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Analysis of Teachers' Needs for Interactive e-Module to Train Critical Thinking Skills in the Merdeka Curriculum Era

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Abstract

Integrating interactive e-module to train critical thinking skills in the Merdeka Curriculum era relies heavily on needs analysis. The Merdeka Curriculum requires a holistic and applicable approach to teaching, utilizing the STEM approach as one of its foundations to achieve this goal. The research consists of three stages: planning, data collection, analysis, and interpretation. Using a descriptive quantitative research method, the researchers collected data from 28 teachers through questionnaires, interviews with five teachers, and document studies. The research focuses on chemistry and ICT teachers who teach in senior high schools in Balikpapan, Indonesia. The objective is to identify students' learning difficulties with atomic structure material and nanomaterial advantages and teachers' needs for interactive e-module and readiness to use them. The study's results indicate that, according to a recent study, 77% of teachers believe that students struggle with the material, while 81% of teachers require interactive media to aid in teaching. Additionally, 83% of teachers are prepared to use interactive media and help students overcome obstacles. These findings offer valuable insights into how teachers can better facilitate STEM-based learning in the Merdeka Curriculum era. Thus, this research can contribute to developing more adaptive interactive e-module, promoting students' critical thinking skills, and supporting the vision of the Merdeka Curriculum in creating relevant and contextualized learning in the era of science and technology development.

Keywords: Needs analysis, Interactive e-module, Critical thinking, Merdeka curriculum

INTRODUCTION

Education is a complex system with significant implications for educational research and policy (Jacobson et al., 2019). The low academic achievement of students in Indonesia is evidence of the country's poor education system (Siregar & Silaban, 2023). The Indonesian government aims to develop a world-class education system by 2025 (Rosser, 2018). The SDGs have set targets for education by 2030, focusing on equitable access, quality teaching, relevant learning, and ensuring that children and young people develop the skills necessary for sustainable livelihoods (Ndaruhutse et al., 2019). The education system in Indonesia faces several challenges that require government support to meet these expectations.

In the 21st century, information technology is rapidly developing. The rapid development is characterized by the rise of machine technology, production machines, and computers beginning to replace routine human work (Aslamiah et al., 2021). Additionally, integrative STEM (Science, Technology, Engineering, and Mathematics) initiatives are at the core of the educational paradigm shift (Hıdıroğlu & Karakaş, 2022). These four core subjects encourage students to gain knowledge and improve their quality of life in the fast-paced, globalized, and

technology-driven 21st century (Manosuttirit, 2019). In Indonesia, the paradigm shift in education is reflected in the implementation of the Merdeka Curriculum, which addresses the challenges of the Fourth Industrial Revolution and the Society 5.0 era (Utary & Anwar, 2023). It also focuses on developing innovative student thought frameworks, as Hartnett et al. (2014) and Löffler & Tschiesner (2013) suggested. The Merdeka curriculum emphasizes project-based learning in line with the STEM approach and developing 21st-century skills, including critical thinking skills. According to Turhan & Demirci (2021), students who have mastered 21st-century skills can discover, acquire, and create knowledge more efficiently than their peers. STEM education emphasizes cognitive skills, including critical thinking (Tytler, 2020). In today's global era, individuals must be active, responsive to change, and capable of critical thinking to meet the challenges of the 21st century (Mutiani & Faisal, 2019). In the 21st century, developing skills requires careful attention to curriculum, teacher quality, and assessment to address these challenges (Hernawati, 2017). Critical thinking skills have measurable benefits in various aspects of life in the 21st century (Wrahatnolo & Munoto, 2018). Therefore, critical thinking education is crucial for students in the era of independent learning (Kurniawan et al., 2020). In successful STEM programs, teachers collaborate with students to develop critical thinking, communication, assessment, and inquiry skills (Lenovo & Intel®, 2015). Developing necessary thinking skills early is crucial for successfully implementing the Merdeka Curriculum, particularly in supporting STEM education.

Integrating diverse AI techniques in complex STEM education systems is an emerging trend. However, the lack of discipline from the definition of T in the acronym STEM has significant implications for achieving curriculum goals, as research has shown (Ellis et al., 2020). When students engage with technology in a meaningful learning environment, they are not simply learning from technology but using it (Lee, 2018). Integrated STEM learning environments can focus on integrating and learning science and mathematics or integrating and learning engineering and technology simultaneously for learners at different levels (Yang & Baldwin, 2020). STEM education has received significant attention in global education reform. Therefore, it is essential to pay attention to teachers as they play a crucial role in successfully implementing STEM education reforms (Nugroho et al., 2019). The study found that using digital technology in STEM education significantly impacts academic achievement (Öztop, 2023). Digital-based learning is expected to have a positive impact on students, particularly in the development of critical thinking skills.

In this context, integrating learning technology, mainly through interactive e-module (electronic module), is essential to support the achievement of new curriculum objectives. e-

module are categorized as online learning, where interactivity is key (Singh & Thurman, 2019). The media used in e-modules has excellent qualifications and, therefore, deserves to be developed (Erviyenni et al., 2023). e-module are educational materials that utilize technology to facilitate student learning (Aswirna, Fahmi et al., 2022). Interactive e-module have the potential to create a more engaging and dynamic learning experience, especially in STEM fields. However, the success of their implementation largely depends on teachers' understanding of their needs as primary agents in the learning process. According to Darling-Hammond et al. (2020), teachers face various challenges, including the need to acquire a broad range of knowledge to adapt the curriculum, the limitations of assessments in addressing learning that aims to transfer and promote higher-order thinking and performance skills, and the lack of support for teachers to develop the knowledge base and dispositions necessary to implement quality teaching and school organization.

Previous research has explored aspects of STEM and its use of technology in the classroom. For instance, