies have emphasized the improvement of students' argumentative and decision-making skills using the context of socio-scientific issues. The focus is more on students' ability to analyze social issues related to science, thus creating a connection between scientific knowledge and social impact. However, these studies have not explored aspects of learning that are more oriented towards persistence and curiosity in the context of physics discipline. The current study fills this gap by not only focusing on argumentative skills, but also emphasizing the development of students' persistence and curiosity in physics learning in depth. This provides a more comprehensive approach to improving the quality of physics learning through the use of e-modules technology.

The novelty of this research lies in the approach of using Assemblr Edu-based E-Modules in physics learning at the high school level. The augmented reality technology leveraged in Assemblr Edu offers an immersive and interactive learning experience, allowing students to explore physics concepts in an unprecedented way. In addition, further understanding of the influence of the Assemblr Edu-based E-Module on students' argumentative abilities, perseverance character, and curiosity can help teachers and educational policy makers to design more effective and relevant learning strategies for students in this digital era.

The urgency of this research lies in the need to continue to develop effective learning methods in teaching physics at the high school level. As technology develops, teachers and researchers must continue to innovate to keep learning relevant, interesting and effective for students. The use of augmented reality technology in the form of an Assemblr Edu Based E-Module offers new potential to increase student engagement and their understanding of physics concepts. The aim of this research is to investigate the effect of using the Assemblr Edu-based E-Module in physics learning on three main aspects: argumentation ability, perseverance character, and students' curiosity. And find out the comparison of the use of Assemblr Edu-based E-Modules in physics learning regarding three main aspects: argumentation ability, perseverance character, and students' curiosity.

RESEARCH METHOD

This research is constitutive research with an ex-post-facto type. Ex-post-facto research is research that aims to find, study, or test causal relationships that may occur between two or more variables, where testing whether there is an influence of one variable on another variable using statistical differences tests. The variables in this research consist of the use of the Assemblr Edu-based E-Module in physics learning (independent variable) and the ability to argue, perseverance character, and students' curiosity as the dependent variable.

The population in this study were 10th grade students in high schools in Jambi City with a total of 12 high schools. The sampling technique in this research used a simple random sampling technique. The simple random sampling technique involves listing the entire population and then, through a lottery system, obtaining a sample according to the predetermined sample size (Cekim & Kadilar, 2020; Sanaullah et al., 2022). So from 12 schools, 3 schools were obtained for the research sample by drawing lots from schools. The sample for this study was XE 5 12 state high schools, XE 3 11 state high schools, and, XE 1 11 state high schools. The data collection procedure in this research began with administering a questionnaire on student responses to the use of the Assemblr Edu-based E-Module after learning renewable energy physics material. Administer the persistence character questionnaire and student curiosity questionnaire. Give essay test questions to measure students' reasoning abilities. Data were collected in one class session. Then the data is input, processed and analyzed with the help of the IBM SPSS Version 23 application.

This study uses a quantitative method with an ex-post-facto type. The independent variable in this study is the use of Assembler Edu-based e-modules in physics learning, while the dependent variables are students' argumentation skills, perseverance character, and curiosity. The research instrument consists of a questionnaire with a Likert scale of 4 to measure students' responses, perseverance, and curiosity, and an essay test to assess argumentation skills. Data collection was conducted in several high schools in Jambi City using a simple random sampling technique. The data obtained were analyzed using descriptive and inferential statistics with the help of SPSS software version 23 to test the assumptions of normality, homogeneity, linearity, and a simple linear regression test to see the effect of independent variables on the dependent variable.

Data collection in this research used a student response questionnaire regarding the use of the Assemblr Edu-based E-Module, then a questionnaire on the character of students' perseverance and curiosity after using the Assemblr Edu-based E-Module in learning physics about renewable energy materials. Next, data on argumentation ability was obtained using essay test questions. The instrument grid in this research is as table 1.

