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Identifying Junior High School Student's Learning Needs and Challenges in Science Education

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ABSTRACT

Understanding students' needs in science education is essential for improving teaching strategies and learning outcomes. This study investigates students' preferences regarding teaching methods, learning materials, and supplementary education outside school. The study employed a descriptive research design involving 119 students and 28 teachers from seven randomly selected schools in Ciamis. Participants had prior experience with online learning. Data were collected through questionnaires and interviews and analyzed quantitatively using percentage-based analysis. Findings reveal that 95% of students enjoy learning science due to its real-life relevance. Approximately 79% favor practical-based learning methods, citing ease of understanding and increased engagement, while 21% reported disinterest or discomfort with practical activities. Face-to-face instruction was preferred by 88.2% of students for its interactive benefits, though 3.57% felt teachers did not sufficiently involve them, potentially limiting critical thinking development. Regarding learning materials, 79.8% of students confirmed material availability, preferring those that are visual, durable, and easy to understand. Only 7.6% of students pursued additional lessons, primarily to enhance comprehension or complete assignments. These findings highlight students' inclination toward interactive and visually supported science instruction. Barriers such as limited engagement and lack of exposure to practical learning should be addressed to foster a more effective educational experience. Identifying and addressing students' preferences in science education can inform more effective instructional approaches and resource development.

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1. INTRODUCTION

Science education plays a pivotal role in shaping students' understanding of natural phenomena and their application in daily life. It involves not only the transmission of scientific facts and theories but also the development of essential skills such as observation, experimentation, and critical analysis (Tyas et al., 2020). Effective science education must be contextualized with real-world situations to ensure relevance for students and alignment with societal needs (Zidny, Sjöström, & Eilks, 2020; Østergaard, 2017). Various pedagogical approaches must be identified and implemented to optimize knowledge acquisition and skill development (Chavez & Colin, 2015).

To enhance the effectiveness of science education, teachers need to adopt interactive, student-centered approaches such as inquiry-based, project-based, and contextual learning. These methods encourage students to actively explore, ask questions, and find solutions through hands-on experiences, thereby strengthening conceptual understanding and scientific skills. Additionally, integrating local and global issues into science lessons can foster critical awareness and social responsibility among students. Thus, science education goes beyond knowledge transmission by cultivating scientific attitudes and preparing students to face real-life challenges with informed perspectives.

Despite its importance, science education in schools faces significant challenges. A major concern is that students often perceive science as abstract and complex, leading to difficulties in comprehension. Teachers, as key facilitators of learning, must bridge the gap between abstract scientific concepts and students' cognitive abilities through well-designed instructional strategies. Teachers are expected to possess both pedagogical and content knowledge, aligning with Law Number 14 of 2005, which mandates that educators have adequate academic qualifications and professional competencies (Estriyanto, 2016). Furthermore, understanding students' diverse learning needs is essential, as each student has unique cognitive capabilities influenced by their background and experiences (Estari, 2020; Khoiri, 2021). Therefore, teachers must employ creative and adaptive teaching methods to enhance learning outcomes.

To effectively implement creative and adaptive teaching methods, educators should integrate technology, hands-on experiments, and interdisciplinary approaches that connect science to everyday life. These strategies can make learning more engaging and relevant, helping students grasp difficult concepts more easily. Additionally, formative assessments should be used regularly to identify learning gaps and tailor instruction accordingly. Collaboration among teachers, curriculum developers, and education stakeholders is also essential to design materials that are both innovative and inclusive. By fostering a growth mindset and encouraging student participation, teachers can create a dynamic learning environment that supports the development of scientific literacy and critical thinking skills.

Previous studies have explored various teaching strategies in science education, such as inquiry-based learning (Wicaksana et al., 2022), problem-based learning (Nurdiansyah & Amalia, 2018), and technology integration (Sukiastini, 2024). However, there is still a gap in understanding how these strategies are implemented in classroom practices and how students respond to these approaches. This study aims to address this gap by examining how teachers design and implement science instruction and how students perceive the various teaching methods applied.

