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Needs Analysis For A Guided Imquiry Based Learning Management System On The Topic Of "Matter And Its Changes" At SMKN 1 Pedamaran Timur

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Abstract

This study aimed to analyze the need for developing a Guided Inquiry-based Learning Management System (LMS) for teaching Matter and Its Changes in Grade X at SMKN 1 Pedamaran Timur. A descriptive approach was employed through observations, interviews, questionnaires, and document analysis involving 129 students and 30 teachers. The results showed that learning was still dominated by lectures, discussions, and assignments, while digital technology had not been systematically integrated. Most students needed interactive digital media (86.8%), learning activities supported by videos, animations, quizzes, and interactive activities (83.7%), and Guided Inquiry-based media (81.4%). Similarly, teachers emphasized the need for digital media to increase student engagement (90.0%), facilitate systematic learning (86.7%), and strengthen Guided Inquiry (83.3%). All students owned smartphones and had adequate internet access. Curriculum analysis also indicated that Matter and Its Changes was suitable for Guided Inquiry because it involves observing, identifying, analyzing, and drawing conclusions from phenomena. Therefore, a Guided Inquiry-based LMS is considered relevant to integrate materials, inquiry activities, interactive media, assessment, and communication in a student-centered learning system.

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Keywords: Learning Management System, Guided Inquiry, IPAS, Matter and Its Changes, needs analysis.

INTRODUCTION

The development of information and communication technology has brought significant changes to the provision of education at various levels. Digital transformation requires teachers not only to master learning content but also to be able to use technology as a means of creating learning processes that are innovative, interactive, and student-centered (Koehler et al., 2020; Munir, 2017). The integration of technology into learning aligns with the implementation of the Merdeka Curriculum (Kurikulum Merdeka), which emphasizes the importance of differentiated learning, the strengthening of 21st-century competencies, and the development of students' critical, creative, collaborative, and communicative thinking skills (Kemendikbudristek, 2022). Therefore, the use of digital learning media has become one of the relevant strategies for improving the quality of learning in schools (Meliyani et al., 2022; Puspitarini & Hanif, 2019).

One form of technology use in education is the implementation of a Learning Management System (LMS). An LMS is a digital platform capable of integrating various learning components such as content delivery, learning activities, discussions, assignments, evaluation, and reporting of learning outcomes within a single structured system (Al-Fraihat et al., 2020; Rahmah et al., 2024). Through an LMS, students gain the opportunity to learn more flexibly, since materials can be accessed anytime and anywhere according to their individual learning needs (Alamri et al., 2022; Gamage et al., 2022). In addition, an LMS makes it easier for teachers to manage the learning process, monitor students' learning activities, and conduct evaluations more effectively (Al-Fraihat et al., 2020; Supuwiningsih & Pramartha, 2024).

Nevertheless, implementing an LMS in learning does not automatically guarantee improved learning quality if it is not supported by an appropriate instructional approach. When an LMS functions merely as a repository for materials or a place to submit assignments, it has not yet been able to encourage students' active engagement in constructing knowledge (Jonassen, 1999; Mursali et al., 2024). Therefore, an integration is needed between learning technology and an instructional model that can facilitate students in discovering concepts independently through a scientific inquiry process (Mursali et al., 2024; Putri et al., 2022).

One instructional model considered suitable for the characteristics of science learning (Dewi et al., 2020; Kuhlthau et al., 2015) is Guided Inquiry. This model positions students as the

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main subject in the learning process through the stages of formulating problems, developing hypotheses, conducting investigations, analyzing data, and drawing conclusions under the teacher's guidance (Kuhlthau et al., 2015; Widodi et al., 2025). The Guided Inquiry approach is not only oriented toward concept mastery but also trains critical thinking, problem-solving, scientific communication, and science process skills (Dewi et al., 2020; Kurniawati et al., 2021; Mursali et al., 2024). Integrating Guided Inquiry into an LMS is expected to create a more interactive, contextual learning environment that encourages students to actively construct their own understanding (Putri et al., 2022; Siregar & Mawardi, 2022).

The topic of Matter and Its Changes is one of the foundational topics in the IPAS subject in Grade X (Kemendikbudristek, 2022), which has conceptual and abstract characteristics (Hinton & Nakhleh, 1999; Wu & Shah, 2004). This topic covers various concepts such as the properties of matter, physical and IPAS changes, the classification of matter, and the changes that occur in daily life. These characteristics require students not only to memorize concepts but also to be able to connect theory with real phenomena through observation, experimentation, and analysis activities (Ardac & Akaygun, 2004; De Jong et al., 2013). However, in learning practice, students are still found to have difficulty understanding the relationships between concepts, which results in low scientific thinking ability and learning outcomes (Saputri & Dewi, 2023; Simbolon et al., 2023).