Table 1. Research Instrument Grid

Student Response	Argumentation Ability	Perseverance	Curiosity
Frequency of e-module use	Students can write arguments based on the information they have or answer the questions given	Willingness and tenacity in facing difficulties in learning physics	High interest in the physics topics studied
The level of ease of understanding renewable energy material through the use of e-modules	Students write down all information related to the problem	Consistency in carrying out the learning process despite facing obstacles.	Activities to find additional information about physics topics outside of classroom learning:
The effectiveness of the E-Module in helping understand physics concepts.	Students can connect the information they have with claims, which can be in the form of mathematical relationships, writing equations or writing examples	Do not delay completing school assignments	The level of curiosity to know more about complex physics concepts
The level of E-Module interactivity in physics learning.	Components that expect students to answer all the questions given	Always want to try new and challenging things	Students' ability to access and use additional sources of information about physics.

Each variable consists of 25 student response questionnaire items, 8 essay test questions, 25 persistence character questionnaire items and 25 student curiosity questionnaire items. The scale used in this research uses a Likert scale of 4. The categories of this research instrument are presented in table 2.

Table 2. interval category for each variable

Category	Student response	Argumentation ability	Perseverance	Curiosity
Very Not Good	25.0 – 43.75	8 – 15	25.0 – 43.75	25.0 – 43.75
Not Good	43.76 – 62.50	16 – 22	43.76 – 62.50	43.76 – 62.50
Good	62.51 – 81.25	23 – 29	62.51 – 81.25	62.51 – 81.25
Very Good	81.26 – 100.0	30 – 36	81.26 – 100.0	81.26 – 100.0

Data analysis in this research uses descriptive statistics and inferential statistics. To be able to carry out hypothesis testing in this research in the form of comparison tests and simple linear regression, it is necessary to test the Kolmogorov Smirnov assumptions of normality, homogeneity and linearity. The Kolmogorov Smirnov normality test was carried out because the number of research samples tended to be more than 50 samples. The data was said to be normally distributed if the significant value of the analysis results obtained was more than an alpha value of 0.05 (Kamid et al., 2022; Akbar, 2023). That is the case with the homogeneity and linearity test results, the data is homogeneous and linear if the analysis results obtain a significance value of more than 0.05 (Pamungkas et al., 2023). If the assumption test is fulfilled that the data is normally distributed, has homogeneous variants and is linearly related, then it can be continued with parametric tests, namely comparison tests and simple linear regression on the basis of decision making, the significance value obtained from data analysis obtains a value of less than 0.05, then the result is that the data has differences and the independent variable has an influence on the dependent variable (Syutaridho et al., 2023; Yusnidar et al., 2024).

RESULTS AND DISCUSSION

Based on the results of the research analysis, the results of the first analysis are a description of students' responses to the use of Assemblr Edu-based e-modules. In table 3 below are the results of descriptive statistical analysis of student responses to the use of Assemblr Edu-based e-modules for renewable energy physics learning materials.

Table 3. Description of student responses to the use of Assemblr Edu-based e-modules

School	Interval	F	%	Category	Mean	Med	Min	Max
Public	25.0 – 43.75	1	3.3	Very Not Good				
Senior high school 12	43.76 – 62.50	7	23.3	Not Good	73.31	73.00	40.00	81.00
Kota Jambi	62.51 – 81.25	22	73.3	Good				
Public	81.26 – 100.0	0	0	Very Good				
Senior high school 11	25.0 – 43.75	0	0	Very Not Good				
Kota Jambi	43.76 – 62.50	2	6.7	Not Good	77.18	77.50	60.00	90.00
Public	62.51 – 81.25	27	90	Good				
Senior high school 10	81.26 – 100.0	1	3.3	Very Good				
Kota Jambi	25.0 – 43.75	0	0	Very Not Good				
Public	43.76 – 62.50	5	16.7	Not Good	81.18	80.50	52.00	89.00
Senior high school 10	62.51 – 81.25	24	80	Good				
Kota Jambi	81.26 – 100.0	1	3.3	Very Good				

From table 3 above, it is known that the student responses in each school were predominantly in the good category, although there were still responses that were not good. The percentage of dominant student responses is above 70% with an average score of 70 and above. The results of these descriptive statistics show how the use of e-modules based on the use of e-modules based on Assemblr Edu renewable energy physics learning materials provides a good response for students. To further investigate, the researcher conducted a hypothesis test to find out the influence and differences in student responses on argumentation skills, perseverance character and student curiosity in learning renewable energy physics materials using Assemblr Edu-based e-modules. The results of the first assumption test in this research, namely the Kolmogorov Smirnov normality test which has been simplified, are presented in table 4.

