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The Effect of Implementing STEM-Integrated Module: to Train STEM Literacy on Knowledge Aspect

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Abstrak
One of the integrated global challenges faced by STEM education is developing STEM literacy. This study aims to examine the increase in STEM literacy of students in aspects of knowledge after applying STEM-based modules on global warming issues. This research method isa quasi-experiment with a group of pretest-posttest designs implemented in a high school in Karawang, Indonesia. The subject of this study was one grade of 10 consisting of 36 learners. To measure the increase in STEM literacy, students in the aspect of knowledge are given a pretest and posttest to students consisting of 20 multiple-choice questions. The results of the pretest and posttest students are analyzed by calculating the value of n-gain and its size effect. The results of this study showed that students' STEM literacy increased (n-gain=0.65), and engineering technology literacy showed the highest increase with an n-gain value of 0.71 (High). Meanwhile, mathematical literacy showedan n-gain of 0.63. While the lowest increase was in science literacy with an n-gain of 0.60 (satisfactory). Thus, it can be concluded that the implementation of STEM-based modules in the physics learning process has a satisfactory influence with a strong size effect on STEM literacy aspects of student knowledge.

Keywords: *Literacy, STEM-Integrated Module, Global Warming*

Introduction

Education in Indonesia must follow current developments in order to remain competitive in various aspects of life, particularly in the realm of science and technology. The 21st century has remarkable advancements in the fields of science and technology, characterized by rapid progress and innovation. So that, resulting in competition between individuals in developing knowledge, skills, and potential to be able to survive in global competition

Techakosit and Nilsook stated that the modern economy requires a workforce equipped with the necessary knowledge and skills to effectively compete with others. This entails being proficient in problem-solving, innovation, and invention, as well as being self-reliant and possessing critical and logical thinking abilities. Workers who have the knowledge and skills to compete with others such as problem solvers, innovators, and inventors, as well as those who can rely on themselves and think rationally (Techakosit&Nilsook, 2018). One solution that can be used to practice these skills is to develop interdisciplinary education encompassing science, technology, engineering, and mathematics (STEM) (Toulmin &Groome, 2007).

Laboy Rush emphasized that STEM Education plays a crucial role in equipping students with the knowledge and skills necessary for success in college and their professional careers.According to the world economic forum, future work is closely relatedto Science, Technology, Engineering, and Mathematics (STEM) (Rush, 2016).In addition, researchers have highlighted the advantages of integrating science, technology, engineering, and mathematics (STEM) education. This approach is believed to bring benefits not only to the national economy but also to teachers and educational institutions as a whole (Tseng et al., 2013). Reeve stated the purpose of STEM education is to create a learning environment that enables students to apply science, technology, engineering, and mathematics in real-life contexts. The goal is to foster connections between these disciplines and specific careers and environments, ultimately equipping STEM-literate students to effectively compete in the era of globalization (Reeve, 2013).

Bybee states that STEM education places emphasis on designing solutions to real-world problems. However, one of the global challenges encountered in STEM education is the development of STEM literacy (Bybee, 2013). STEM Education and STEM Literacy are closely interconnected. STEM Education refers to the input provided by teachers to learners, while STEM literacy is the outcome that learners develop.

STEM literacy encompasses the learners' ability to identify, apply, and integrate concepts from science, technology, engineering, and mathematics in order to innovate and solve complex problems (Balka, 2011).

Science Literacy refers to the ability of students to effectively use and process scientific knowledge, including subjects such as physics, chemistry, biology, and earth and space sciences. It involves understanding and applying scientific concepts. Technology Literacy encompasses the proficiency to operate and utilize technology efficiently and productively. It involves conducting research and solving problems collaboratively using various technological tools and resources. Engineering Literacy is defined as the capability to apply scientific and mathematical principles in a systematic and creative manner to achieve practical objectives. It involves utilizing engineering concepts and problem-solving strategies. Mathematical Literacy refers to the ability to identify, comprehend, and engage with mathematics. It encompasses thinking creatively about problem-solving and utilizing mathematical concepts in various contexts (Zollman, 2012). STEM literacy entails the aptitude to employ diverse disciplines, knowledge, skills, and attitudes to effectively solve real-world problems within a specific context. Furthermore, students engage in the application of the engineering process as they tackle problems and find solutions.

