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Needs Analysis of a Linear Motion E-Module Based on Discovery Learning and Local Wisdom to Facilitate Students' Scientific Literacy

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ABSTRACT

Scientific literacy is an essential competency that students must possess to cope with the advancement of science and technology. However, a preliminary study at SMAN 1 Nan Sabaris revealed that students' scientific literacy skills remain in the very low category, with an average score of 43.2%. The indicator for interpreting data and scientific evidence recorded the lowest percentage at only 29.5%. Meanwhile, an analysis of the teaching materials currently in use showed a score of 67%, which falls into the moderate category, yet these materials have not comprehensively integrated scientific literacy indicators nor connected the concept of linear motion to students' everyday contexts. This study aims to analyze the need for developing a Discovery Learning-based e-module integrated with local wisdom to facilitate students' scientific literacy skills in linear motion. This research employed a Research and Development approach using the 4-D model, focusing on the Define stage. Data were collected through front-end analysis, learner analysis, task analysis, concept analysis, and learning-objective analysis. Questionnaire results indicated that students require digital teaching materials that are interactive, engaging, easy to understand, and supported by visual presentations. The novelty of this study lies in integrating Discovery Learning syntax with Minangkabau local wisdom to create contextual and meaningful physics learning. The practical contribution is providing an innovative alternative teaching tool that bridges the gap between abstract scientific concepts and students' real-world experiences. This study concludes that developing this e-module is essential, as it directly addresses the identified pedagogical gaps and holds the potential to significantly enhance students' ability to interpret evidence and scientific data, while fostering deeper scientific literacy within a culturally relevant framework.

Keywords :e-module, linear motion, discovery learning, scientific literacy, local wisdom.

I. INTRODUCTION

The rapid development of science and technology in the current era has brought significant changes to various aspects of life, including education. Education is no longer oriented solely toward the mastery of knowledge but also toward developing the competencies that students need to face increasingly complex life challenges. One of the competencies that has become a primary focus in education is scientific literacy. Scientific literacy refers to an individual's ability to use scientific knowledge to explain phenomena, interpret scientific data and evidence, and make appropriate decisions based on available information in various life contexts [1]. This ability is increasingly important because students are required not only to understand scientific concepts theoretically but also to apply them in solving various problems encountered in everyday life [2]. Therefore, strengthening scientific literacy has become one of the major focuses in the implementation of the *Kurikulum Merdeka* (Independent Curriculum), which emphasizes meaningful, contextual, and student-centered learning [3].

In the learning process, physics is one of the disciplines that plays a strategic role in developing students' scientific literacy. Physics does not merely study facts, concepts, principles, and laws of nature but also teaches students how to acquire knowledge through a systematic scientific inquiry [4]. Through physics learning, students are expected to develop the ability to observe phenomena, formulate problems, collect and analyze data, and draw conclusions based on the empirical evidence obtained [5]. These abilities are important components of scientific literacy that students need to face developments in science and technology, as well as various challenges of modern life, critically and responsibly [1,5].

However, physics is still often perceived as a difficult subject because learning is dominated by the use of mathematical formulas and the solution of numerical problems. Consequently, students tend to memorize concepts without understanding their connection to real phenomena in their surroundings [6,7]. This condition highlights the importance of presenting physics content in a way that connects scientific concepts with students' real-life experiences. One topic that can serve as a foundation for this approach is Linear Motion, which discusses changes in an object's position over time through the concepts of distance, displacement, speed, velocity, and acceleration [6]. A good understanding of Linear Motion will help students comprehend various motion phenomena encountered in everyday life and in the development of modern transportation technology [8].

Nevertheless, various studies have shown that students still experience difficulties in understanding the basic concepts of Linear Motion, particularly in distinguishing distance from displacement and speed from velocity, as well as in interpreting position–time and velocity–time graphs. These difficulties indicate that students have not fully succeeded in connecting the mathematical, visual, and conceptual representations involved in Linear Motion. Difficulties in understanding these basic concepts may affect students' ability to apply physics concepts to explain phenomena and interpret data scientifically, both of which are important components of scientific literacy.

Similar problems were also found among Grade XI students in Phase F at SMAN 1 Nan Sabaris. An initial study conducted through a scientific literacy test involving 33 students showed that their scientific literacy skills were still categorized as very low, with an average percentage of 43.2%. The lowest achievement was found in the indicator of interpreting data and evidence scientifically, which reached only 29.5%. These findings indicate that students still experience difficulties in interpreting information presented in the form of data, relating it to relevant physics concepts, and drawing conclusions based on the available scientific evidence [9]. This result is consistent with a study conducted by Rahman et al., which showed that students' scientific literacy skills remained in the low category and therefore required learning innovations capable of providing more meaningful and student-centered learning experiences [10].

