JPPIPA 11(12) (2025)

Jurnal Penelitian Pendidikan IPA

http://jppipa.unram.ac.id/index.php/jppipa/index

A Study of Physics Scientific Literacy and Students' Learning Independence in Three Subdistricts of East Lombok

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Received: October 24, 2025
Revised: November 15, 2025
Accepted: December 25, 2025
Published: December 31, 2025

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DOI: 10.29303/jppipa.v11i12.13243

Abstract: This study aims to analyze the physics science literacy and self-regulated learning of high school students in three sub-districts in East Lombok and their relationship. The research uses a descriptive quantitative method. Quantitative data were obtained through a physics science literacy test and a self-regulated learning questionnaire. A total of 91 students were selected using stratified random sampling. The results show that students' physics science literacy is at a moderate level with an average score of 49 (range 39–77). In terms of self-regulated learning, 38% of students were in the moderate category (score 36–54), and 2% were in the low category (score 18–35). Pearson correlation analysis revealed a positive relationship between physics science literacy and self-regulated learning, with a weak to moderate strength ($r = 0.17–0.43$; $p < 0.05$). Factors influencing both include the suboptimal use of learning materials, weak study habits, lack of parental support, and the ineffective implementation of self-regulated learning strategies. In conclusion, collaboration between teachers, schools, and parents is needed to create an environment that supports the improvement of science literacy and self-regulated learning among students.

Keywords: East Lombok; Physics science literacy; Self-regulated learning

Introduction

Physics education at the upper secondary level faces numerous challenges, particularly in science literacy and self-regulated learning. According to the 2022 results of the Programme for International Student Assessment (PISA) in the field of science, Indonesia's student performance remains relatively low. Only about 34% of students reached Level 2 or higher, significantly below the OECD average of 76%. At this level, students are only able to understand simple scientific explanations and evaluate conclusions based on basic data (OECD, 2022). In the global ranking, Indonesia ranked 61st out of 70 participating countries in PISA 2022, with a score of 383, showing a decline from a score of 396 in 2018. This situation reflects the substantial challenges in achieving science literacy among Indonesian students.

According to Mazidah et al. (2025), science literacy skills need to be further developed to produce high-quality human resources. Based on their research, the average science literacy score in Indonesia for physics is 55.31. Meanwhile, in West Nusa Tenggara, students also face challenges in science literacy, as shown by the following research data. A study by Lestari et al. (2021) indicated that the average science literacy achievement of junior high school students in Mataram, Lombok, was 53.7. Another study by Amalina et al. (2023) showed that science learning outcomes in Lombok, particularly at SMPN 04 Keruak, were categorized as low, with an average score of 34.1, highlighting significant deficiencies in science literacy. Additionally, the science literacy of junior high school students in the coastal areas of East Lombok remains very low, with an average score of 38.76. The highest score was obtained by SMPN 1 Keruak (48.28), and the lowest by MTs NW Bahrul Ulum

How to Cite:
Zahara, L., Santosa, M. H., & Widiana, I. W. (2025). A Study of Physics Scientific Literacy and Students' Learning Independence in Three Subdistricts of East Lombok. *Jurnal Penelitian Pendidikan IPA*, *11*(12), 308–315. https://doi.org/10.29303/jppipa.v11i12.13243

(32.12) (Fahmi, 2022). Based on this research data, it is evident that science literacy among students in Indonesia, especially in Lombok, NTB, is low. However, the focus has not been specifically on physics, nor has it reviewed the situation at the senior high school level.

Meanwhile, self-regulated learning needs to be given greater attention as it impacts student learning outcomes. According to a study by Muljadi et al. (2022), self-regulated learning positively influences the learning outcomes of secondary school students. Therefore, to optimize student learning outcomes, policies and regulations are needed to enhance self-regulated learning. According to Oktaviani et al. (2023), self-directed learning in Indonesia, particularly among students at SMPN 259 Jakarta, is inadequate. Another study by Cahyono (2025) found that the majority of junior high school students in Bengkulu exhibited low levels of self-regulated learning. A further study by Wasyilah et al. (2021) also showed low levels of self-directed learning among students, and according to Capriat (2024), the observed level of self-regulated learning among students was low, with an indicator of only 37.5%. Based on this data, it is necessary to review self-regulated learning practices.

Several studies indicate a positive relationship between self-regulated learning and academic achievement. Some studies related to science literacy and academic achievement include research by Nurhasanah (2022) which found that self-regulated learning positively influences academic performance, as shown by the study's findings. Another study by Kurniawan (2022) found a significant relationship between self-regulated learning and academic achievement, with self-regulated learning contributing 18.1% to student performance. Research conducted by Fitriana et al. (2022) also revealed a significant relationship between self-regulated learning and academic achievement, with a correlation coefficient of 0.182, indicating a weak positive relationship. While some of these studies examine the relationship between self-regulated learning and science literacy, they do not specifically focus on physics content.