Based on observations conducted at one of the Karawang High Schools, it has been found that the STEM literacy levels among students are currently relatively low, this is reinforced by the results of researcher interviews with several students at the school (1) who are still rarely directed in solving problems with a concept. So that students have difficulty understanding abstract physics concepts, besides that students also consider physics learning only about the application of formulas; (2) There is no interactive learning media available. Additionally, it has been observed that the learning media utilized during the educational process at the school is primarily limited to the use of projector-based media. The absence of interactive learning media has resulted in students having insufficient knowledge and familiarity with technology; (3) The lack of student knowledge about STEM, physics learning should integrate between disciplines but the fact in the field of physics learning only focuses on physics content

Research on STEM literacy is currently not widely carried out both in Indonesia and in other developed countries, especially in applying STEM-based physics modules designed by the needs of an independent curriculum to train students' STEM literacy at the high school level. Learning materials play a crucial role in the teaching and learning process at the education level. These materials provide valuable opportunities for students to enhance and deepen their knowledge and understanding. By engaging with learning materials that involve scientific explanations of real-world phenomena, students can further develop their comprehension and gain a more in-depth understanding of the subject matter, and can practice the skills they need in the world of work later (Utami et al., 2020). In fact, teachers need interactive physics modules in learning that can train STEM Literacy, students so that students. The modules used in this study have first gone through the development stage and are declared suitable for use in the teaching and learning process to train students' STEM literacy.

Physics Module is developed physics subjects in the independent curriculum at the upper secondary level it provides several concepts of everyday real-world problems, mathematical calculations, and the use of technology, one of the concepts that are closely related to real-world problems is climate change and global warming. Climate change and global warming materials are important to study because it is to solve social problems or global issues. Scientific social problems are key concerns within the framework of Society 5.0, and they rely on scientific knowledge for explanation and potential resolution. These problems have magnified the significance of science and related disciplines. Notably, climate change and global warming, ecological crisis, renewable energy sources, and genetic cloning are among the issues that align with the challenges addressed by Society 5.0.(Baran et al., 2021).

Based on this background, solutions are needed to train the skills needed by students in the 21st century. Therefore, this study aims to train STEM literacy aspects of learners' knowledge by applying STEM-based physics modules to global warming material.

Research methods

This research is a quasi-experimental research with a group of pretest-posttest designs implemented in one high school in Karawang. The sample in this study was class X students totaling 36 students. The sampling technique is carried out randomly class (cluster random sampling) because all classes in class X are considered to have equal abilities. The selection of classes is based on information that the placement of students in class X is not based on superior classes or non-superior classes but by considering the balance of the proportion of students who are above average, average, and below average in each class.

To evaluate the increase in STEM literacy among students in terms of knowledge, a pretest and posttest will be administered before and after the implementation of STEM-based physics modules. The sample group will undergo these assessments to measure the change in their understanding and proficiency.

STEM literacy is measured using 20 multiple-choice questions specifically consisting of 4 Science literacy questions, 4 Mathematics literacy questions, and 8 Engineering Technology literacy questions. Previously, the STEM literacy question instrument was validated and tested so that the instrument was declared suitable for use.

