



## Bridging the GAP in Middle School Physics: A Multi-Stakeholder Need Analysis for the Systematic Development of Guided Inquiry-Based Modules

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### Abstract

This study considering the above description, this study presents an initial needs assessment focused on a pilot case study in developing physics modules for eighth-grade science learning using a guided inquiry approach. The method used is qualitative descriptive with the research subjects being a science teacher and three students representing high, medium, and low abilities. Data were collected through interviews and analyzed descriptively to obtain an overview of the learning conditions at school. The results showed that science learning was still teacher-centered, specifically lacking the visualization of abstract concepts like (Hydrostatic pressure) and dominated by lectures, while teaching materials were limited to textbooks and student worksheets. Teachers faced significant barriers in aligning laboratory availability with curriculum demands, leading to a reliance on rote memorization. Students expressed a critical need for teaching materials that transition from static text to visual inquiry-based illustrations. This study concludes that developing guided inquiry-based physics modules is essential to foster active investigation. This analysis provides a replicable framework for schools facing laboratory resource constraints, offering a pedagogical model to enhance students' scientific reasoning in resource-limited environments.

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## INTRODUCTION

In the 21st century, the world of education has undergone major changes in its paradigm, both in terms of perspective and implementation. The learning process is no longer understood simply as the transfer of knowledge from teacher to student, but rather as an effort to build the ability to think, act, and behave in ways that are relevant to facing the various challenges of the modern era. In line with these changes, the role of teachers is no longer just as conveyors of knowledge, but also as facilitators, motivators, and mentors who help students build their own knowledge. Meanwhile, students play an active role as subjects of learning who are directly involved in the process of exploration, discovery, and reflection to achieve a more meaningful and deeper understanding.

In the context of achieving learning objectives, the availability of teaching materials plays an important role as a guideline in the teaching and learning process. This is in agreement with Shidqon & Aceng, (2024) The availability of teaching materials can be one of the supporting factors for the success of the learning process because it allows students to learn a competency in a sequential and systematic manner so that they are expected to be able to master all competencies as a whole. In addition, teaching materials have a strategic role because they can be adapted to various conditions and needs of students to support the success of the learning process (Waraulia, 2020). Lovisia, (2018) emphasizes that to obtain the expected learning outcomes, they must be supported by quality teaching materials. In line with this, Astuti et al., (2018) emphasize that to create effective and efficient learning, teachers need to prepare teaching materials that can facilitate students in understanding the material in depth. Furthermore, De'aulia & Rukmana, (2023) add that teaching materials play an important role in helping teachers present learning materials that are in accordance with learning needs and objectives as well as the learning model applied. According to Shidqon & Aceng, (2024) one form of teaching material that is widely used in the learning process is modules, which are compiled systematically and structurally. Modules provide flexibility for students to learn and assess their abilities independently (Sa'diah et al., 2024)

A module is a teaching material that is systematically and attractively arranged, covering learning methods, content, and evaluation that can be used independently to achieve certain competencies and can be accessed at any time (Lastri, 2023) This is in line with Apriyani et al., (2020) who state that modules are programmed teaching materials that are structured in such a way and presented in an integrated manner. According to Shidqon & Aceng, (2024) the uses of learning modules include: (1) as a provider of basic information, (2) as instructional material or guidelines for students, (3) as supplementary material accompanied by illustrations, and (4) as effective teaching guidelines for educators as well as a means for students to practice self-assessment.

The shift toward Inquiry-Based Science Education (IBSE) has become a global imperative to foster 21st-century skills. International studies (e.g., Murphy et.al., 2021) demonstrate that traditional, teacher-centered instruction often fails to bridge the gap between abstract physics concepts and real-word application. This pedagogical divide is not unique to single region but represents a widespread challenge in transitioning from rote memorization to scientific inquiry.