Despite the recognized importance of scientific literacy and the identified problems at SMAN 1 Nan Sabaris, there is still a significant gap between the current condition of physics learning and the ideal conditions required to foster scientific literacy. First, the teaching materials currently used do not adequately facilitate the development of all scientific literacy indicators, particularly in the topic of Linear Motion. An analysis of the Grade XI Physics textbook written by Ni Ketut Lasmi, which is used for learning at SMAN 1 Nan Sabaris, showed a feasibility percentage of 67%, categorized as moderate according to the Purwanto criteria. Although the book was developed based on the *Kurikulum Merdeka*, scientific literacy indicators were not evenly integrated across all subtopics of Linear Motion.

Second, the existing teaching materials have not connected the concepts of Linear Motion to contextual phenomena that are close to students' lives, nor have they integrated elements of local wisdom that could enhance the meaningfulness of learning. Third, the learning process is still dominated by the use of textbooks and teacher explanations, as confirmed by an interview with the physics teacher. Meanwhile, the results of the student needs analysis through a questionnaire indicated that most students had access to smartphones and were more interested in using digital teaching materials containing visual elements, videos, animations, and interactive activities. These findings reveal a gap between students' learning preferences and the available learning resources.

Furthermore, while various studies have developed e-modules or implemented Discovery Learning or integrated local wisdom separately, there has been no systematic effort to combine these three elements-Discovery Learning, local wisdom, and scientific literacy-into a single integrated teaching material specifically designed for Linear Motion. This gap represents an opportunity to develop an innovative learning resource that addresses both the pedagogical and contextual needs of students.

The novelty of this study lies in the integration of three key components into a single e-module: (1) the Discovery Learning model, which provides students with opportunities to discover concepts independently through observation, problem identification, data collection and processing, verification, and conclusion drawing based on empirical evidence; (2) Minangkabau local wisdom, such as the *Tijak-Tijak Bambu* game, the *Pacu Kudo* tradition, and the *Sipak Rago* game, which are related to the concepts of distance, displacement, speed, velocity, and acceleration [11], [12], [13]; and (3) scientific literacy indicators, which include explaining phenomena scientifically, interpreting data and evidence scientifically, as well as evaluating and designing scientific enquiry.

Unlike previous studies that focused only on one or two of these aspects, this study offers a comprehensive integration that not only makes physics learning more contextual and meaningful but also systematically facilitates the development of students' scientific literacy skills. The e-module is designed to be interactive, visually engaging, and aligned with the characteristics of digital-generation students, who are accustomed to accessing information through technological devices [14]. The integration of local wisdom is expected to connect scientific concepts with students' real-life experiences through cultural contexts that are close to their daily lives, thereby making learning more meaningful and supporting the development of scientific literacy [15].

Therefore, this article aims to describe the results of preliminary research as a basis for designing a Linear Motion e-module based on Discovery Learning and local wisdom to facilitate students' scientific literacy. This preliminary research is expected to provide a comprehensive needs analysis that will serve as the foundation for developing an e-module that is valid, practical, and effective in improving students' scientific literacy skills in the context of physics learning.

II. METHOD

This study employed a Research and Development (R&D) method using the 4-D development model, which consists of the define, design, develop, and disseminate stages [25,26]. In this article, the study was limited to the define stage because the primary objective of this research was to analyze the need for developing an e-module as a foundation for the subsequent design and development stages. This limitation was based on the consideration that the define stage is a crucial foundation in the 4-D model, as errors in the initial needs identification would affect the entire product development process. By conducting an in-depth and comprehensive needs analysis, the developed product is expected to truly align with student characteristics, learning conditions, and curriculum demands.

In addition, time and resource constraints also contributed to the limitation of this research stage. The define stage aimed to analyze the need for developing a Linear Motion E-module based on Discovery Learning and local wisdom as an effort to facilitate students' scientific literacy. This stage was conducted to obtain an overview of physics learning conditions, teaching-material needs, student characteristics, and initial scientific literacy skills as the basis for designing the product to be developed.