The physics module is designed in alignment with the current Indonesian curriculum, known as Curriculum Merdeka. It focuses on STEM concepts related to global warming and is intended for grade 10 students in upper secondary education. Each page of the module emphasizes different aspects of science, technology, engineering, and mathematics, depending on the specific topic being covered. The test instruments used to evaluate students' understanding are developed based on established assessment frameworks. The science and mathematics literacy questions are derived from the Programme for International Student Assessment (PISA), while the technology engineering literacy problems are based on the National Assessment of Educational Progress (NAEP). These frameworks ensure that the assessment instruments are comprehensive and aligned with international standards. The improvement in STEM literacy aspects of learners' knowledge is measured by comparing the average N-gain value of <g> and its classification using equation1 :

$$< g > = \frac{\%G}{\%Gmax} = \frac{(\%S_f - \%S_i)}{(100 - \%S_i)} \quad (1)$$

$$< g > = \frac{\%G}{\%Gmax} = \frac{(\%S_f - \%S_i)}{(100 - \%S_i)}$$

Which:

<g> = N-gain
G = Actual gain
Gmax = Maximum gain possible
Sf = Posttest score
The = Pretest scor

After improving STEM literacy, aspects of student knowledge are measured using equation 1, the next step is to classify the <g> score in Table 1 below.

Table 1. Normalized Gain Score Criteria

<g>	**Classification**
g > 0,7	High
0,3≤≤ g ≤≤ 0,7	Satisfactory
0 <g < 0,3	Low
g ≤≤ 0	Failed

(Hake, 1999)

To determine the *effect size of* students' STEM literacy on aspects of knowledge, by calculating the average *effect size* normalized. The difference in pretest and posttest scores is assumed to be an effect of the treatment and divided by the result of the standard deviation. Account *effect size is* intended to determine the effect of increasing students' STEM literacy on aspects of knowledge. *The effect size* on a single group is calculated by equation 2(Cohen, Louis, Manion, & Morrison, 2007).

$$effect\ size = \frac{average\ score\ posttest - average\ score\ pretest}{standard\ deviation}$$

$$effect\ size = \frac{average\ score\ posttest - average\ score\ pretest}{standard\ deviation} \quad (2)$$

After *the effect size value is obtained then the value is classified based on the* effect sizecriteria *in Table 2 below.*

Table 2 Effect Size Criteria

Size	**Criterion**
0 < ES ≤ 0.2	No *practical effect*
0.2 ≤ ES < 0.5	Small effect
0.5 ES 1.00≤<≤<	Medium *effect*
>1.00pm	Strong (*Large effect*)

(Cohen et al., 2017)

Results and Discussion

1. Science Literacy of Learners

Science literacy consists of 8 questions that assess both content knowledge and procedural knowledge. Within these questions, specifically questions 1, 2, 3, and 4, the focus is on content knowledge related to science. These questions are designed to evaluate students' understanding and grasp of scientific concepts.While the question of science literacy in the aspect of procedural knowledge is contained in 4 questions, namely at numbers 9, 10, 11, and 12. A recapitulation of the increase in science literacy based on two aspects can be seen in Table 3.

Table 3. Science Literacy Recapitulation

No	Aspects	N	***Pretest***	***Posttest***	n-gain <g>	SD	ES
1	Explain scientific phenomena and plan investigations.	4	29,86	79,17	0,70	24,99	1,97
2	Interpret data and evidence scientifically.	4	63,19	77,78	0,40	31,27	0,47
	Science Literacy		**46,53**	**78,47**	**0,60**	**22,05**	**1,45**

Based on Table 3, it can be concluded that there is a notable improvement in students' understanding of science literacy when utilizing STEM-based modules, this is evident from the n-gain value of<g> of 0.60 with the satisfactory category. There are 2 aspects of the assessment of students' science literacy knowledge, namely aspects of content knowledge (explaining scientific phenomena and planning investigations) and procedural knowledge (interpreting data and evidence scientifically). In the aspect of content knowledge, the n-gain value of <g> was 0.70 with the high category, the average pretest and posttest were 29.86 and 79.17 respectively and the effect size was 1.97 with a strong category on the academic performance of students.

The findings related to science literacy in the aspect of procedural knowledge based on calculations obtained an n-gain value of 0.40 in the medium category, the average pretest and posttest respectively 63.19 and 77.78, and the effect size of 0.47 in the medium category. From the two contents, it can be concluded that the increase in n-gain <g> content science knowledge literacy is greater than procedural knowledge by a difference of 0.30.