Based on the results of interviews and analysis of teaching material needs and usefulness with 8th grade teachers at SMP Negeri 14 Lubuklinggau, namely (1) Students are not very interested in science learning, especially physics material, (2) The learning process still focuses on the use of textbooks as the only learning resource, (3) The learning model used is still the lecture method, (4) The availability of learning resources such as learning media and modules in schools is still very limited, (5) Teachers have never made their own modules for science learning, (6) Teachers have not implemented a guided inquiry model in science learning. These conditions indicate a gap between the demands of 21st-century learning and learning practices in schools, particularly in relation to the availability of innovative teaching materials and inquiry approaches.

To overcome these problems, it is necessary to develop teaching materials in the form of physics modules based on guided inquiry learning models. The solution offered is the development of physics modules that are in line with the curriculum, suit the characteristics of the students, and utilize guided inquiry syntax to improve the quality of the learning process and outcomes. Through these teaching materials, students are expected to more easily understand the physics concepts being studied and actively engage in the learning process that fosters scientific process skills (SPS). Modules were chosen because they are teaching materials that are systematically organized and allow students to learn independently. Modules facilitate a structured teaching and learning interaction process, making teachers facilitators and providing space for students to evaluate their own learning (Sholikha et al., 2022)

The use of guided inquiry models is one of the approaches chosen in the development of this module. This model is in line with the Merdeka Curriculum approach, as it emphasizes independent learning, student activities in discovering concepts, and strengthening scientific process skills through targeted guidance from teachers. In the current curriculum, namely the Merdeka Curriculum. In its implementation, the development of this Guided Inquiry-based physics module is expected to help students understand the material, because in the learning process, students are required to actively connect the material directly to their daily lives. Through inquiry activities, students are invited to observe, question, and investigate various events. Guided inquiry itself is a learning approach that invites students to discover concepts through investigation with teacher guidance. Teachers act as facilitators to help students think critically, develop questions, and find answers independently (Nupus et al., 2021). Through this model, students are actively encouraged, helping them to become independent, active, and skilled in solving problems based on the information they obtain (Sunarya et al., 2019) Considering the above description, this study considering the above description, this study presents an initial needs assessment focused on a pilot case study at SMP Negeri 14 Lubuklinggau. This assessment serves as a foundational step to identify critical pedagogical gaps before the systematic development of guide inquiry-based physics modules.

## METHOD

This study employs a qualitative descriptive method designed as a pilot case study. This approach was selected to provide a granular and in-depth understanding of the learning obstacles faced by a specific instructional unit. By conducting an initial needs assessment with a purposive sample of participants, the researcher can capture the nuanced challenges

of implementing guide inquiry a resource-constrained environment. This method was chosen because it is suitable for describing and understanding phenomena in depth without manipulating variables. The research data was obtained through interviews with science teachers and three students. The students were selected based on their learning abilities, namely high-ability students, medium-ability students, and low-ability students. The interviews with teachers focused on the use of science teaching materials in schools and the average learning outcomes of students during the learning process. Meanwhile, the interviews with students aimed to explore information about the difficulties or obstacles they faced when learning science, as well as to find out which learning methods, they considered interesting and easy to understand.

The interview guide for teachers was developed based on four main aspects, namely learning models and their effectiveness, student learning outcomes and mastery, teachers' constraints and efforts in learning, and the need for the development of Guided Inquiry-based teaching materials. The interview instrument for students is designed with consideration of five main aspects, namely student interest in science subjects, difficulties experienced during learning, preferred learning methods, views on science practical activities, and student responses to the teaching materials used in learning.

Table 1. teacher interview instrument grid

No	Question Indicator	Question Number
1	Learning models and their effectiveness	1,2,3
2	Student learning outcomes and mastery	4,5
3	Teacher obstacles and efforts in learning	6,7
4	The need to develop guided inquiry-based teaching materials	8,9,10,11,12,13

Table 2 Student interview instrument grid

No	Question Indicator	Question Number
1	Student interest in science subjects	1
2	Difficulties experienced while learning	2
3	Students' preferred learning methods	3,4
	Perspectives on science labs	5,6
4	Responses to science teaching materials	7,8,9,10

To ensure the trustworthiness of the findings, data triangulation was performed by cross-referencing interview transcripts from the teacher and students with an analysis of existing teaching materials and curriculum documents. Member checking was also conducted by returning the interview summaries to the participants to confirm the accuracy of their responses.