This research also underscores the evolving role of teachers as adaptive learning designers who not only facilitate learning but also integrate innovative methods to enhance student engagement and comprehension. The study contributes to both theoretical and practical aspects of science education by providing empirical data that can inform curriculum development and educational policy at the national level.

By offering insights into the relationship between student characteristics, science materials, and teaching methodologies, this study seeks to provide valuable recommendations for improving science education. It highlights the necessity of incorporating relevant teaching methods, utilizing technology-based learning media, and adopting student-centered pedagogical approaches. These findings can serve as a reference for educators, researchers, and policymakers striving to improve the quality of science education in Indonesia.

Ultimately, fostering an inclusive and innovative science education system requires collaboration among teachers, students, parents, and policymakers. By addressing existing challenges and exploring effective instructional strategies, this research aims to contribute to the development of a science education framework that equips students with the necessary knowledge and skills to thrive in an increasingly complex world.

2. METHODS

This study employed a descriptive method to identify students' science learning needs without implementing any specific treatment. The purpose was to obtain an objective overview of science education conditions at the junior high school level. The research sample was randomly selected from seven junior high schools, including Islamic Junior High Schools (Madrasah Tsanawiyah), consisting of third-grade students. These students had experienced both online and offline learning. A total of 119 student respondents participated in the questionnaire, while interviews were conducted with 28 science teachers from five different schools to enrich the data and provide perspectives from educators.

The research instrument used was an open-ended questionnaire designed to collect in-depth information. The questions explored student profiles, study habits, learning method preferences, availability of instructional materials, and the challenges encountered in learning science. The questionnaire was used directly in the field without prior validity testing. However, the questions were systematically constructed to address the study's focus. The decision not to conduct validity testing was based on the exploratory nature of the study, which emphasized qualitative insights gathered from students' actual learning experiences.

Data collection was conducted by distributing the questionnaire directly to the respondents to ensure the accuracy and completeness of the responses. In addition, interviews with teachers were conducted to obtain supplementary information regarding science teaching strategies used in schools. These interviews were semi-structured to allow for deeper exploration of the topics discussed. The data collection process was carried out within a specific timeframe, under careful supervision to ensure active and honest participation by both students and teachers in accordance with the research procedures.

The collected data were analyzed descriptively by presenting the findings in the form of percentages and thematic categories. This approach was intended to facilitate interpretation and highlight general patterns related to students' needs and challenges in science learning. Thematic categories were developed based on recurring responses from participants. The analysis was conducted systematically to ensure the validity and relevance of the findings. Presenting data in simple statistical formats and thematic narratives allowed the researchers to convey the results in a comprehensive and accessible manner for educational stakeholders.

This study was conducted with full consideration of research ethics. All participants were informed about the purpose and benefits of the study prior to completing the questionnaire or participating in interviews. Their involvement was voluntary and conducted without coercion, and the confidentiality of their identities and responses was strictly maintained. Data collection was handled carefully to minimize any risk to participants. Moreover, the researchers were committed to maintaining data integrity by avoiding manipulation and accurately reporting the findings. These efforts were made to ensure the research results are trustworthy, ethical, and useful for improving science education at the junior high school level.

3. FINDINGS AND DISCUSSION

3.1 Findings

Science learning plays an important role in building students' understanding of scientific concepts related to everyday life. To determine the extent of students' interest in science learning, an analysis was conducted on aspects of learning potential, which include several indicators such as interest in science learning, preferred material, reading habits, independent practice, and participation in study guidance. Data collected from 119 students in the Ciamis area show that the majority of students have a high interest in science learning, which can be a supporting factor in improving the effectiveness of learning in schools.