The study was conducted at SMAN 1 Nan Sabaris in the second semester of the 2025/2026 academic year. The research subjects consisted of 33 Grade XI Phase F students and one physics teacher. The object of the study was the need to develop a Linear Motion E-module based on Discovery Learning and local wisdom to facilitate students' scientific literacy. The selection of the research site was based on preliminary findings showing that students' scientific literacy skills were still low and that there was a need for innovative digital teaching materials suited to the characteristics of physics learning at the school. Prior to the implementation of the study, the researcher submitted a research permit letter to the school and obtained approval from the principal of SMAN 1 Nan Sabaris.

The define stage included five activities: front-end analysis, learner analysis, task analysis, concept analysis, and specifying instructional objectives. Front-end analysis was conducted through observation and interviews with the Grade XI Phase F physics teacher to identify learning conditions and the problems faced in physics learning. Learner analysis was carried out through questionnaires and scientific literacy tests to obtain information about learning characteristics, technology use, learning experiences, initial scientific literacy skills, and students' needs for digital teaching materials that support physics learning. Student participation in this study was voluntary, and during the data collection process, students were accompanied by the physics subject teacher.

Learning-objective analysis was conducted on the Grade XI Physics textbook by Ni Ketut Lasmi used at the school to examine its alignment with learning outcomes, scientific literacy indicators, concept presentation, scientific representations, everyday-life contexts, and integration of local wisdom. Next, concept analysis was conducted to identify essential concepts, relationships among concepts, and the scope of Linear Motion content to be developed in the e-module. Instructional objective analysis was conducted by reviewing the learning outcomes and instructional objectives in the *Kurikulum Merdeka* as the basis for formulating indicators and learning activities to be integrated into the Discovery Learning-based e-module with local wisdom.

The research instruments consisted of a scientific literacy test, a student needs questionnaire, a teaching-material analysis sheet, and a physics teacher interview guide. The scientific literacy test was administered to 33 students on 29 January 2026 and consisted of 10 essay questions developed based on the three PISA scientific literacy competencies: explaining phenomena scientifically, evaluating and designing scientific enquiry, and interpreting data and evidence scientifically. The test instrument adapted scientific literacy questions developed by Indana Zulfa (2022) which had been declared valid and reliable. Thus, the scientific literacy test instrument was declared feasible for measuring students' scientific literacy abilities.

The student needs questionnaire was used to obtain information about learning characteristics, needs for digital teaching materials, and technology use in physics learning. The teaching-material analysis sheet was used to examine the quality of the textbook used in learning based on several assessment aspects, while the interview guide was used to obtain information about learning conditions, obstacles faced by the teacher, and the need for e-module development.

The research data were analyzed using descriptive statistics. The scientific literacy test data were analyzed by calculating the percentage scores obtained by students on each scientific literacy competency to determine their initial ability level. For the essay questions, a scoring procedure was implemented using a scoring rubric developed for each item. Each item was assigned a maximum score of 4 (answering with appropriate keywords and explanations) to a minimum score of 0 (no answer at all). Each student's total score was calculated by summing the scores obtained from all items and the maximum score. This score was then converted into a percentage by comparing the student's score with the ideal maximum score.

The percentage scores from the student needs questionnaire and teaching-material analysis were analyzed using a five-point Likert scale adapted from Sugiyono. This scale was used to measure the level of suitability or agreement with each assessed indicator. The five-point Likert scale assessment criteria are presented in Table 1.

Table 1. Score Criteria

Skor	Kategori
1	Strongly Disagree
2	Disagree
3	Neutral
4	Agree
5	Strongly Agree

(Source: Ref[18])

The percentage scores from the student needs questionnaire, teaching-material analysis, and scientific literacy test were calculated by comparing students' scores with the ideal maximum score for each test, then multiplying by 100%, as shown in Equation (1).

$$Score = \frac{\text{score obtained by students}}{\text{ideal maximum score of the relevant test}} x100\% \qquad (1)$$

The resulting percentages were then interpreted using the assessment criteria outlined by Purwanto (2010), as presented in Table 2.

Table 2. Assessment Criteria

Skor (%)	Kategori
86-100	Very Good
76-85	Good
60-75	Fair
55-59	Poor
≤ 54	Very Poor

(Source: Ref[19])

Meanwhile, the teacher interview data were analyzed descriptively to obtain an overview of physics learning conditions, students' difficulties in understanding Linear Motion, and the need for e-module development. The results of the analysis from all instruments in the Define stage were used as the basis for designing the Linear Motion E-module based on Discovery Learning and local wisdom, in accordance with students' characteristics, the needs of physics learning, and an orientation toward developing scientific literacy.