The results of preliminary observations conducted at SMKN 1 Pedamaran Timur show that the IPAS learning process is still dominated by the lecture method and the use of simple presentation media. The use of learning technology has not been optimized (Kusumawati, 2019), resulting in relatively low student interaction during the learning process. Teachers generally use communication applications such as WhatsApp or Google Classroom to share materials and assignments (Zhafiri & Ekohariadi, 2021), but have not yet used a platform capable of integrating all learning activities into a single system. This condition causes students to tend to be passive, less motivated to explore the material independently (Puspitarini & Hanif, 2019), and to experience difficulty understanding the abstract concepts in the topic of matter and its changes.

The needs analysis conducted through observations, interviews, questionnaires, and documentation involving 129 Grade X students and 30 teachers at SMKN 1 Pedamaran Timur shows a strong need for the development of interactive digital learning media that support student-centered learning. The questionnaire results indicate that 112 students (86.8%) stated they needed more interactive digital learning media, 108 students (83.7%) wanted learning

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supported by videos, animations, quizzes, and interactive activities, and 105 students (81.4%) stated they were interested in using website-based learning media accessible through digital devices. Meanwhile, of the 30 teachers, 27 teachers (90.0%) stated that digital learning media capable of increasing student engagement was needed, 26 teachers (86.7%) stated they needed media that could facilitate learning activities systematically, and 25 teachers (83.3%) considered that instructional approaches encouraging students to observe, formulate problems, propose hypotheses, collect data, analyze, and draw conclusions still needed to be strengthened in learning. These findings indicate that the need for digital learning media relates not only to the presentation of materials but also to the need for a system capable of integrating inquiry-based learning activities in a structured manner (Meliyani et al., 2022; Putri et al., 2022). Therefore, the development of a Guided Inquiry-based Learning Management System (LMS) is relevant for implementation at SMKN 1 Pedamaran Timur as an interactive, systematic learning tool capable of facilitating students in building understanding through the inquiry process (Mursali et al., 2024; Sari et al., 2023).

Various previous studies show that the use of an LMS can increase learning flexibility, learning independence, and student engagement when combined with an appropriate instructional model (Mursali et al., 2024; Siregar & Mawardi, 2022). Research conducted by Gamage et al. (2022) shows that an LMS has a positive impact on learning effectiveness when designed with attention to student-centered learning activities. Meanwhile, research by Oguguo et al. (2021) revealed that inquiry-based learning contributes to improved critical thinking skills and science learning outcomes. Nevertheless, research on the development of a Guided Inquiry-based LMS on the topic of Matter and Its Changes at the vocational high school level remains relatively limited (Fitriarieswa et al., 2024; Rahmah et al., 2024), so further research is needed.

Based on the description above, this study aims to develop a Guided Inquiry-based Learning Management System (LMS) on the topic of Matter and Its Changes for Grade X Computer and Network Engineering (TKJ) students at SMKN 1 Pedamaran Timur. The developed product is expected to meet the criteria of validity, practicality, and effectiveness (Richey & Klein, 2014; Sugiyono, 2013) so that it can become an alternative digital learning medium that supports the implementation of the Merdeka Curriculum (Kemendikbudristek, 2022) while also improving the quality of IPAS learning at the school.

RESEARCH METHODOLOGY

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This study is a descriptive study aimed at producing a product in the form of a Guided Inquiry-based Learning Management System (LMS) on the topic of Matter and Its Changes for Grade X vocational high school students. The study was conducted at SMKN 1 Pedamaran Timur during the even semester of the 2025/2026 academic year. The research subjects consisted of 35 Grade X Computer and Network Engineering (TKJ) students, comprising 20 male students and 15 female students. In addition to the students, the study also involved an IPAS subject teacher as a practitioner. The Analysis stage was carried out to identify learning needs through classroom observations, interviews with the teacher, distribution of questionnaires to students, and analysis of curriculum documents. The analysis focused on student characteristics, the characteristics of the Matter and Its Changes topic, the conditions of ongoing learning, the availability of facilities and infrastructure, and the need for digital learning media. The research instruments used included an observation sheet, an interview guide, and a needs-analysis questionnaire. All instruments were developed based on indicators referring to the research objectives and the characteristics of the Guided Inquiry model. The data analysis technique used was descriptive qualitative analysis. Data from the validation results, practicality questionnaires, and response questionnaires were analyzed using percentages with the following formula:

$$P = \frac{\sum X}{\sum X_i} \, x \, 100\%$$

RESULT AND DISCUSSION

Analysis Stage

The analysis stage is the initial stage aimed at obtaining comprehensive information about learning needs as a basis for product development (Branch, 2009; Morrison et al., 2010). In this study, the analysis was carried out through classroom observations, interviews with the IPAS subject teacher, distribution of questionnaires to students, and documentation studies of the learning materials used at SMKN 1 Pedamaran Timur. The information obtained was used to determine the characteristics of the Learning Management System (LMS) to be developed so that it aligns with the teacher's needs, student characteristics, and the demands of the Merdeka Curriculum (Kemendikbudristek, 2022).