Based on the data analysis results, around 95% of students stated that they liked science learning, with the main reasons being that science material is closely related to everyday life, nature, and the engaging teaching methods used by teachers. This indicates that the active learning strategies implemented by teachers have a positive impact on students' interest. However, around 5% of students still do not enjoy science because they find it difficult to understand the terms and formulas in the material being taught. Therefore, a more innovative and adaptive learning approach is needed to help students who face challenges in understanding scientific concepts more easily and enjoyably.

Based on the results of data obtained from 119 students in the Ciamis area, the first aspect regarding students' learning potential consists of 4 indicators, namely liking science learning, preferred material content, time reading books, doing practice questions independently, and following study guidance. In indicator 1, it can be seen that the percentage of students who like science learning is around 95%, in figure 1.

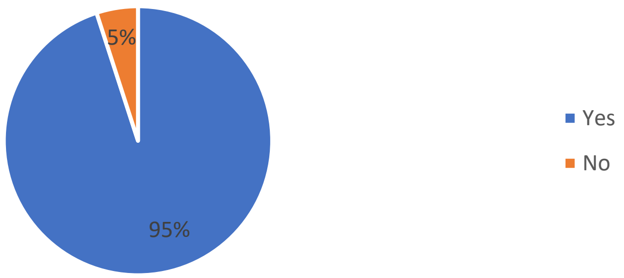

Figure 1. Percentage of students liking science learning

Based on Figure 1, around 95%, namely 113, like science learning, and only 5%, namely 6, do not like science learning. The reasons why students like learning science is because the science material is related to everyday life and nature, and the reason it is fun to study science is because the teachers are good. Most teachers in schools teach learning with active learning activities to students. Students who don't like learning science because they have difficulty understanding the material, difficulty with terms, and difficulty with formulas.

The data from Figure 1 indicates a highly positive attitude toward science learning, with approximately 95% of students expressing that they enjoy the subject. This overwhelming preference suggests that science education is generally well-received among junior high school students, particularly when the content is perceived as relevant to daily life and nature, and when it is delivered by competent and engaging teachers. These findings underline the importance of contextual and relatable instruction, as well as the role of teacher quality in fostering student interest and motivation.

On the other hand, the small minority of students (5%) who do not enjoy science cited difficulties in understanding complex material, unfamiliar terminology, and challenging formulas. This points to a pedagogical gap where some students may be struggling due to cognitive overload or a lack of scaffolding in concept delivery. It also suggests that while active learning is employed, it may not always be differentiated or tailored to diverse learning needs.

From a teaching strategy perspective, the data supports the continuation—and refinement—of active learning approaches that make science tangible and relevant. However, it also calls for targeted interventions, such as remedial instruction, visual aids, simplification of scientific language, and the integration of formative assessments to identify students who are falling behind.

Policy-wise, these findings recommend sustained investment in teacher training, particularly in strategies for differentiated instruction and inclusive pedagogy. It also implies a need for curriculum developers to ensure that learning materials are accessible and supportive for students at various ability levels. Overall, while the majority enjoys science, the minority who struggle must not be overlooked, as addressing their needs is key to achieving equitable science education for all.

Understanding students' interest in science learning is an important aspect of designing effective teaching strategies. To determine which science fields students prefer, a survey was conducted with 119 students through questionnaire completion. The analysis results show variations in students' preferences for different science fields, which can serve as a reference for educators in developing learning approaches that better suit students' needs. Data on the percentage of students' interest in various science material fields can be seen in Figure 2.

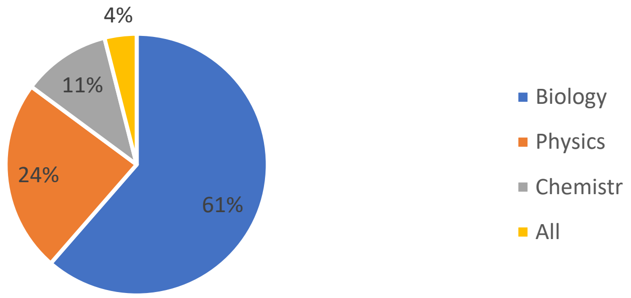

Figure 2. Percentage of science material areas preferred by students

Based on the data obtained, 62% of students prefer science material related to biology compared to physics (24%) and chemistry (11%). Several reasons behind this preference include difficulties in understanding formulas and calculations in physics and chemistry, the large amount of theory that must be learned, and time constraints due to reduced school hours. Nevertheless, learning biology also presents its own challenges, particularly in understanding the system of processes that occur in living organisms.