The qualitative descriptive analysis used in this pilot case study describes the specific needs of teachers and students. These findings are not intended for board generalization but act as a primary framework (initial needs assessment) for designing a module prototype that is contextually relevant. The analysis process was carried out in two main stages. First, the coding stage, which involved analyzing the interview data by repeatedly

reading the transcripts to identify important statements. Second, the thematic analysis stage, which involved examining the categories that had been formed to find patterns, connections, and main themes that emerged from the data. This stage helped researchers gain a comprehensive understanding of the experiences of teachers and students regarding the use of science teaching materials, the difficulties they faced, and their preferences in the learning process.

## RESULT AND DISCUSSION

The results of thematic analysis of interviews with teachers and students revealed a number of key findings that describe the actual conditions of science learning, particularly in physics. These findings are summarized in the following combined table, which contains themes, categories, and main codes to describe learning needs and the direction of development of the Guided Inquiry module. This analysis also highlights various obstacles that still arise in the learning process, which need to be followed up through the development of more appropriate teaching materials.

Table 3. Combined Thematic Analysis of Teachers and Students

Main Theme	Category	Code (Abbreviated)
Learning Models & Methods	Learning practices	Teachers: lectures, discussions, assignments. Students: prefer practical work.
	Effectiveness	Teacher: effective with the material, not very active. Students: get bored with lectures.
	Inquiry experience	Teachers have never fully implemented it; only trigger questions.
Learning Outcomes & Mastery	Values & completeness	Average 70; 19 completed, 12 incompletes.
Learning Obstacles	Teacher obstacles	Limited time, insufficient resources, low student focus.
	Student obstacles	Quick explanation, minimal practice, difficult to understand without examples.
Activities	Practical implementation	Practical work is rare; students want more experiments.
	Practical benefits	S1: understand the concept. S2–S3: be more active and easier to understand.
Current Teaching Materials	Types of teaching materials	Textbooks, workbooks, blackboards, pictures.
	Weaknesses	Not very interesting, lots of text, minimal visuals.
Teaching Material/Module Requirements	Teacher expectations	Clear steps, simple activities, attractive appearance.
	Student expectations	Interactive, colourful, lots of pictures, simple language, not too thick.

Based on interviews with teachers, it was found that the science learning process in schools is still teacher-centered. It is known that learning has been conducted using conventional methods. Teachers explained that the most frequently used approaches are lectures, discussions, and assignments. These methods are considered practical for delivering material and adjusting to limited learning time allocations. However, teachers admit that these methods are not fully effective in increasing student activity and critical thinking skills. Teachers said that in the learning process, most students tend to be passive. They listen and take notes, but rarely engage directly in the process of discovering concepts. According to teachers, this condition causes students to quickly become bored and less motivated to learn. Teachers also assessed that students' science process skills, such as observing, questioning, trying, and concluding, have not developed optimally.

When asked about the implementation of guided inquiry learning models, teachers stated that they had tried to implement them, but had not been able to do so optimally. The obstacles encountered included limited equipment and materials, lack of time to carry out activities, and varying levels of student ability. Teachers revealed that not all students were prepared and brave enough to participate actively, especially when asked to express their opinions or observations in front of the class. The teacher added that experiment-based learning is still rarely carried out because the school's laboratory facilities are inadequate. Many of the experimental tools are incomplete, and their number is not proportional to the number of study groups in the class. This condition means that experiments are more often carried out in the form of demonstrations by the teacher, rather than by the students themselves. As a result, students only become passive observers and do not gain real scientific learning experiences.

This statement is in line with the findings of Nuraini et al. (2016), who found that teachers had difficulty implementing the guided inquiry learning model due to limited facilities and infrastructure, limited learning time, and differences in student abilities in the classroom. Similar results were also described by Iswatun et al., (2017) who stated that the implementation of the guided inquiry model was not optimal due to a lack of laboratory facilities and low student readiness to actively participate in the learning process. In addition, research by Effendi et al., (2019) shows that many science teachers in Indonesian secondary schools still face obstacles in the form of a lack of practical tools, limited laboratory space, and the dominance of lecture-based learning over direct student experiments.