III. RESULTS AND DISCUSSION

Results

The results of the study were organized based on the research objectives. The findings presented in this article are limited to the Define stage. This stage aimed to identify the initial learning conditions as the basis for developing a Linear Motion e-module. The e-module integrates Discovery Learning and local wisdom to support students' scientific literacy. The Define stage consisted of five activities: front-end analysis, learner analysis, task analysis, concept analysis, and specifying instructional objectives. These activities produced information regarding learning conditions, student characteristics, teaching materials, content scope, and learning objectives. This information served as the foundation for designing the e-module in accordance with physics learning needs.

Front-end analysis was conducted through observation and interviews with the Grade XI Phase F physics teacher. The purpose was to identify learning conditions and problems encountered in the Linear Motion topic. Based on the observation results, physics learning at SMAN 1 Nan Sabaris has implemented the *Kurikulum Merdeka*. The school also provides adequate learning facilities, such as internet access and smartphone use. However, technology utilization in learning has not been fully optimized. The learning process remains dominated by textbooks and teacher explanations.

The interview results revealed that Linear Motion is still considered a difficult topic for students. Therefore, more interactive supporting teaching materials are needed. The teacher stated that students have difficulty distinguishing the concepts of position, distance, displacement, speed, velocity, and acceleration. They also struggle to connect these concepts with phenomena encountered in daily life. In addition, learning still focuses on problem solving and formula use. As a result, students are not yet accustomed to interpreting data or explaining phenomena scientifically.

In conclusion, physics learning at SMAN 1 Nan Sabaris has implemented the Kurikulum Merdeka with adequate facility support. Nevertheless, technology utilization remains limited to textbooks and lectures. Students experience difficulties in understanding basic Linear Motion concepts and connecting them to real-world phenomena. They are also not yet accustomed to scientific literacy skills, such as interpreting data and explaining phenomena scientifically. These findings indicate the need for interactive and contextual digital teaching materials.

Learner analysis was carried out through a student needs questionnaire and a scientific literacy test. This analysis aimed to obtain information about students' learning characteristics, technology use in learning, and initial scientific literacy ability. This information served as a basis for e-module development.

Student Needs Analysis for Digital Learning

The questionnaire results showed that digital learning implementation at SMAN 1 Nan Sabaris falls into the fair category, with an average percentage of 75.25%. This condition is supported by the fact that 83.6% of students own smartphones. The school policy also allows smartphone use as a learning support medium. Students' enthusiasm for participating in digital learning reached 70.9%. Furthermore, 79.4% of students stated that they understand physics more easily when the material is presented through visual media. Such media includes images, videos, animations, simulations, and other interactive formats.

The average percentage of 75.25% indicates that students have access to and interest in digital learning. However, there is still room for improvement. The lowest indicator was proficiency in using digital platforms, which reached only 68.48%. This suggests that students need an e-module with an intuitive and user-friendly interface. The detailed percentages of students' digital learning analysis are presented in Figure 1.

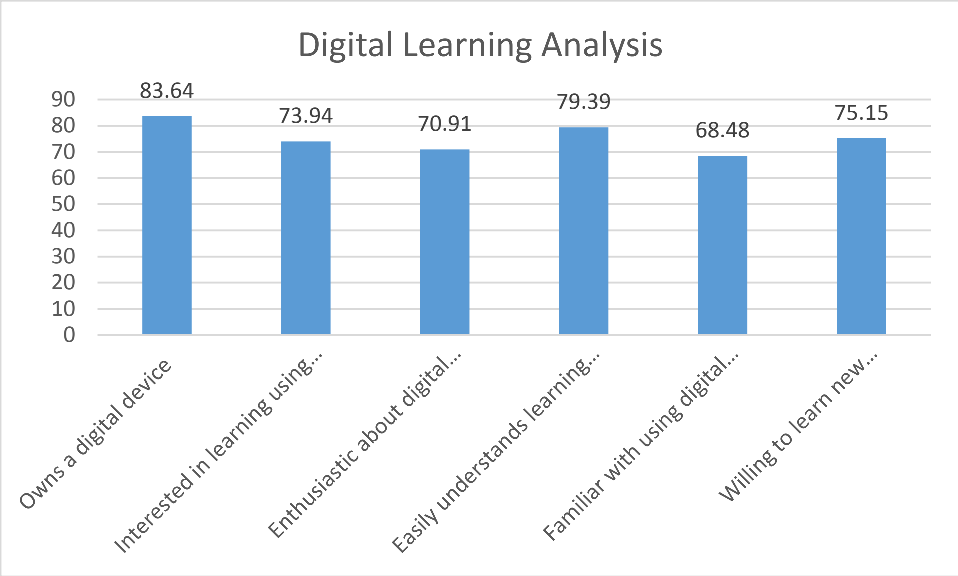

Fig. 1. Digital Learning Analysis

Based on these findings, it can be concluded that the majority of students (83.6%) own digital devices. They also demonstrate high interest and enthusiasm for digital learning, with an average of 75.25%. The lowest indicator was proficiency in using digital platforms (68.48%). This highlights the need for an e-module with an intuitive and easy-to-use interface. Overall, students are prepared for digital teaching materials. They require more engaging and interactive learning media that align with their learning characteristics.