The data reveals a clear preference among students for biology-related science material, with 62% favoring it over physics (24%) and chemistry (11%). This trend suggests that students are more comfortable with science content that is descriptive and closely linked to observable phenomena in everyday life, such as living systems and the human body. The lower interest in physics and chemistry may stem from cognitive challenges related to abstract concepts, mathematical formulas, and problem-solving processes, which require higher-order thinking skills and more instructional time—something limited due to shortened school hours. These findings highlight the importance of instructional design that simplifies complex concepts and integrates cross-disciplinary strategies, such as visual aids, simulations, and contextual examples. Moreover, while biology is seen as more accessible, its process-based nature still requires structured guidance. Teachers must therefore, balance content delivery with student engagement and differentiated support, ensuring that all branches of science are approached in ways that promote both interest and comprehension. Additionally, students' habits of reading science books vary, as shown in Figure 3, where most students allocate less than one hour per week to studying science.

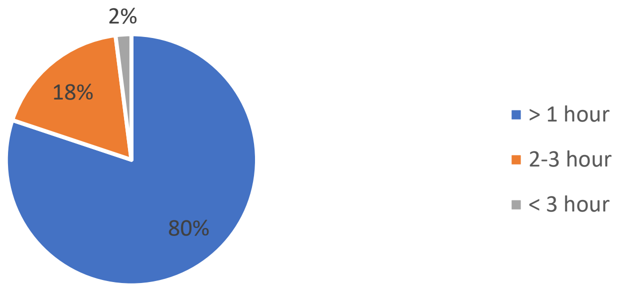

Figure 3. Percentage of reading time for science lessons

The strong preference for biology over physics and chemistry, as shown in the data, may also be influenced by students' limited study habits. According to Figure 3, most students spend less than one hour per week studying science, indicating a minimal engagement with science content outside of classroom instruction. This low allocation of study time can significantly impact students' ability to grasp complex and abstract topics, particularly those found in physics and chemistry, which often require additional practice and reinforcement through problem-solving and conceptual review. In contrast, biology—being more narrative and descriptive—may be perceived as easier to understand with minimal study effort. This correlation suggests that students' learning preferences may not solely reflect interest, but also align with perceived difficulty and the amount of independent study required. To address this, schools and educators should implement strategies that foster stronger study habits, such as structured reading assignments, science clubs, or guided study sessions, to deepen engagement across all science domains.

In the learning process, students' initiative to study independently is one of the factors that can support their academic success. However, not all students have the habit of doing practice exercises independently without encouragement from teachers. The data obtained shows that only about 52.1% of students take the initiative to do practice exercises on their own. Additionally, student participation in tutoring is also relatively low, with only 7.6% of the 119 students attending additional tutoring programs. This percentage provides an overview of students' learning patterns and their tendency to seek additional learning resources outside of school.

It is also different when students take the initiative to learn independently by doing learning exercises. Only 52.1% did so, you can see the picture in figure 4. And the indicator of students participating in tutoring is only 7.6% of the 119 students. The percentage of the total number of students participating in tutoring can be seen in figure 5.