Overall, the average pretest and posttest of students' science literacy were obtained at 46.53 and 78.47 respectively, Therefore, it can be firmly concluded that there was a substantial improvement in students' science literacy in terms of knowledge from the beginning to the end of the learning process.The increase occurred due to the learning process using the help of STEM-based modules by training students' STEM literacy. How much influence the use of the module has on increasing students' STEM literacy can be seen from the ES value (size effect) in Table3, which is 1.45 with a strong category. That means STEM-based modules have a strong influence on improving students' science literacy. Utami's research on implementing STEM-based modules specifically focused on the theory of Earth structure and its dynamic topics has found a notable increase in students' STEM literacy in terms of knowledge. This study offers additional proof supporting the efficacy of STEM-based approaches in enriching students' comprehension and competence in the realm of Earth science (Utami et al., 2020). Furthermore, Sejati in his research stated that implementing STEM-based workbooks focused on the lever system in the human body leads to an enhancement in various aspects of students' learning. These include improved comprehension of knowledge, problem-solving aptitude, innovative thinking skills, and the development of a sense of responsibility (Sejati et al., 2017).

Based on the study results in Table 3, students' science literacy is better at content knowledge (explaining scientific phenomena and planning investigations) than procedural knowledge aspects (interpreting data and evidence scientifically). This can happen because of the problem of science literacy, the aspect of content knowledge is to ask students' understanding of one particular topic (in this case about the topic of global warming) so that it can be memorization and give a deeper understanding. While the problem of procedural knowledge is to measure the ability of students to interpret data, numbers, charts, or scientific evidence so it requires special abilities that must be possessed by these students to answer questions about procedural knowledge. The task procedural knowledge of learners is almost always faced with solving problems related to technical knowledge, outcome measures are always accurate, and algorithms, methods, and criteria to determine appropriate procedures (Hidayat & Abdillah, 2019).The difficulty level of these questions increases as learners must possess the ability to interpret data presented in pictures or graphs. Merely understanding and memorizing the topic is not sufficient for answering them correctly. Conversely, even if learners can interpret the data effectively, they will still struggle to answer the questions if they lack a comprehensive understanding of the topic.

In addition, students' conceptual understanding improves better on content knowledge compared to procedural knowledge because STEM-based modules used more training content knowledge than procedural knowledge. Content knowledge is trained in almost every material in the form of an essay quiz that requires students to understand the material first before answering the quiz while procedural knowledge, especially in interpreting data is only delivered on pages 7, 8, 15, 16, and 20. Therefore, the suggestion for future researchers is to increase the proportion of content and similar procedural knowledge so that the increase in content knowledge is not higher than that of procedural knowledge.

Science literacy of students is increasing after the application of STEM-based modules, this is because in the integrated module the four STEM concepts are followed by *engineering design* process activities. This integration will help learners to improve their science literacy. In line with this, Aulia in her research explained that learning physics using TPACK-STEM-based e-modules can improve students' science literacy skills because students become more independent and more active in participating in learning (Aulia et al., 2021). Similarly, Siew's findings indicate that incorporating the engineering design process in science learning can significantly enhance students' understanding of science concepts (Siew et al., 2015).

2. Engineering Technology Literacy of Students

In this study, there are 8 Engineering *Technology literacy questions* given to students, 7 questions about understanding aspects of technology principles in numbers 13, 15, 16, 17, 18, 19, and 20. 1 question about developing aspects of solutions to achieve goals in number 14. A recapitulation of the increase in technological engineering literacy based on two aspects is presented in Table 4.