Several studies in East Lombok regarding students' difficulties in learning science materials highlight various challenges. Husna (2025) identified inadequate infrastructure, uneven teacher distribution, and socio-economic barriers as key factors contributing to disparities in science education in remote areas like East Lombok, leading to challenges in accessing quality science education. According to Effendi et al. (2024), challenges such as limited internet access and high infrastructure costs must be addressed to improve science learning outcomes in East Lombok. Additionally, Angraini et al. (2020) noted that students in East Lombok face significant difficulties in understanding basic physics and mathematics concepts, which are linked to diverse educational backgrounds, low-quality inputs, and traditional teaching methods that emphasize rote learning rather than inquiry-based and experiential approaches. These conditions significantly affect both science literacy and self-regulated learning among students.

Based on previous studies, several research works have examined the impact of self-regulated learning on science literacy, but none have focused specifically on high school physics content. Therefore, the aim of this study is to analyze the level of physics science literacy among high school students in three sub-districts of East Lombok, measure the level of self-regulated learning among the students, and analyze its impact on their understanding of physics science. Additionally, the study seeks to identify the factors influencing physics science literacy and self-regulated learning among students.

Method

This study uses a descriptive quantitative approach to measure the relationship between self-regulated learning and science literacy, as well as the factors influencing both. The population of this study consists of high school students in three sub-districts of East Lombok. The research sample was selected using stratified random sampling, where the population was first divided into homogeneous strata (e.g., based on region, school type, or grade level), and then a random sample was taken from each stratum (Cochran et al., 2004). The research population includes all high schools in East Lombok District. The sampling technique used was stratified random sampling, with sub-districts as strata. One school was randomly selected from each stratum. Then, within each selected school, one science class (Grade X IPA) was randomly chosen as the sample unit. In this study, the sample consists of 91 students from three schools in different sub-districts of East Lombok. The research instruments include a self-regulated learning questionnaire with four main indicators: 1) Motivation, 2) Discipline, 3) Initiative, and 4) Responsibility (Erdogan et al., 2016), and a physics science literacy test with multiple-choice questions based on the Assessment Framework Key Competencies in Reading, Mathematics, and Science (OECD, 2009). The physics topics assessed are: 1) Explaining scientific phenomena; 2) Evaluating and designing scientific investigations; 3) Interpreting data and evidence scientifically. Additionally, interviews with several teachers and students were conducted to gain deeper insights into their perceptions of self-regulated learning and science literacy.

The data collection procedure involved distributing the self-regulated learning questionnaire and the physics science literacy test directly to students in the classroom. For supporting data, interviews were conducted with three physics teachers from three different schools and with nine students from these schools. The quantitative data analysis during the pilot test of the science literacy questions and the self-regulated learning questionnaire was conducted at a private school in one of the sub-districts, which was part of the research location but in a different class. To examine the relationship between self-regulated learning and science literacy, Pearson correlation analysis was used.

Result and Discussion

Instrument Validation Process

The instrument trial was conducted in two stages to ensure both validity and reliability. The first trial, conducted on September 10, 2025, at a private school in East Lombok, resulted in 20 valid items out of 45 items in the Physics literacy test and 18 valid statements out of 20 items in the autonomy questionnaire. The validity test was performed using the point-biserial correlation technique for the test items and the Pearson Product-Moment correlation for the questionnaire validity. Meanwhile, the reliability test was conducted using the KR-20 formula (Mertasari, 2021).

Physics Science Literacy of Students

The valid instrument was subsequently administered at three schools, two public schools and one private school in the district, between September and October. In the private school, with 28 students, the scores ranged from 30 to 90, with an average score of 59. This moderate average indicates that while some students have achieved a high level of understanding, many others are still at a lower level. At Public School I, with 31 students, the scores ranged from 20 to 75, with an average score of 49. At Public School II, with 32 students, the scores ranged from 20 to 75, with an average score of 40. These findings are further illustrated in Table 1.

Table 1. Science Literacy Data

School	Total	Science Literacy Score
1	28	59
2	31	49
3	32	40
Average		49

In the development of science literacy questions, I referred to the Assessment Framework for Key Competencies in Reading, Mathematics, and Science (OECD, 2009) for Physics, which includes: 1) Explaining scientific phenomena; 2) Evaluating and designing scientific investigations; 3) Interpreting data and evidence scientifically. The criteria for science literacy assessment are based on the Stanine classification (Widodo, 2021), where students' scores can be grouped into three main categories. The high category, ranging from scores of 78 to 100; the moderate category, representing the majority, ranging from scores of 39 to 77, reflecting average achievement; and the low category, with scores from 0 to 38, indicating below-average achievement. Based on the science literacy test scores from the three schools, the average score was 49, placing it in the moderate category.