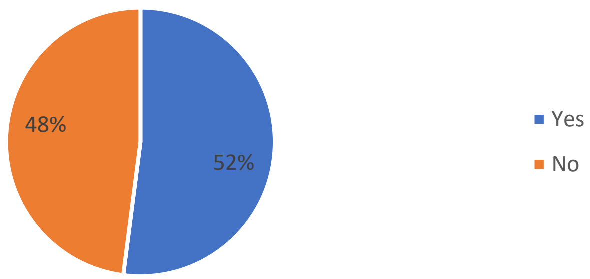

Figure 4. Percentage of doing exercises independently without teacher prompts

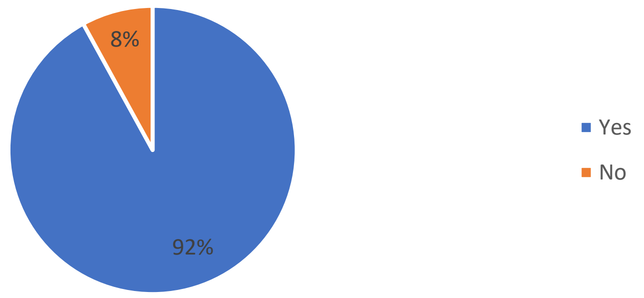

Figure 5. Percentage of participating in tutoring

The data indicates that only 52.1% of students demonstrate initiative in doing independent practice exercises, suggesting that nearly half of the student population relies heavily on teacher-driven instruction. This low level of autonomous learning may hinder the development of critical thinking and problem-solving skills, which are essential in science education. It also implies that students may lack motivation, confidence, or understanding of how to approach science learning outside of the classroom. The absence of a strong culture of self-directed learning could stem from limited support systems at home, insufficient access to learning resources, or a learning environment that does not sufficiently encourage independent exploration. To improve this, schools must cultivate student agency by incorporating inquiry-based learning and giving students structured opportunities to practice independently within a supportive framework.

Furthermore, the participation rate in external tutoring programs is notably low, with only 7.6% of students enrolled in such support systems. This figure reflects a limited tendency among students to seek supplemental learning resources beyond the school setting, which may be influenced by socioeconomic factors, lack of awareness, or limited availability of affordable tutoring services. It also suggests that the majority of students depend solely on regular classroom instruction to master science content, which may be insufficient for those who struggle with understanding. These findings highlight the need for schools to provide alternative forms of academic support, such as in-school tutoring, peer mentoring, or after-school learning clubs. Ensuring equitable access to additional learning opportunities is crucial for supporting students who may otherwise fall behind due to lack of personalized reinforcement.

Apart from the aspect of independent learning, students' needs for science learning methods are also an important concern. One of the most preferred methods by students is practical-based learning activities. The data shows that 79% of students like this method because it is considered more engaging, not boring, and helps them understand material concepts more easily through direct experience. According to Nisa (2017), practical methods can improve students' understanding and critical thinking skills. However, some students still do not like practical-based learning, citing reasons such as never having experienced it, difficulty understanding practical activities, challenges in following the implementation steps, or a lack of understanding of the activities.

In addition to practical methods, online and offline learning strategies are also key factors in the effectiveness of science learning. According to the data, the majority of students prefer face-to-face (offline) learning, with a percentage reaching 88.2%. The main reason for this preference is the ease of interacting directly with teachers and peers, as well as the opportunity to discuss and ask questions more freely. On the other hand, students struggle to adapt to online learning, which affects their learning effectiveness (Singh et al., 2021). Thus, students' preferences for certain learning methods can be an important consideration in designing more effective teaching strategies that align with their needs.