As a way to overcome limitations, teachers utilize simple tools and materials available in the school environment that can be used for simple experiments. In addition, teachers also use videos or online simulations to help students understand abstract concepts. However, teachers realize that the use of these media is not yet systematic and has not become part of a planned learning strategy. Teachers expressed their desire for teaching materials that not only contain theoretical explanations but also guide students to carry out scientific activities. According to them, good teaching materials should be student-centered, provide space for critical thinking, and encourage students to discover concepts through observation and simple experiments. Teachers consider that the guided inquiry model is very suitable for achieving these objectives because it can direct students to learn independently with structured guidance from teachers. This is in line with the results of research conducted by Rinda et al., (2021) which shows that the application of the guided inquiry model can improve students' science process skills because they are directly

involved in observation and experimentation activities. In addition, research by Prastiwi & Haryani, (2018) also proves that guided inquiry-based learning can increase student motivation and learning activity compared to conventional learning.

Furthermore, teachers believe that guided inquiry-based teaching materials can also make it easier for teachers to manage learning activities in the classroom. The availability of step-by-step activity guides and simple practical instructions enables teachers to guide students in conducting scientific investigations without the need for complex equipment. Teachers hope that the teaching materials developed will be equipped with illustrations, contextual experimental activities, and trigger questions that encourage students to think critically, argue, and draw conclusions. Thus, these teaching materials are expected to foster scientific thinking skills while increasing students' interest in physics.

The average score for students in science during the last semester was 70. This score indicates that most students are close to meeting the Minimum Competency Criteria, but there are still some students who need additional assistance in order to improve their learning outcomes. Based on the evaluation results, out of 31 students in the class, 61.29% of students have met the minimum mastery criteria for science subjects. Meanwhile, 38.71% of students have not yet met the criteria and need additional guidance to improve their learning outcomes. Teachers believe that this situation highlights the need to develop more interactive and contextual teaching materials to help improve students' overall understanding and learning outcomes.

Table 4. Results of Teacher Needs Analysis Interviews

	Questions	Answers
1	What learning model do you use to deliver the material?	So far, I've used lectures, discussions, and assignments. I usually explain first, then have students work on problems or exercises.
2	Is this model effective?	It's quite effective for delivering material. But I don't think it's effective for encouraging students to be active and think critically.
3	Have you ever used the guided inquiry model?	Not yet. I've tried asking prompting questions to encourage students to find answers on their own, but it wasn't structured like the inquiry model.
4	Could you please explain what the average student learning outcome score was in science over the past semester?	The average student learning outcome score in science over the past semester was 70. This score indicates that most students are approaching the minimum completion criteria, but some still need additional support to improve their learning outcomes.
5	Of the total number of students in the class, could you please tell us how many have achieved mastery in science and how many have not?	Based on the evaluation results, of the 31 students in the class, 19 have met the minimum mastery criteria for science. Meanwhile, there are still 12 students who have not yet achieved mastery and need additional guidance to improve their learning outcomes.
6	The challenges in implementing this learning model?	Learning time is limited, while the material is quite extensive. Furthermore, school facilities are also

		limited. Students often lack focus when asked to observe or investigate something without aids.
7	What efforts have you made to overcome these obstacles?	I usually use simple tools and materials from the local area so students can still practice. However, due to time constraints, not all students have the opportunity to try.
8	What teaching materials have been used so far?	I use government textbooks, a whiteboard, and sometimes pictures. If simple aids are available, I also use them, such as objects around the classroom.
9	How effective are the teaching materials used?	The existing teaching materials are helpful, but not optimal. Sometimes students get bored quickly because the presentation isn't engaging, especially if they're just reading from a book.
10	Have you ever used guided inquiry-based teaching materials like modules?	No. Honestly, i don't have any references or examples of inquiry-based modules that i could use. If there were clear guidelines, i'd be interested in trying them, as they seem like a great way to train students to think independently.
11	In your opinion, how important is the use of teaching materials in science learning?	Very important. Especially in science, when only theory is used, students often get confused. With teaching materials, students can see firsthand and understand the material more easily.
12	In your opinion, do teaching materials help students learn more actively?	Absolutely, as long as they're engaging and appropriate to their ability level. However, due to limited resources and time, this isn't something we can do often.
13	Do you have any suggestions for developing the Guided Inquiry module?	If possible, create modules with clear, easy-to-follow steps. Include simple activities that can be done in the classroom without laboratory equipment. Images and visuals are also important to engage students