Table 4. Recapitulation of Technology Engineering Literacy

No	Aspects	N	*Pretest*	*Posttest*	n-gain <g>	SD	ES
1	Understand the principles of technology	4	44,05	82,54	0,69	29,34	1,31
2	Develop solutions to achieve goals	4	52,78	94,44	0,88	60,36	0,69
Technology-Engineering Literacy			**45,14**	**84,03**	**0,71**	**26,18**	**1,49**

Based on Table4 above, it can be seen that there is an increase in engineering technology literacy after using STEM-based modules, namely n-gain <g> of 0.71 with the high category and the effect size of 1.49 with the strong category. There are 2 aspects of the assessment of*students' engineering* technology literacy knowledge, namely aspects of understanding technology principles and developing solutions to achieve goals.

First, the aspect of understanding the principles of technology has a result of <g> of 0.69 with a satisfactory category. The pretest and posttest scores of 44.05 and 82.54 respectively with a difference of 38.49. Thus, it can be said that engineering technology literacy in the aspect of understanding technological principles has increased. Furthermore, from Table4 it can be seen that the size effect of this aspect is 1.31 with a strong category. That means, STEM-based modules have a strong influence on increasing students' engineering technology literacy in the aspect of understanding technology principles.

Second, the aspect of developing solutions to achieve the goal has a pretest and posttest score of 52.78 and 94.44 respectively with a difference of 41.66. In this aspect, an n-gain of 0.88 is obtained which means an increase in the high category and the result of the size effect is 0.69 with the medium category. Thus, it can be said that STEM-based modules, provide greater engineering technology literacy in the aspect of developing solutions to achieve goals and provide greater influence in the aspect of understanding technology principles.

The improvement in engineering technology literacy is more prominent in the aspect of developing solutions and achieving goals. This is due to the fact that this particular aspect is conveyed through a single question, which reduces the likelihood of errors in answering. Consequently, students have a better chance of accurately demonstrating their proficiency in this area. In the process of implementing STEM-based modules, students carry out science activities in designing electric cars that use solar panels as a drive to reduce fossil fuels. This activity will certainly increase the engineering technology literacy of students because at this stage students carry out the engineering design process to solve problems by applying technological principles and developing solutions. Fan in his research revealed that the *engineering* design process can encourage learners to do intuitive and real questions and experiences, practice skills, and gain experience in *engineering design* that can help them in understanding the main concepts of STEM as well as guide them in connecting conceptual knowledge with problems that may arise in the process of making projects, so that grow their core competencies in engineering design (Fan et al., 2021).

3. Students' Mathematical Literacy

There are 4 math literacy questions presented in question number 5, 6, 7, and 8. It measures students' mathematical processes by answering questions to formulate situations mathematically. A recapitulation of the increase in mathematical literacy is presented in Table 5.

Table 5. Mathematical Literacy Recapitulation

No	**Aspects**	**N**	***Pretest***	***Posttest***	**n-gain <g>**	**SD**	**ES**
1	Formulate situations mathematically	4	41,67	78,47	0,63	39,41	0,93

Table 5 shows mathematical literacy results with pretest-posttest of 41.67 and 78.47, respectively. The calculation of <g> is 0.63 and the effect size is 0.93 so it can be concluded that there is a satisfactory increase with moderate influence due to the use of STEM-based modules.

After implementing STEM-based modules in physics learning, specifically through electric car manufacturing projects, students' mathematical literacy quite increased because in designing electric cars, students must apply mathematical calculations to real life. The calculation in question is such as calculations in designing electric cars, determining the tools or materials used, and so on.

Despite the math literacy scores, learners improved overall, but in fact, only 17 students improved significantly, while 19 others only improved in the moderate category. Based on the analysis of students' answer sheets, it is evident that they encounter challenges when it comes to analyzing and interpreting data presented in graphs. Consequently, they face difficulties in generating summaries based on mathematical procedures. To be considered proficient in mathematical literacy, a student should demonstrate the ability to effectively analyze, reason, and communicate mathematical knowledge and skills. Additionally, they should be capable of solving and interpreting mathematical problems (Farida et al., 2021).