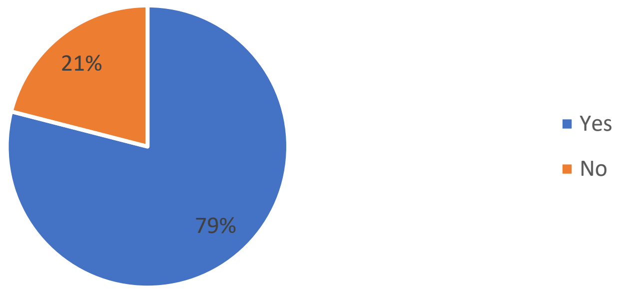

Figure 6. Percentage of students liking Practical Learning

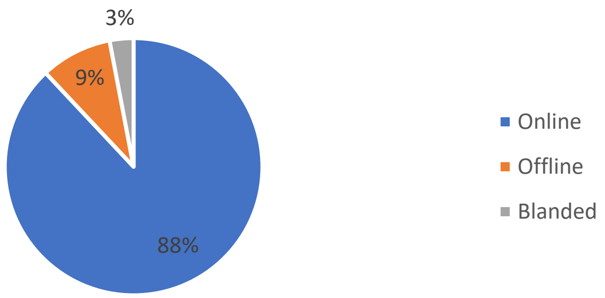

Figure 7. Percentage of Students Who Like Face-to-Face/Offline, Online, and Blended Learning

In the process of science learning, the availability of reading materials and the teaching methods used play an important role in enhancing students' understanding. Based on the results of the analysis, there are still students who have access to science reading books at school, but only a small number have their own reading materials outside of school. This indicates that there are still limitations in students' reading habits, which can affect their preparedness for learning. In addition, students' preferences for learning methods also vary, with face-to-face learning being preferred over online learning as it provides opportunities for direct interaction with teachers and peers. Although online learning has its own challenges, such as a large number of assignments without adequate explanations, this method still has benefits in certain situations, such as during a pandemic. Therefore, it is essential for educators to design more adaptive learning strategies, taking into account students' needs and the effectiveness of various teaching methods.

The third aspect regarding learning books for students consists of indicators, 1) reading books available at school, 2) reading materials owned by themselves, and 3) reading materials desired by students. Based on indicators of science reading books available in schools, the percentage is around 79.8%. Learning reading books must be provided by the school, either in the library or in textbooks made by the teacher. Reading books as a learning resource for students follows the opinion of (Krismawati et al., 2018) that the use of textbooks or teaching materials has an important role in the learning process. The second indicator, namely having your reading materials without being asked by the teacher, is only 47. 1%. By not having science reading books, students will not prepare to learn science during classroom learning activities. This follows the opinion (Irawati & Saifuddin, 2018) that students who do not have teaching materials do not yet have prepared the material to be studied so that in learning there is only one-way learning. The indicators for learning reading books that most students want are reading books that have colorful pictures, have questions, language that is clearly understood, not long-winded, and there is discussion of the questions.

Aspects of the problems facing science learning include, firstly, student inactivity in learning activities during learning is only 2.5%. Learning activities that do not have an active role for students in learning make them bored. The second indicator is problems in face-to-face learning, the main problem during face-to-face learning, namely 21% answered, namely giving a lot of assignments, then the material is difficult to understand because learning resources do not change so that students are bored. However, the majority of face-to-face learning is preferred over online learning, namely around 88.2%. Based on the results of filling out the questionnaire that has been carried out, students like face-to-face (offline) learning because most can communicate more freely directly with teachers and friends. If there is something they don't understand, they can ask directly so that it is easier to understand the material compared to online. This means that online learning makes it difficult for students to learn because of the large amount of material being studied and the lack of understanding of the material presented (Munandar et al., 2022). Another reason for not liking online learning is that students are given a lot of assignments and there are no explanations. Not only offline or face-to-face learning, online learning is also required to have skills and determine approaches to teaching that teachers need to master. So, teachers have challenges in facilitating teaching and learning (Afolabi, 2021). Even though online learning has a negative impact, it also has a positive impact, namely making it easier when we experience a pandemic event, or an event where we cannot carry out face-to-face learning.

3.2 Discussion

This subsection discusses various critical aspects of science education at the school level, including students' potential and challenges, preferences for teaching methods, resource needs, and the obstacles faced in both face-to-face and online learning. Additionally, it provides theoretical analysis and practical recommendations to enhance the effectiveness of science education. This approach is expected to support the creation of a learning ecosystem that is relevant, adaptive, and oriented towards the needs of students in the modern era.