Analysis of Initial Scientific Literacy Ability

In addition to the needs analysis, students' initial scientific literacy skills were also assessed. A scientific literacy test was given to 33 Grade XI Phase F students. The analysis showed that the average scientific literacy score was only 43.2%. According to Purwanto's criteria, this falls into the very poor category.

An analysis of each indicator revealed varying results. The ability to explain phenomena scientifically (K1) obtained the highest percentage at 61.1%. In contrast, the ability to interpret data and evidence scientifically (K2) obtained the lowest percentage at 29.5%. The indicator of evaluating and designing scientific enquiry (K3) obtained a percentage of 39.0%. The low achievement on K2 (29.5%) indicates that students face significant difficulties in interpreting data. They also struggle to connect scientific evidence with physics concepts and to draw conclusions based on available information.

The substantial gap between K1 (61.1%) and K2 (29.5%) is noteworthy. This suggests that although students can explain phenomena qualitatively, they remain weak in quantitative data analysis. They also lack skills in interpreting scientific evidence. The detailed percentages of students' scientific literacy skills are presented in Figure 2.

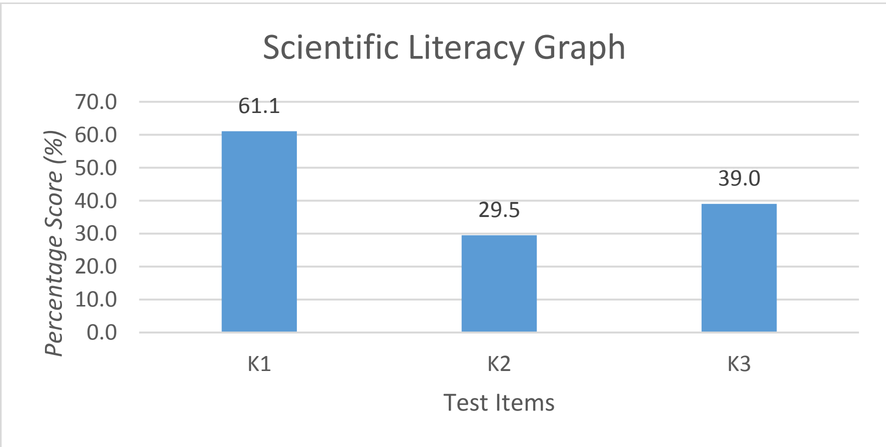

Fig. 2. Percentage of Students' Scientific Literacy Skills

In conclusion, students' overall scientific literacy ability falls within the very low category (43.2%). The most significant weakness is in the indicator of interpreting data and evidence scientifically (29.5%). This indicates the need for an e-module that specifically facilitates the development of data interpretation skills. It should also support the development of scientific evidence skills through structured and contextual learning activities.

Task analysis was conducted through an analysis of the teaching material currently used in physics learning at the school. The material analyzed was the Grade XI SMA/MA Physics textbook by Ni Ketut Lasmi. The analysis focused on several aspects: alignment of content with learning outcomes, content presentation, integration of scientific literacy indicators, presentation of scientific representations, relevance to everyday-life contexts, and integration of local wisdom.

The results showed that the teaching material obtained a feasibility percentage of 67%. According to Purwanto's criteria, this falls into the fair category. Although the book was prepared based on the *Kurikulum Merdeka*, it has several limitations. Scientific literacy indicators were not evenly integrated across all Linear Motion subtopics. In addition, the material and questions presented did not sufficiently connect Linear Motion concepts with contextual phenomena. The content also lacked relevance to students' daily lives. Moreover, the teaching material did not integrate local wisdom as a learning context. As a result, opportunities to increase the meaningfulness of students' learning had not been fully utilized.

Based on these findings, it can be concluded that the teaching materials currently in use have limitations. They lack integration of scientific literacy and relevance to students' life contexts. The feasibility score of 67% indicates that these materials still need improvement. More contextual and meaningful learning materials are required. These findings indicate the need for an e-module that integrates scientific literacy, the Discovery Learning model, and local wisdom in physics learning.