4. Science, Technology, Engineering, and Math (STEM) Literacy Students

The STEM literacy of students is quite increased with a value of <g> of 0.65 can be seen in Table 5 below. The utilization of STEM-based modules in physics education had a significant impact on the overall STEM literacy of students, with an effect size of 1.29, indicating a strong category of improvement. Therefore, it can be concluded that the increase in students' STEM literacy is positively influenced by the implementation of STEM-based modules in physics learning. The improvement in students' STEM literacy, particularly in terms of knowledge, is evident from the average scores of the pretest and posttest. The pretest average was 44.45, while the posttest average increased significantly to 80.32 with an increase of 35.87 after learning using STEM-based modules.

Table 6. STEM Literacy Recapitulation

Aspects	N	Pretest	Posttest	n-gain <g>	SD	ES
Science Literacy	8	46,53	78,47	0,60	22,05	1,45
Technology-Engineering Literacy	8	45,14	84,03	0,71	26,18	1,49
Mathematical Literacy	4	41,67	78,47	0,63	39,41	0,93
STEM Literacy	**20**	**44,45**	**80,32**	**0,65**	**29,21**	**1,29**

Based on Table6, it can be seen that students' STEM literacy has increased quite a bit with a value of <g> of 0.65. While the effect of the use of STEM-based modules on the overall STEM literacy of students was obtained by 1.29 with a strong category, thus it can be said that the increase in STEM literacy of students is influenced by the use of STEM-based modules in physics learning. The increase in students' STEM literacy in the aspect of knowledge can be seen in the average results of the pretest and posttest with each value of 44.45 and 80.32 with an increase of 35.87 after learning using STEM-based modules.

Classes that apply to learning using STEM-based modules are trained to be able to predict scientific phenomena that are happening and design one of the solutions to overcome or reduce these scientific phenomena. One solution is to reduce the use of fossil fuels which contribute to carbon dioxide emissions in the transportation sector. To reduce the use of fossil fuels, students are challenged to make car projects by using solar panels as fuel that can drive the car like a car in general. The challenge faced by researchers in electric car design activities is the lack of knowledge and experience of students related to project tasks. The project task that has been carried out so far is the cubit project, where the work procedure material tools have been given in advance by the teacher. The activity of designing electric cars trains the scientific imagination of students, because students are trained to determine tools and materials, strategies, and work procedures to make it easier for students to design their electric car projects. The application of scientific concepts in electric car design is closely related to technological engineering literacy indicators, namely to understand technological principles and develop solutions to achieve goals.

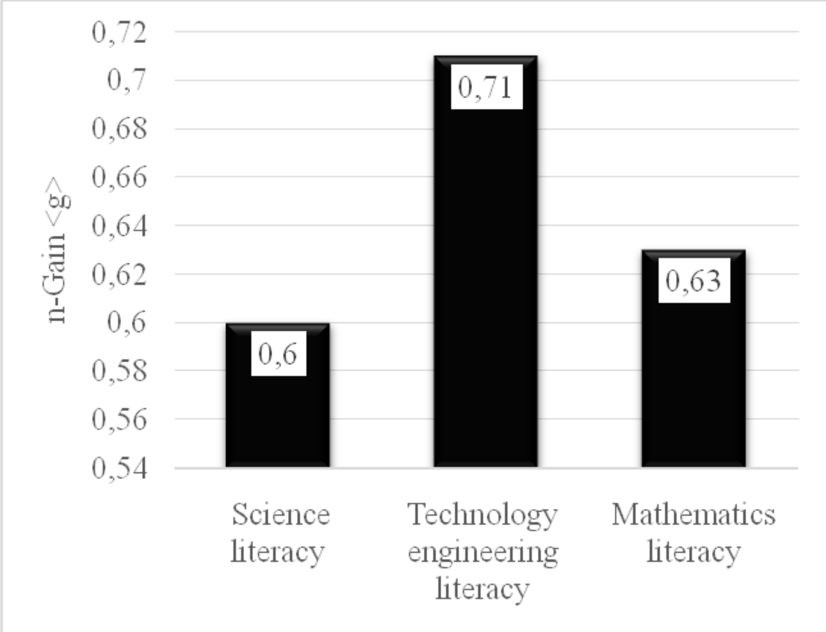

Figure 1. Recapitulation of Normalization of STEM Literacy Acquisition

Based on Figure 1, the highest increase in <g> occurred in engineering technology literacy which showed an n-gain score of 0.71 thus a significant increase occurred in engineering technology literacy and there was a strong difference from STEM literacy aspects of student knowledge after they used STEM-based modules in physics learning that they had done. Mathematical literacy occupies the second highest position with a value of <g> of 0.63. While the lowest increase in <g> scores occurred in science literacy, which was 0.6.