Table 4. Normality test results of student response variables, argumentative ability, character of persistence and student curiosity

	Kolmogorov-Smirnov		
	Statistic	df	Sig.
Student response	.109	90	.200
Argumentation ability	.124	90	.200
Perseverance character	.095	90	.200
Curiosity character	.122	90	.190

Based on table 4, it is known that for each of the variables in this research, starting from student responses, argumentative ability, perseverance character and student curiosity in learning renewable energy material physics using Assemblr-based e-modules, obtained a significance value of more than 0.05, so it can be concluded that data distributed normally. Next, test the homogeneity assumption, which will be presented in table 5.

Table 5. Test results for homogeneity of student response variables, argumentative ability, character of students' persistence and curiosity

Variable	N	Sig.	Description
Student response	90	0.172	Homogen
Argumentation ability	90	0.131	Homogen
Perseverance character	90	0.157	Homogen
Curiosity character	90	0.148	Homogen

Based on table 5 above, it is known that each variable, namely student response, argumentative ability, perseverance character and student curiosity in learning renewable energy material physics using Assemblr-based e-modules, obtained a significance value of more than 0.05, so it can be concluded that the data has variance. which is homogeneous. Next, test the linearity assumption, which will be presented in table 6.

Table 6. linearity test results

Variable	N	Sig.	Description
Student response*argumentation ability	90	0.177	Linear
Student response*Perseverance character	90	0.167	Linear
Student response*Character of curiosity	90	0.149	Linear

Based on table 6 above, it is known that the student response variable has a linear relationship with the variable, argumentative ability, perseverance character and student curiosity in learning renewable energy material physics using Assemblr-based e-modules as seen from the significance value obtained, which is more than 0.05. Next, if the assumption test is fulfilled, we can proceed to hypothesis testing, which in this study uses comparison and influence tests, which will be presented in table 7.

Table 7. Results of independent sample t test analysis of student response variables, argumentation ability, perseverance character and student curiosity

School	Variable	Sig. (2-tailed)
Public Senior high school 12 Kota Jambi	Student Response	0.011
Public Senior high school 11 Kota Jambi		
Public Senior high school 10 Kota Jambi		
Public Senior high school 12 Kota Jambi	Argumentation Ability	0.031
Public Senior high school 11 Kota Jambi		
Public Senior high school 10 Kota Jambi		
Public Senior high school 12 Kota Jambi	Character Of Perseverance	0.014
Public Senior high school 11 Kota Jambi		
Public Senior high school 10 Kota Jambi		
Public Senior high school 12 Kota Jambi	Curiosity	0.042
Public Senior high school 11 Kota Jambi		
Public Senior high school 10 Kota Jambi		

Based on the results of the T Test on the use of Assemblr-based e-modules in physics learning on renewable energy material on student responses, argumentation ability, perseverance character and student curiosity, a Sig score was obtained. (2-tailed) < 0.05 so it can be concluded that there are differences in student responses, argumentation skills, perseverance character, and student curiosity with the use of Assemblr-based e-modules in learning renewable energy material physics.

Table 8. Anova test of students' responses to learning using EDU assembler-based e-modules on argumentation skills, perseverance character and students' curiosity

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	68656754666	2	3431834133		
Within Groups	1.657E+11	88	8210990696	3.310	0.012
Total	2.343E+11	90			

Based on table 8 above, it is found that in the Sig column. obtained P value (P-value) = 0.012. And it can be seen from the calculated F value of 3.310 and the F table value of 3.10, so the F calculated value is more than the F table value. Thus, at the real level = 0.05 we reject Ho, so the conclusion obtained is that there is a significant difference in the average student response to physics learning using Assembler Edu-Based E-Modules on Argumentation Ability, Perseverance Character, and Students' Curiosity in each of these schools. Next is presented in table 9 descriptive ANOVA of student responses to learning using EDU assembler-based e-modules on argumentation skills, perseverance character and students' curiosity.