Interviews with three students with high (s1), medium (s2), and low (s3) academic abilities provided an overview of their learning needs and experiences in science subjects, particularly physics. In general, students stated that they liked physics lessons when they were accompanied by examples that were relevant to everyday life. High-ability students (s1) mentioned that physics becomes interesting when teachers provide real examples accompanied by experiments, making the learning process easier to understand.

The analysis revealed a significant pedagogical gap: while the teacher acknowledged the importance of inquiry, the actual implementation was hindered by systemic constraints, such as heavy curriculum loads and perceived lack of specialized laboratory assistants. This explains the persistent reliance on conventional lecture methods. Furthermore, the students' preference for 'illustrated' materials should not be viewed merely as an aesthetic choice, but as a cognitive demand for scaffolding. In physics, abstract concepts like hydrostatic pressure require visual representations to reduce the extraneous cognitive load. By integrating guided inquiry into a structured module, we offer a 'middle-ground' solution that provides the rigor of scientific investigation without overwhelming the teacher's limited time or the school's physical resources.

In terms of learning obstacles, students complained that they often had difficulty understanding the teacher's explanations because the material was delivered too quickly and there were few opportunities for hands-on practice. Students also felt that lessons would be easier to understand if they were accompanied by concrete examples, experiments, or the use of interesting learning media. Regarding preferred learning methods, almost all students prefer practice-based learning over lectures or reading textbooks. They believe that practical activities make the learning atmosphere more enjoyable and less boring, and help them understand concepts directly through experience. Meanwhile, learning methods that are too teacher-centered are considered to make students bored quickly and less motivated to learn.

In addition, the interview results also showed that students were rarely facilitated to conduct laboratory activities or experiments independently. They hoped that such activities could be carried out more often so that they could learn through observation and direct experience. High-ability students mentioned that practical activities helped them understand concepts better, while medium- and low-ability students felt that practical learning helped them be more active and understand the material being taught more easily. In terms of teaching materials, all students admitted that the teaching materials used by teachers so far are still limited to textbooks and workbooks. Students argued that these teaching materials are not interesting because they are dominated by text and lack visualization. They suggested that teaching materials be presented in a more interactive and colourful form and be equipped with pictures so that the material is easier to understand. Students also wanted teaching materials that are not too thick and use simple language.

Table 5. Results of Student Needs Analysis Interviews

No	Questions	Student Code	Answers
1	Do you like science, especially physics? Why?	S1	"I like it when things are explained using real-life examples. It can be difficult sometimes, but when I study with friends or experiment, it's more understandable and enjoyable."
		S2	"I don't really like physics because it's hard to understand. If the teacher explains it quickly, I often fall behind. Especially when I start calculating, I get confused about which formula to use."
		S3	"I don't like physics because it's really hard. There are so many formulas and numbers, I often don't understand them."
2	What difficulties or obstacles do you experience when studying in class?	S1	"I find it difficult when the teacher explains things too quickly, so I often miss things, and the textbook doesn't provide any example questions."
		S2	"I often get confused when the lesson is difficult and there aren't any examples, so it's a bit hard to understand."