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Learning Needs Analysis

Table 1 Results of the Needs Analysis

Respondent	Finding	Number	Percentage
Students (129)	Need interactive digital media	112	86.8%
Students (129)	Want videos, animations, quizzes, interactive activities	108	83.7%
Students (129)	Interested in Guided Inquiry-based media	105	81.4%
Teachers (30)	Digital media increases engagement	27	90.0%
Teachers (30)	Media facilitates systematic learning	26	86.7%
Teachers (30)	Guided Inquiry needs to be strengthened	25	83.3%

The observation results show that Grade 10 IPAS learning is still dominated by the lecture method, simple discussions, and assignments. Although teachers have used PowerPoint and online communication applications, their use has not yet been integrated into a single structured learning system. This condition causes students to primarily receive information and to be not yet optimally engaged in inquiry activities (Meliyani et al., 2022). These findings are consistent with the results of the needs analysis, namely that 86.8% of students need more interactive digital media and 86.7% of teachers need media that can facilitate learning systematically. Therefore, an LMS is needed that can integrate various learning activities while also supporting students' active engagement through the Guided Inquiry approach (Mursali et al., 2024; Putri et al., 2022). Based on the observation results, several main problems were identified as follows.

Table 2 Results of the Learning Needs Analysis

Problem	Finding
Instructional model	Still dominated by lectures
Learning media	PowerPoint and textbooks
Technology use	Not yet using an LMS
Student activity	Tends to be passive
Learning	Teacher-centered
Evaluation	Not yet digitally integrated

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The observation results show that the learning media currently used have not been able to facilitate active learning in line with the characteristics of the Merdeka Curriculum (Kemendikbud, 2022). In fact, the topic of Matter and Its Changes requires visualization, simulation, and exploratory activities so that abstract concepts can be more easily understood (Ardac & Akaygun, 2004; De Jong et al., 2013; Mayer, 2009).

Therefore, a digital learning medium is needed that can integrate the presentation of materials, learning activities, evaluation, and communication between teachers and students within a single, easily accessible platform (Al-Fraihat et al., 2020; Horton, 2011).

This finding indicates a gap between learning practices and the demands of 21st-century learning (National Research Council [NRC], 2012; P21, 2019). An LMS does not only function as a repository for materials but can also become a digital learning environment that enables students to learn actively, independently, and collaboratively (Jonassen, 1999; Zimmerman, 2002). Therefore, the development of a Guided Inquiry-based LMS is considered relevant to address the IPAS learning needs at SMKN 1 Pedamaran Timur (Putri et al., 2022; Sari et al., 2023).

Curriculum Analysis

The curriculum analysis was conducted by reviewing the Learning Outcomes (Capaian Pembelajaran/CP), Learning Objectives (Tujuan Pembelajaran/TP), Learning Objective Flow (Alur Tujuan Pembelajaran/ATP), teaching modules, and IPAS Phase E learning materials of the Merdeka Curriculum (Kemendikbudristek, 2022).

The analysis results show that the topic of Matter and Its Changes requires students not only to master concepts but also to develop scientific skills through the activities of observing, identifying, classifying, analyzing, and drawing conclusions about various phenomena related to changes in matter (Kemendikbud, 2022; Kuhlthau et al., 2015).

In general, the expected competencies include:

- identifying the properties of matter;
- distinguishing between physical changes and IPAS changes;
- classifying elements, compounds, and mixtures;
- explaining methods of separating mixtures;
- relating the concept of changes in matter to everyday life phenomena.

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In addition to knowledge competencies, the curriculum also emphasizes the development of critical thinking skills, scientific communication, collaboration, creativity, and digital literacy (Kemendikbudristek, 2022; P21, 2019).

These characteristics indicate that IPAS learning requires media capable of facilitating the inquiry process in stages (Kuhlthau et al., 2015). Therefore, Guided Inquiry was chosen as the instructional approach to be integrated into the LMS (Dewi et al., 2020; Mursali et al., 2024).

The Merdeka Curriculum places students at the center of learning (Kemendikbud, 2022), so the media developed must be able to provide students with space to explore knowledge independently. A Guided Inquiry-based LMS meets these characteristics because every learning activity is designed to follow the scientific inquiry process (Kuhlthau et al., 2015; Putri et al., 2022).