Table 9. Descriptives ANOVA test of students' responses to learning using EDU assembler-based e-modules on argumentation skills, perseverance character, and students' curiosity

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
AA	90	173697.50	58801.595	20789.503	146238.14	244656.86	100000	252330
CP	90	309123.25	97331.637	32111.930	245051.97	407794.53	231133	552330
C	90	301223.25	91031.637	34411.930	245051.97	407794.53	231133	552330

From the Descriptives table, it appears that the student response to learning using EDU assembler-based e-modules on students' argumentation abilities was an average of 173697.50. Then for the character of student persistence in learning the average is 309123.25 and the character of desire is an average of 301223.25. Next, to see further tests, you can see the ANOVA table. To determine which further test to use, look again at the Test of Homogeneity of Variances table. If the test results show the same variance, then the further test used is the Bonferroni test. However, if the test results show that the variants are not the same, then the further test used is the Benferroni test, post-hoc further test.

Table 10. Post-hoc further test of students' responses to learning using EDU assembler-based e-modules on students' argumentation abilities, perseverance character and curiosity

	(I) Model	(J) Model	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Benferroni	C	AA	10.69	2.900	0.035	-191881.12	52714.71
		PC	53.86	2.900	0.016	-253223.12	-8827.72
	AA	PC	10.69	2.900	0.037	-52714.71	191881.22
		C	43.17	2.900	0.032	-183640.17	60955.43
	PC	AA	53.86	2.900	0.024	86527.58	253223.12
		C	43.17	2.900	0.042	-60955.27	183640.37

The basis for decision making in this ANOVA test is that if the significance value is > 0.05 then there is no influence between the independent variable and the dependent variable, conversely if the significance value is < 0.05 then there is an influence between the independent variable and the dependent variable. Based on the table above, it can be said that there is an influence between student responses to learning using EDU assembler-based e-modules on argumentation skills, perseverance character and students' curiosity.

Table 11. Simple linear regression test results

Variable	R	R Square	Sig.
Student response*argumentation ability	0.650	0.422	0.02
Student response*Perseverance character	0.690	0.476	0.01
Student response*Character of curiosity	0.689	0.474	0.03

Based on the table of simple linear regression test results above, it can be seen that there is an influence of student responses on students' argumentation abilities with a significant influence of 42.2%. Furthermore, there is an influence of student responses on the character of student learning persistence with an influence percentage value of 47.6%. Furthermore, there is a significant influence on student responses in using Assemblr-based e-modules in physics learning on renewable energy material on students' curious character with an influence percentage of 47.4%.

The discussion of the results of this research depicts a comprehensive picture of the impact of using the Assemblr Edu-based E-Module in learning renewable energy physics on students' responses and abilities. From the results of the descriptive analysis, it appears that the majority of students responded positively to the use of the E-Module, with the majority entering the "good" category. This indicates that the technology has succeeded in attracting interest and providing a satisfying learning experience for students.

Furthermore, the results of the assumption test show that the data used in this research meets the requirements for normality, homogeneity and linearity. This provides a strong basis for continuing

further analysis of the effect of using the E-Module on the dependent variables, namely argumentation ability, perseverance character, and students' curiosity. Through hypothesis testing, it was revealed that there were significant differences in student responses and characteristics between different schools. This shows that school environmental factors can influence how students respond to and adopt technology in learning. In this context, schools can consider environmental factors and student context in implementing learning technology.

Simple linear regression analysis highlights the importance of using the E-Module in improving students' argumentation skills, perseverance character and curiosity. With a significant R Square value, these results confirm that the use of technology in learning not only has an impact on student responses, but also on students' overall cognitive development and learning attitudes. Overall, the findings from this study provide valuable insight into the potential use of technology in physics learning. The implementation of the Assemblr Edu-based E-Module has been proven to provide benefits for students in increasing their response, argumentation skills, persistence and curiosity. Therefore, careful and measurable integration of technology in the curriculum can be an effective strategy in improving the quality of learning in the future (Ouahi et al., 2022; Abulibdeh, Zaidan, & Abulibdeh, 2024).