Research findings indicate that 95% of students enjoy science learning, driven by the relevance of the material to daily life and the ability of teachers to create an engaging learning atmosphere. However, 5% of students struggle with understanding terms, formulas, and concepts in science, which can hinder their interest. This aligns with constructivist theory, emphasizing the need for conceptual understanding through real-world contexts (Bruner & others, 1966). Dislike for specific subjects, such as physics and chemistry, which require formula comprehension, underscores the need for more applicative and interactive teaching methods.

The data suggests a positive reception to science learning among most students, with the majority enjoying the subject due to its connection to everyday life and engaging teaching. However, the 5% who struggle highlight a critical gap in comprehension, particularly in subjects like physics and chemistry that require understanding abstract concepts, formulas, and terminology. This aligns with Bruner's constructivist theory, which advocates for knowledge-building through real-world connections. The difficulties faced by a small subset of students indicate the importance of teaching strategies that bridge the gap between theoretical knowledge and practical application. This could involve incorporating more hands-on activities, contextualizing abstract concepts with real-life examples, and fostering interactive learning environments. By doing so, teachers can address students' challenges in understanding complex scientific ideas while maintaining their interest and motivation. It also reinforces the need for differentiated instruction to cater to diverse learning needs in the classroom.

A majority of students (79%) expressed interest in practical methods. Practical activities enable students to understand concepts deeply through direct experiences. According to Nisa (2017), this approach enhances students' critical thinking abilities. However, the minority of students who do not favor this method indicate a lack of experience or guidance in conducting practical activities. Additionally, a preference for face-to-face learning (88.2%) over online learning highlights the importance of direct interaction in the learning process, consistent with Vygotsky (1978) perspective on the significance of social interaction in education.

The strong preference for practical methods among students shows that most learners benefit from hands-on experiences that allow them to explore and apply scientific concepts directly. Such activities not only make learning more engaging but also help deepen understanding by connecting theory with observable outcomes. The minority of students who are less inclined toward practical work may reflect a lack of exposure, confidence, or support in conducting experiments, suggesting a need for better preparation and scaffolding from teachers. Furthermore, the overwhelming preference for face-to-face learning emphasizes the importance of classroom interaction, where students can ask questions, discuss with peers, and receive immediate feedback. This interaction is often missing in online settings, leading to reduced engagement and motivation. These insights suggest that to optimize science learning, educators should prioritize practical, interactive strategies within in-person environments while ensuring all students are adequately supported to participate actively and confidently in practical tasks.

The results show that 79.8% of students have access to textbooks at school, but only 47.1% own personal reading materials. The lack of personal learning resources can hinder students' preparedness, as highlighted by Irawati & Saifuddin (2018). Students also expressed a desire for engaging learning materials, such as illustrated books with simple language and discussion-based questions. This underscores the importance of innovation in learning material design to enhance student motivation.

The data reveals a significant disparity between access to school textbooks and the ownership of personal reading materials, suggesting that many students may rely heavily on school-provided resources and have limited opportunities for independent study at home. This gap can negatively affect learning continuity, especially when students are expected to review or explore topics beyond classroom hours. The fact that less than half of the students own personal science materials indicates a potential barrier to reinforcing concepts and developing deeper understanding. Moreover, students' interest in engaging materials—such as those with illustrations, simplified language, and discussion prompts—signals that conventional textbooks may not fully meet their learning preferences. This highlights the urgent need for more student-centered and visually enriched resources that can cater to different learning styles. By offering materials that are more relatable and easier to understand, educators and curriculum developers can foster better engagement, improve comprehension, and encourage greater enthusiasm for science learning outside the classroom.

In face-to-face learning, the main issue is the heavy workload assigned by teachers, which students perceive as burdensome. Additionally, monotonous learning resources can diminish student interest. On the other hand, online learning faces challenges such as limited interaction and insufficient explanation of materials. These findings align with the study by Munandar et al. (2022), which highlights the need for more innovative teaching strategies in online education. However, online learning also offers flexibility, especially during emergencies like the pandemic (Afolabi, 2021).