		S3	“I often don't understand when the teacher explains things, because sometimes they go too fast, and I'm embarrassed to ask questions.”
3	What kind of learning method do you like the most when studying?	S1	“I prefer learning through practice or experiments, rather than just listening to explanations. Because if it's just theory, I often get bored quickly”
		S2	“I like learning with real-life examples or videos. If I'm just told to read a book, I quickly get sleepy and have a hard time understanding.”
		S3	“I prefer learning that involves games or experiments.”
4	Do you prefer learning by doing or just reading theory?	S1	“I prefer learning through practice, because if I only read theory, i often forget things and don't understand them.”
		S2	“I like practicing, because if i only read books, I often get confused.”
		S3	“I prefer practicing and don't get bored.”
5	Do teachers often take science students to the field and in the laboratory?	S1	“Rarely, sometimes only once during the first semester.”
		S2	“Only once, more often in class”
		S3	“At the end of the semester and when practical assessments are taken”
6	Do you think we need to learn science with practical work?	S1	“It's really necessary, ma'am. Because with lab work, I can see firsthand what I'm learning.”
		S2	“I think it's necessary because it makes it easier for me to understand.”
		S3	“It's necessary because when I practice, I'm more enthusiastic about learning.”
7	Are you bored with the way/methods science teachers have been teaching so far?	S1	“Sometimes I get a little bored if the class just consists of explanations without any practical activities.”
		S2	“Sometimes I get a little bored if I just listen to the teacher explain all the time. I prefer practical activities or games to make the atmosphere less tense.”
		S3	“Yes, sometimes it gets boring, because all I have to do is take notes and listen to explanations.”
8	What do you know about teaching materials?	S1	“As far as I know, teaching materials are resources or materials used for learning, such as textbooks, or student worksheets”
		S2	“In my opinion, teaching materials are books or sheets containing the lesson being studied”
		S3	“Teaching materials are like books or paper given by teachers for studying.”
9	Have you ever been provided with various teaching materials by your teacher? If so	S1	“My teacher has provided teaching materials like books and instructional videos. But not very often, usually only when there's a specific topic.”

		S2	“Yes, i have. Sometimes teachers provide teaching materials like books or videos, but not for every topic.”
		S3	"I've been given books, usually just for assignments. I prefer it if the teacher also explains using pictures or videos so it's easier to understand."
10	Do you like the teaching materials used in class in the learning process and are they effective enough in your learning process?	S1	“I quite like the teaching materials used in class, but i find them sometimes a bit uninteresting. If they were more colorful or included real-life examples, it might help me understand the material better.”
		S2	“I quite like them, but sometimes the teaching materials are a bit boring because they contain a lot of writing.”
		S3	“I like them, but sometimes i don't understand the content because there's a lot of writing.”

Results of the analysis of teaching material requirements conducted based on teachers' needs show that teachers require:

1. Teaching materials that are contextual and student activity-oriented, not just theoretical.
2. Learning guides that lead students to carry out simple scientific activities, such as observation, experimentation, and drawing conclusions.
3. Guided inquiry-based learning models equipped with activity steps, simple practical instructions, and thought-provoking questions.
4. Simple or alternative learning media and tools, given the limited laboratory facilities and experimental tools in schools.
5. Visual and engaging teaching materials, accompanied by pictures, illustrations, and activities that are easy to implement in the classroom.

Meanwhile, based on interviews with high, medium, and low-ability students, the following needs were identified:

1. Learning accompanied by real and contextual examples so that it is easy to understand and not abstract.
2. Greater opportunities for hands-on practice or experiments, as these activities make learning more enjoyable and help students understand physics concepts in a concrete way.
3. Interactive and visually appealing teaching materials that are colorful, illustrated, not too thick, and use simple language.
4. A learning model that encourages active student participation, rather than just listening to the teacher's explanations.

## CONCLUSION

These initial needs assessment confirms that the transition to 21st-century science education in middle schools requires more than just new curriculum mandates; it necessitates targeted instructional tools that address specific teacher constraints and student cognitive barriers. This study contributes a replicable framework for identifying 'inquiry-readiness' in resource-limited schools. Theoretically, it reinforces that guided inquiry acts as a critical bridge for 8th-grade students—a pivotal transition period where interest in physics is often lost. The practical implication extends beyond the local context, offering a strategic model for developers to create 'low-barrier, high-impact' guided inquiry modules that prioritize conceptual visualization over rote mathematical memorization.

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