The results of this test align with the findings from interviews with teachers and students, which revealed that children tend to read only when they have homework or exams, and there is a lack of literacy practices in their home environment. According to Data Literacy Boost, children with better reading habits and access to reading materials tend to achieve higher reading scores, highlighting the importance of a supportive home literacy environment (Dowd et al., 2013). Additionally, based on the students' backgrounds, most of their parents have an education level of high school, junior high school, or elementary school. In relation to parental education, Haryuniati (2021) and Addido et al. (2025) state that the level of parental education significantly affects students' academic achievement.

Based on the interviews with students from the three schools, overall, students from all three schools generally have similar study habits, relying mostly on class notes and teaching materials. Students expect physics learning materials that are simple, easy to understand, engaging, and illustrated, making it easier for them to study, such as physics e-comics. To improve science literacy, it is hoped that teachers will create teaching materials that can attract students' interest, aligned with the physics content. Furthermore, it was found that the laboratory facilities in the private school are fairly supportive, although Class X students rarely conduct experiments in the laboratory. About 97% of students do not have additional tutoring at home, indicating a lack of literacy activities at home, which aligns with the data obtained. Therefore, the role of both parents and teachers in providing self-directed learning programs is crucial, so students can manage their own learning patterns with better time management.

Science literacy requires further development of scientific concepts and their application in everyday life (Jara et al., 2025; Susilawati et al., 2023). According to Chinn et al. (2023), an independent curriculum should focus on understanding science and engaging students with science in their daily lives. This aligns with the

Kurikulum Merdeka (Independent Curriculum), which emphasizes holistic development and contextual learning aimed at fostering scientific literacy, in line with the PISA domains (Wijaya et al., 2025). The Independent Curriculum emphasizes contextual, flexible, and student-centered learning, which enhances basic scientific literacy (Yumna et al., 2025). Therefore, strengthening science literacy through the Kurikulum Merdeka is a crucial step in preparing a generation that is aligned with technological advancements in the 21st century.

Student Learning Independence

Data on student learning independence was obtained from three schools using an independence questionnaire with high, medium, and low criteria. The data on the level of learning independence from three schools in East Lombok can be seen in Table 2.

Table 2. Data of Learning Independence in Percentage

School	High	Medium	Low
1	36%	64%	0%
2	68%	29%	3%
3	75%	22%	3%
Average	60%	38%	2%

Based on the calculation (Widodo, 2021) using the formula for Ideal Mean (Mi) and Ideal Standard Deviation (SDi) on a questionnaire consisting of 18 items with a Likert scale ranging from 1 to 4, three score levels were obtained. The high category falls within the score range of 55 to 72, indicating a strong or optimal level of learning independence. The medium category includes scores between 36 and 54, representing a sufficient or average level of learning independence. Meanwhile, the low category is within the score range of 18 to 35, suggesting that the respondents' learning independence is still low or underdeveloped. Based on the data on learning independence levels in Table 3, it is known that 38% of students fall into the medium category of learning independence, while 2% are in the low category.

Based on the medium and low levels of learning independence, several studies, including Nurmalasari et al. (2023), state that low learning independence is characterized by students struggling to solve their learning problems, being highly dependent on others for assistance, and ultimately achieving scores below the average of their peers. According to Purmia et al. (2024), low learning independence is marked by students who do not complete assignments, fail to bring textbooks, and are highly dependent on teachers for guidance. According to Ningsih (2024), low learning independence is characterized by students who frequently rely on guidance from others, struggle with decision-making, feel confused when choosing options, and are easily distracted, which hinders their ability to self-regulate and manage their learning process effectively. Furthermore, the data on learning independence indicators can be seen in Table 3.

Table 3. Indicators of Learning Independence

School	Motivation	Discipline	Initiative	Responsibility
1	55	48	55	56
2	56	52	55	54
3	56	50	54	55

Based on Table 3 above, an analysis of learning independence in three schools in East Lombok was conducted across four main indicators: 1) Motivation, 2) Discipline, 3) Initiative, and 4) Responsibility (Erdogan et al., 2016). With a maximum score of 72 (18 items with a scale of 1 to 4) and following the criteria for high scores above 54 (as shown in Table 2), it was found that the indicators of learning independence varied. It was observed that all three schools achieved a medium score on the discipline indicator. A small portion of students showed a medium score on the initiative and responsibility indicators. Regarding the low discipline indicator, it may suggest the need for better strategies to foster self-responsibility among students and reflective practices in their learning process (Sitaresmi et al., 2024). According to Izal et al. (2023), undisciplined students show a lack of preparedness for learning, which negatively impacts their overall academic performance. Chaerunnisa et al. (2024) highlight the need for better time management strategies to cultivate discipline in learning.