Analysis of Student Characteristics

Table 3 Summary of Student Characteristics Analysis

Aspect	Finding
Smartphone ownership	100%
Internet access	Very good
LMS experience	Low
Interest in visual media	Very high
Difficulty with abstract material	High

The questionnaire results show that all students already own a smartphone and are accustomed to using the internet in their daily activities (Darmawan, 2017; Setiawan, 2020). Most of them have also used online learning platforms, although their use is still limited to submitting assignments (Zhafiri & Ekohariadi, 2021).

The student needs analysis shows that they experience difficulty with abstract material, particularly in distinguishing between physical changes and IPAS changes, classifying matter, and understanding the relationship between theory and phenomena occurring in their surrounding environment (Hinton & Nakhleh, 1999; Saputri & Dewi, 2023; Wu & Shah, 2004). Students stated that they were more interested in learning using media containing videos, simulations, animations, virtual experiments, and interactive exercises compared to printed media (Clark & Mayer, 2016; Mayer, 2009).

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These student characteristics indicate that technological readiness is no longer the main obstacle in implementing an LMS (Salloum et al., 2022). The more important challenge is how to design learning activities that can increase student engagement in independently constructing concepts (Koehler et al., 2020). Guided Inquiry provides this opportunity because students not only receive information but also conduct investigations into the phenomena being studied (Kuhlthau et al., 2015; Vygotsky, 1978).

Teacher Needs Analysis

The interview results show that teachers need learning media that can:

1. integrate all learning activities into a single platform (Al-Fraihat et al., 2020);
2. increase student learning motivation (Puspitarini & Hanif, 2019);
3. simplify the learning evaluation process (Rahmah et al., 2024);
4. support the implementation of the Merdeka Curriculum (Kemendikbudristek, 2022);
5. be easy to use without requiring programming skills (Hardyanto & Surjono, 2016).

Teachers also stated that the topic of Matter and Its Changes would be easier to understand if students could observe phenomena through videos, simulations, or virtual experiments (De Jong et al., 2013; Saputri & Dewi, 2023).

The results of the teacher needs analysis show that LMS development is not merely a matter of keeping up with technological developments but is a solution to real learning problems (Meliyani et al., 2022). Therefore, the LMS being developed is designed not only as a medium for delivering materials but also as a learning medium that comprehensively supports Guided Inquiry activities (Putri et al., 2022; Sari et al., 2023).

CONCLUSION

Based on the results of the needs analysis, curriculum analysis, student characteristics analysis, and teacher needs analysis, it can be concluded that IPAS learning in Grade X at SMKN 1 Pedamaran Timur still faces limitations in the use of technology and the implementation of student-centered learning. Learning is still dominated by the lecture method, the use of media is limited to PowerPoint and textbooks, and an LMS that integrates materials, learning activities, and evaluation in a unified manner is not yet available. The results of the needs analysis reinforce these findings, with 86.8% of students needing interactive digital media, 83.7% wanting videos, animations, quizzes, and interactive activities, and 81.4% interested in using Guided Inquiry-

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based media. On the teachers' side, 90.0% needed digital media that could increase student engagement, 86.7% needed media that facilitates learning systematically, and 83.3% considered that the implementation of Guided Inquiry needed to be strengthened. In addition, all students already owned smartphones and had good internet access, indicating that they were technologically ready to use an LMS. The curriculum analysis results show that the topic of Matter and Its Changes requires observing, identifying, analyzing, and drawing conclusions about phenomena, which aligns with the characteristics of Guided Inquiry learning. Thus, there is alignment between the needs of students and teachers, the characteristics of the material, the demands of the Merdeka Curriculum, and students' technological readiness. Therefore, the development of a Guided Inquiry-based LMS on the topic of Matter and Its Changes is considered relevant and necessary as a solution to create IPAS learning at SMKN 1 Pedamaran Timur that is more interactive, systematic, active, independent, and student-centered.

FUTURE DIRECTIONS

This study has several limitations. First, the needs analysis was conducted at only one vocational high school, so the findings may not fully represent the conditions of other schools with different characteristics. Second, the study focused primarily on identifying students' and teachers' needs and did not yet evaluate the effectiveness of a Guided Inquiry-based LMS in improving learning outcomes. Third, the analysis was limited to the topic of Matter and Its Changes in Grade X. Future research should therefore involve a broader range of schools and participants to obtain more comprehensive findings. Further studies are also needed to develop and validate the proposed LMS and examine its practicality and effectiveness through implementation in actual learning environments. Future research could additionally investigate the impact of the LMS on students' critical thinking, inquiry skills, learning independence, and engagement in learning.

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