Concept analysis was conducted to identify the scope of the content to be developed in the e-module for the Linear Motion topic. This analysis aimed to determine the content coverage based on relevant knowledge dimensions. These dimensions include factual, conceptual, procedural, and metacognitive knowledge. The results of the concept analysis are presented in Table 3.

Table 3. Concept Analysis

Dimension of Knowledge	Analysis Results
Factual	Motion phenomena in everyday life as learning contexts.
Conceptual	Concepts, principles, and equations in Uniform Linear Motion (GLB) and Uniformly Accelerated Linear Motion (GLBB).
Procedural	Observation activities, experiments, data analysis, and problem-solving in Linear Motion.
Metacognitive	Reflection, evaluation, and strategy selection in solving Linear Motion problems.

Based on Table 3, the concept analysis showed that the Linear Motion topic covers four knowledge dimensions: factual, conceptual, procedural, and metacognitive. The factual dimension includes various motion phenomena in everyday life that are used as learning contexts. The conceptual dimension includes the concepts, principles, and equations of Uniform Linear Motion (GLB) and Uniformly Accelerated Linear Motion (GLBB). Meanwhile, the procedural and metacognitive dimensions involve observation, data analysis, problem solving, and reflection on the learning process and outcomes.

The topic was then developed through contextual phenomena originating from West Sumatran local wisdom. Examples include the traditional games Tijak-Tijak Bambu, Pacu Kudo, and Sipak Rago. This approach allows students to connect physics concepts with real experiences in their surrounding environment.

In conclusion, the Linear Motion topic encompasses four knowledge dimensions. These can be developed contextually through West Sumatran local wisdom. The results of this concept analysis served as the basis for several decisions. These include determining the sequence of content presentation, structuring Discovery Learning-based learning activities, and developing science-literacy-oriented questions.

The analysis of instructional objectives was conducted by reviewing the Physics Learning Outcomes for Phase F in the *Kurikulum Merdeka*. These outcomes were then formulated into Learning Objectives (LO) and Learning Objective Achievement Indicators (IKTP). The results showed that the learning objectives for the Linear Motion topic are not only oriented toward conceptual mastery. They also aim to develop students' ability to explain phenomena scientifically, interpret scientific data and evidence, and evaluate and design scientific enquiry. These competencies are in line with scientific literacy requirements.

Based on these findings, it can be concluded that the learning objectives for the Linear Motion topic are aligned with scientific literacy competencies. They encompass three main indicators: explaining phenomena scientifically, interpreting data and evidence scientifically, and evaluating and designing scientific enquiry. These findings served as the basis for designing Discovery Learning-based learning activities combined with local wisdom contexts. Consequently, the developed e-module will be aligned with the demands of the *Kurikulum Merdeka*. It will also address the current needs of physics learning.

Overall, the results at the Define stage showed that physics learning on the Linear Motion topic still requires more innovative teaching materials. The front-end analysis revealed that technology utilization remains limited. The learner analysis showed that students' scientific literacy skills are very low (43.2%), with the greatest weakness in interpreting data and evidence scientifically (29.5%). The task analysis indicated that the teaching materials used have not optimally integrated scientific literacy indicators and local wisdom (feasibility score of 67%). The concept analysis confirmed that the Linear Motion topic has the potential to be developed through West Sumatran local wisdom contexts. Finally, the instructional objective analysis showed that learning objectives are already aligned with scientific literacy competencies.

Therefore, this preliminary research provides the basis for designing a Linear Motion e-module based on Discovery Learning and local wisdom. This e-module is expected to support the development of students' scientific literacy. It will also align with the characteristics of physics learning in the *Kurikulum Merdeka*.

Discussion

The findings indicate that developing a Linear Motion e-module based on Discovery Learning and local wisdom is necessary to facilitate students' scientific literacy. This need was identified through the Define stage, which included front-end analysis, learner analysis, task analysis, concept analysis, and specifying instructional objectives. The Define stage aimed to identify initial learning conditions as a basis for determining the characteristics of the e-module to be developed [17]. Based on these analyses, information was obtained regarding learning conditions, student characteristics, teaching materials, content scope, and learning objectives. This information formed the foundation for designing an e-module aligned with physics learning needs and the demands of the *Kurikulum Merdeka*.