Meanwhile, low initiative and responsibility contribute to high student dependence on teachers and low student independence (Alrabai, 2017). The lack of initiative and responsibility among students leads to a decline in motivation, the absence of learning goals, and dependence on others to complete tasks, which negatively impacts academic performance (Rahmawati et al., 2022). According to Nurfadhilah et al. (2025), low learning independence is correlated with a lack of initiative and responsibility. Experiential learning can enhance these traits by fostering problem-solving skills, creativity, and decision-making, which ultimately promotes greater student independence in the learning process.

Student Learning Independence and Its Impact on Physics Science

After obtaining the science literacy and learning independence scores, Pearson correlation analysis was applied to determine the strength of the relationship between the two variables. The higher the correlation coefficient between the two variables (the closer it is to

1), the stronger the relationship between them (Nuryadi et al., 2017). The correlation data between learning independence and Physics Science Literacy is presented in Table 4.

Table 4. Correlation Between Learning Independence and Literacy

School	Correlation	Criteria
1	0.17008	The correlation is very weak
2	0.43500	The correlation is moderate
3	0.21568	The correlation is weak

Based on Table 4 above, it is evident that there is a correlation between learning independence and science literacy in the field of Physics, with moderate and very weak criteria. This study aligns with research conducted by Cahyo et al. (2025), which shows that the implementation of a problem-based learning model significantly improves science literacy in Physics in the moderate category, thus encouraging learning independence among students. Meanwhile, according to Sari et al. (2025), it is suggested to identify strategies such as metacognition and contextual learning, which can support students with varying levels of science literacy in developing higher-order thinking skills.

Based on interviews with teachers from three schools, the teachers stated that students still need encouragement to improve their science literacy, as well as their learning independence. The level of students' learning independence at school also needs to be enhanced through the creation of a specialized program. In the context of moderate-level self-directed learning, Budin et al. (2022) emphasize that teachers should use clear teaching language and implement modeling and guided practice. Teachers should also provide opportunities for students to practice independently and offer constructive feedback to support their learning process. Additionally, monitoring learning progress and adjusting teaching methods are essential aspects to ensure that learning goals are effectively achieved. Meanwhile, Perels et al. (2020) highlight the importance of utilizing technology-based educational media to support Self-Regulated Learning (SRL) strategies, particularly metacognitive strategies relevant to modern learning contexts. In line with this, Salsabila et al. (2025) emphasize the implementation of metacognitive strategies involving three main components: planning, monitoring, and evaluation. The planning stage includes setting goals, selecting learning strategies, and organizing resources. In the monitoring stage, students actively assess their level of understanding and learning progress, adjusting strategies as needed. The evaluation stage occurs after the learning activity, where students reflect on the process and outcomes to assess the effectiveness of strategies and identify areas for improvement.

Thus, the key factors influencing students' physics science literacy and learning independence include the underutilization of available teaching materials, limited literacy activities at home, the low level of parental education affecting learning support, limited laboratory facilities and access to technology, and the lack of implementation of Self-Regulated Learning strategies in teaching. To improve science literacy and learning independence, a synergy between teachers, schools, and parents is needed to create a learning ecosystem that is active, reflective, and grounded in real scientific practices, enabling students to develop into independent learners with a deeper understanding of science.

Conclusion

Based on the research findings, it can be concluded that the science literacy level of high school students in three districts of East Lombok is generally at a moderate level. This indicates that most students have a basic understanding of scientific concepts but still face difficulties in connecting theory with real-life phenomena and applying science in daily life. Students' learning independence has a significant impact on their level of science understanding. Students with high learning independence tend to have better science literacy. The key factors influencing physics science literacy and students' learning independence include the underutilization of teaching materials, poor study habits, low parental support, limited facilities, and the suboptimal application of Self-Regulated Learning strategies. Overall, this study emphasizes that learning independence plays a crucial role in the success of students' physics science literacy, and therefore, educational development strategies at the high school level should synergistically incorporate both aspects into the curriculum and teaching practices.

Acknowledgments
Thank you to all parties who have helped in this research so that this article can be published.

Author Contributions
All authors contributed to writing this article.

Funding
No external funding.

Conflicts of Interest
No conflict interest.

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