The findings indicate that while face-to-face learning provides essential interaction and support, it can also overwhelm students when not managed properly. Excessive assignments and repetitive materials may reduce motivation and lead to fatigue, especially if tasks are not perceived as meaningful or aligned with students' abilities. To address this, teachers need to design more balanced and purposeful workloads that focus on quality over quantity. Diversifying instructional resources—such as incorporating visual aids, project-based learning, or group work—can make lessons more engaging and reduce monotony, helping sustain student interest and participation.

Conversely, online learning offers flexibility and accessibility, especially during disruptions like the COVID-19 pandemic. However, limited teacher-student interaction and inadequate explanation of materials remain significant barriers to effective learning. These issues can hinder students' ability to fully grasp complex scientific concepts. To improve the quality of online learning, educators must adopt interactive platforms, provide timely feedback, and use multimedia resources to enhance clarity. Blended learning models that combine the strengths of both modalities may offer a more balanced and effective approach.

Theoretically, the findings of this study affirm the relevance of Vygotsky's social learning theory in the context of science education. Optimal social interaction, whether through face-to-face discussions or practical activities, plays a crucial role in supporting a deeper conceptual understanding. Science learning is not only focused on knowledge transfer but also on the development of scientific process skills, which involve exploration, investigation, and reflection on findings. Therefore, a more experience-oriented learning approach needs to be implemented so that students can be more actively engaged in understanding scientific concepts.

Practically, teachers need to design more varied teaching strategies to enhance the effectiveness of science learning. For instance, the use of interactive demonstrations in physics and chemistry subjects can help students understand abstract concepts more concretely. Additionally, direct experimental activities and group discussions should be intensified to familiarize students with scientific methods for analyzing phenomena. By providing students with more opportunities for exploration and investigation, they can develop critical thinking skills and a stronger scientific attitude.

Based on the findings of this study, several recommendations can be implemented to improve the quality of science learning. First, it is essential for teachers to strengthen their competencies in managing engaging and effective practical methods. Training programs for teachers in designing and conducting simple experiments relevant to everyday life can be a solution to increasing student engagement in the learning process.

Second, the provision of engaging learning materials that align with students' levels of understanding should be prioritized. Contextual materials related to everyday phenomena will be easier for students to grasp and will also enhance their curiosity about science. Moreover, the development of interactive teaching materials, such as the use of models or simple visual aids, can help students gain a deeper understanding of scientific concepts.

Third, the teaching methods used should be adapted to students' needs and characteristics. Inquiry-based, discussion, and direct experimental approaches are recommended so that students can construct their own understanding through real-life experiences. In science learning, hands-on activities are crucial as they provide a more meaningful learning experience. Therefore, teachers should encourage students to engage more in exploration through laboratory activities, observations, or simple research-based projects.

Finally, it is important for schools and policymakers to support the facilities and resources needed for science education. The availability of adequate laboratory equipment and materials will greatly assist students in comprehensively understanding scientific concepts. With this support, science learning is expected to be more effective in enhancing scientific attitudes, scientific process skills, and a better conceptual understanding among students.

4. CONCLUSION

The effectiveness of science education relies on collaboration between teachers, students, and policymakers to create an inclusive and innovative learning ecosystem. This study demonstrates that learning experiences involving hands-on practice, such as laboratory activities, along with face-to-face instruction, contribute to increaseds student motivation and a better understanding of scientific concepts. Additionally, the quality of learning materials, such as books and worksheets with engaging illustrations and clear language, plays a crucial role in supporting the learning process.

From a theoretical perspective, these findings reinforce the concept of *constructivist learning*, which emphasizes the importance of direct experiences and active student engagement in building their understanding. Practically, the results of this study can serve as a foundation for the development of educational policies, teacher training, and curriculum design that better align with students' needs. For future research, further exploration is recommended on the effectiveness of project-based learning methods and the integration of technology in science education to create more adaptive and innovative learning experiences.

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