The front-end analysis showed that physics learning at SMAN 1 Nan Sabaris has implemented the *Kurikulum Merdeka*. It is also supported by learning facilities such as internet access and students' smartphone use. However, technology utilization in the learning process has not been fully optimized. Learning remains dominated by textbooks and teacher explanations. This condition reflects a gap between curriculum policy that encourages technology use and classroom reality, which still relies on conventional approaches

The interview results also revealed that Linear Motion remains one of the most difficult topics for students to understand. Students struggle particularly in distinguishing the concepts of position, distance, displacement, speed, velocity, and acceleration. They also find it difficult to relate these concepts to phenomena encountered in everyday life. In addition, learning is still oriented toward problem solving and formula use. As a result, students are not accustomed to explaining phenomena or interpreting data scientifically. These findings indicate that the learning process still emphasizes procedural problem solving rather than deep conceptual understanding.

This result aligns with previous studies, which stated that physics learning needs to be designed through learning experiences that can develop students' scientific thinking and scientific literacy. Based on these findings, digital teaching materials are needed. These materials should present content contextually and interactively while providing opportunities for students to construct concepts through the stages of Discovery Learning [20]. Thus, the e-module serves not only as a learning resource but also as a means to shift the learning paradigm from teacher-centered to student-centered.

The learner analysis showed that students are well prepared for using digital teaching materials. Most students already own smartphones and demonstrate strong interest in learning that uses videos, animations, simulations, and interactive media. This condition indicates that students' learning characteristics support the use of e-modules as digital teaching materials in physics learning. This finding is consistent with previous research, which stated that e-modules can increase learning motivation because they present material in a more attractive, interactive, and accessible way [21]. This study is also supported by other findings, which explained that students need information-technology-based teaching materials. Such materials can support more engaging learning while facilitating the implementation of scientific literacy [22]. Therefore, e-modules are an appropriate teaching-material alternative that aligns with students' characteristics and technological developments in physics learning.

In addition to the student needs questionnaire, learner analysis was also conducted through a scientific literacy test. The results showed that students' scientific literacy skills remain in the very poor category, with an average percentage of 43.2%. The lowest percentage was obtained in the indicator of interpreting data and scientific evidence (29.5%). In contrast, the indicator of explaining phenomena scientifically obtained the highest achievement (61.1%).

The low achievement in the indicator of interpreting data and scientific evidence (29.5%) warrants special attention. Several factors may explain this condition. First, physics learning has been predominantly oriented toward memorizing formulas and solving numerical problems. Consequently, students are not accustomed to data interpretation activities. Second, the teaching materials used have not presented authentic data that require students to analyze and draw conclusions scientifically. Third, students lack practice in connecting empirical evidence with relevant physics concepts. Fourth, laboratory activities or experiments that can train data interpretation skills are rarely conducted. This situation is exacerbated by time and facility constraints, leading teachers to avoid practical activities that require longer preparation.

This condition indicates that the learning process has not yet fully facilitated the development of all scientific literacy competencies. The findings are consistent with previous studies, which state that scientific literacy emphasizes not only conceptual mastery but also the ability to explain phenomena, interpret data, and evaluate scientific evidence [1]. Similarly, other research has reported that students' scientific literacy in physics learning remains low, especially in the competency of interpreting scientific data[10]. Therefore, the e-module needs to be designed to facilitate all three scientific literacy competencies. This can be achieved through Discovery Learning activities involving phenomenon observation, data analysis, and contextual problem solving.

The task analysis results showed that the teaching material used is aligned with the Learning Outcomes of the *Kurikulum Merdeka*. However, it still has several limitations in facilitating scientific literacy. Scientific literacy indicators were not evenly integrated across all Linear Motion subtopics. Scientific representation remained limited. The material and questions did not sufficiently connect concepts to everyday-life phenomena or local wisdom. These findings support previous research, which stated that physics teaching materials tend to be mathematically oriented, thus providing limited opportunities for students to develop scientific literacy[23].

These results are reinforced by other studies, which stated that physics teaching materials need to integrate real-life contexts, scientific representations, and student-centered learning activities to improve scientific literacy [20]. Similarly, other findings showed that the use of technology-based teaching materials in schools has not yet been optimal in supporting scientific literacy [22]. Meanwhile, other research explained that physics teaching materials integrating real-life contexts and scientific literacy can help students build conceptual understanding more meaningfully [24].

The concept analysis results showed that the Linear Motion topic includes factual, conceptual, procedural, and metacognitive dimensions of knowledge. These characteristics indicate that learning Linear Motion requires more than mastery of concepts and equations. It also demands the ability to observe phenomena, analyze data, solve problems, and reflect on the learning process. These characteristics align with the Discovery Learning model, which allows students to discover concepts through investigation and analysis activities.