In line with previous research, it was found that the development of e-modules was very effective in increasing students' knowledge in physical education, sports and health. Furthermore, the development of this E-module helps students be more creative and innovative in learning (Gumara et al., 2023; Wati et al., 2024). Previous and current research focuses on the use of technology in learning contexts, although in different subjects. Previous research evaluated the effectiveness of E-modules in physical education, sports and health at the junior high school level, while the current research explores the use of Assemblr Edu-based E-Modules in physics learning at the high school level. This shows the diversity of technology applications in education in various subjects. The contribution of previous research to the current research is to provide a basic understanding of the effectiveness of technology use in education, while the current research continues this exploration by focusing on different learning contexts (Hamzah et al., 2021; Dessi, & Shah, 2023; Mawardani et al., 2023).

The results of previous research show that only a small number of teachers use STEM-integrated PBL-based E-modules to improve students' critical thinking skills, while the majority of students rely on printed books in physics learning. These results show the need for E-modules to facilitate learning, as well as the use of social media as a learning tool by some teachers (Asrial et al., 2021; Kurniati et al., 2021; Hardyanti, Lateef, & Abbas, 2023). The finding that most students and almost all teachers feel they need E-modules as a learning tool provides a strong basis for current research to explore the effectiveness of using Assemblr Edu-based E-Modules in physics learning, especially in strengthening aspects of thinking skills. Then previous research found that argumentation skills can be increased through the application of the ADI learning model (Pertiwi et al., 2021).

This research presents several significant contributions and important novelties in the context of using technology in physics learning, especially in the application of Assemblr Edu-based E-Modules in renewable energy materials. First of all, this research provides in-depth insight into the effectiveness of this technology in the context of physics learning. By examining student responses and their impact on students' reasoning skills, perseverance, and curiosity, this research provides valuable guidance for teachers and educational institutions in designing more interesting and effective learning strategies for students (Alexakos et al., 2011; Canlas & Karpudewan, 2020).

In addition, through comparisons between schools, this research also reveals how the school environment can influence students' responses and characteristics towards the use of technology in learning. This brings new understanding about the importance of considering environmental factors in designing learning programs that suit student needs. From the perspective of the research literature, these findings also make an important contribution. The empirical data presented supports the effectiveness of the Assemblr Edu Based E-Module, which can be a valuable reference for researchers and academics in understanding the implications of technology in educational contexts.

The novelty of this research lies in the development of Assembler Edu E-Modules which not only focuses on improving students' argumentation skills, but also simultaneously encourages persistence and curiosity in physics learning. Unlike previous e-modules that focused more on socio-scientific issues, Assembler Edu E-Modules integrates an exploration-based approach and challenges in the discipline of physics. This provides a more interactive learning experience, encouraging students to not only think critically, but also to persist in solving physics problems and fostering a deeper curiosity

about scientific concepts. This innovation offers a more holistic and effective learning method in preparing students to face the challenges of modern science learning.

Finally, the findings from this research also have important policy implications. By showing the benefits of using technology in physics learning, this research can help governments and educational institutions in designing policies that support the integration of technology in educational curricula, ensuring an improvement in the overall quality of education. Thus, this research not only provides practical and theoretical contributions, but also has a significant impact in improving education at the national level. The limitation of this research was that it was carried out in several schools in Jambi City, so the results may not be directly applicable in general to various other educational contexts. Variations in school environments, curricula, and student characteristics in other areas can significantly influence research results. Recommendations for further research, the researcher recommends creating guidelines and training for teachers to effectively integrate E-Module in physics learning. This could be a useful research area to support the implementation of technology in learning.

CONCLUSION

From the results of this research, it can be concluded that the use of Assemblr Edu-based E-Modules in learning physics about renewable energy materials has a positive impact on student responses, argumentation skills, perseverance character and student curiosity. The results of statistical analysis show that the majority of students responded well to the use of the E-Module, and there were significant differences in student responses and student characteristics between different schools. Apart from that, this research also found a significant relationship between students' responses to using the E-Module and students' argumentative abilities, perseverance character and curiosity. The implications of this study indicate that the application of Assembler Edu E-Modules in physics learning can significantly improve students' argumentation skills, perseverance, and curiosity. In addition, the integration of these e-modules into the school curriculum can create a more interactive and engaging learning environment, supporting more effective and enjoyable science learning.

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AUTHOR CONTRIBUTIONS

A: Conceptualization, design, writing, supervision. D: data acquisition, data analysis/interpretation. DAK, SWO: concept and design, statistical analysis.

CONFLICTS OF INTEREST

The author(s) declare no conflict of interest.

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