The highest increase in STEM literacy occurred in the aspect of developing solutions to achieve goals, namely question number 14 with <g> of 0.88. The lowest literacy in scientific literacy occurs in the aspect of interpreting data and evidence scientifically with a <g> of 0.40, which is found in questions number 9, 10, 11, and 12. Science literacy with a value of <g> of 0.40 indicates a satisfactory improvement after using STEM-based modules to learn the physics of global warming matter. However, the low <g> of science occurs because students still have difficulty interpreting data and evidence scientifically, this can be seen from the students' answer sheets and supported by students' answers to the example questions in the module about interpreting data and evidence scientifically. The low competence in science literacy is influenced by students' understanding of science literacy which is still lacking, this is because students have not matured in the concept of learning (Sujudi et al., 2020). Furthermore, Irwan stated that students' errors in answering epistemic knowledge questions and indicators interpret data and evidence scientifically because in answering questions, students do not rely on rote memorization but on the ability to think to understand things and provide reasons and conclusions about them (Irwan, 2020).

In general, the implementation of STEM-based modules in the physics learning process has led to an overall increase in students' literacy in the fields of science, engineering technology, and mathematics. The integration of STEM principles and approaches has positively influenced students' understanding and proficiency in these subjects, resulting in improved literacy outcomes.The research conducted by Utami in its journal states that the implementation of STEM-based modules on the structure of the earth and its dynamic topics can increase students' STEM literacy in aspects of knowledge (Utami et al., 2020).Furthermore, Hikmawati in her research stated that there was a noticeable increase in STEM literacy among students both before and after the implementation of earthquake-themed teaching materials. This suggests that the use of these teaching materials during the learning process effectively enhanced students' understanding and proficiency in STEM disciplines (Hikmawati et al., 2020).

In addition, students' STEM literacy in the knowledge aspect increases because students not only learn science topics but also engage in integrated STEM concepts and activities that incorporate the engineering design process. These activities provide students with opportunities to apply their knowledge and skills in solving real-world problems. As a result, students' STEM literacy improves as they better understand how scientific concepts can be applied. The research conducted by Hamidah teaching materials that incorporate challenge-based learning with STEM elements plays a crucial role in the learning process. These materials provide students with valuable opportunities to develop problem-solving skills that are essential in the 21st century (Hamidah&Ardiansyah, 2023). STEM-based learning enables students to apply a diverse range of knowledge across multiple disciplines when solving problems. It also introduces engineering and technology processes (Mulyani, 2019). Zollman further states that STEM literacy in knowledge refers to the ability of learners to effectively interpret, conceptualize, and apply their theoretical knowledge in practical, real-world contexts (Zollman, 2012).

Conclusion

Based on the results of the analysis, STEM literacy aspects of learners' knowledge increased after using STEM-based modules on global warming material in the physics learning process. This can be proven by the overall STEM literacy <g> value of 0.65 which is categorized as a moderate or quite satisfactory increase with a size effect of 1.29 in the strong category. The highest increase occurred in engineering technology literacy <g> of 0.71 (high category) because students carried out the engineering design process in designing electric cars, mathematical literacy was ranked second highest after technological literacy with <g> of 0.63. While the lowest increase was in science literacy with <g> of 0.60 (satisfactory category). Thus, it can be concluded that the implementation of STEM-based modules has a moderate or quite satisfactory and effective influence on training STEM literacy aspects of student knowledge.

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