In this study, the Linear Motion concept was developed through the context of West Sumatran local wisdom. Examples include the traditional games Tijak-Tijak Bambu, Pacu Kudo, and Sipak Rago. This approach allows students to connect physics concepts with real experiences in their surrounding environment. This finding is supported by previous research, which stated that modules based on scientific literacy and local wisdom can help students become actively involved in learning [25]. Similarly, other studies explained that physics teaching materials integrating local wisdom can create more contextual, meaningful, and student-relevant learning [26].

The results of the instructional objectives analysis showed that the formulation of Learning Outcomes, Learning Objectives, and Learning Objective Achievement Indicators are interrelated and systematically arranged. The analysis showed that the learning objectives for Linear Motion are oriented not only toward conceptual mastery but also toward developing students' ability to explain phenomena scientifically, interpret scientific data and evidence, and evaluate and design scientific enquiry. These competencies are in line with scientific literacy requirements. The alignment between learning objectives, learning activities, and assessment became the basis for structuring the e-module. Consequently, each learning activity contributes to achieving the expected competencies.

The findings of this study have several practical implications for physics teachers. First, teachers need to shift from conventional approaches oriented toward formulas and calculations toward more contextual and student-centered approaches. Second, teachers can utilize the developed e-module as an alternative teaching material that is interactive and aligned with the characteristics of digital-generation students. Third, teachers should integrate local wisdom into physics learning to enhance the meaningfulness of learning and help students connect abstract concepts with real experiences. Fourth, teachers need to design learning activities that specifically train data interpretation and scientific evidence skills. This can be done through simple experiments, graph analysis, and data-based discussions. Fifth, teachers can use this e-module as a tool to implement the Discovery Learning model more systematically. This approach helps students become accustomed to the process of independently discovering concepts. Thus, the developed e-module serves not only as a learning resource but also as a tool for teachers to create more innovative, meaningful, and relevant physics learning that meets 21st-century demands.

Overall, the results indicate that the need for e-module development is supported by the front-end analysis, learner analysis, task analysis, concept analysis, and instructional objectives analysis conducted at the Define stage. Unlike previous studies, this research shows that teaching material limitations are not only related to suboptimal presentation of everyday-life contexts and learning technology use. They also stem from the failure to integrate local wisdom as a learning resource in the Linear Motion topic. In fact, integrating local wisdom into teaching materials has the potential to create more contextual learning, increase the meaningfulness of learning, and facilitate the development of students' scientific literacy. This is achieved through learning experiences that are close to students' environment and culture. Therefore, this study contributes a model for developing an e-module that systematically integrates Discovery Learning, local wisdom, and scientific literacy. This model can serve as a reference for developing similar teaching materials in other physics topics.

IV. CONCLUSION

Based on the preliminary research findings at the Define stage, developing a Linear Motion e-module based on Discovery Learning and West Sumatran local wisdom is necessary to facilitate students' scientific literacy at SMAN 1 Nan Sabaris. This need is based on three main findings: (1) students' scientific literacy skills remain very low (43.2%), with the greatest weakness in the indicator of interpreting data and scientific evidence (29.5%); (2) the existing teaching materials obtained a feasibility score of only 67% and have not integrated local wisdom as a learning context; and (3) students demonstrate good readiness for digital learning (average 75.25%) and require more interactive and contextual teaching materials. The integration of three main components the Discovery Learning model, West Sumatran local wisdom (the traditional games Tijak-Tijak Bambu, Pacu Kudo, and Sipak Rago), and scientific literacy competencies (explaining phenomena scientifically, interpreting data and scientific evidence, and evaluating and designing scientific enquiry) into a single e-module represents the novelty of this research, which is expected to help students connect physics concepts with real experiences in a more meaningful way.

This study has only reached the Define stage, so it is recommended that the research be continued to the Design, Develop, and Disseminate stages to produce a valid, practical, and effective e-module. Practical recommendations for future e-module development include designing an intuitive and user-friendly interface, structuring learning activities that explicitly train data interpretation and scientific evidence skills, integrating local wisdom as an integral part of the Discovery Learning syntax, and adding interactive features such as simulations and experiment videos. Validation by content, media, and language experts should be conducted before limited trials and field trials to measure the e-module's practicality and effectiveness. Further research can also examine the e-module's effectiveness on other physics topics, compare it with other learning models, or qualitatively explore students' and teachers' perceptions of its use.

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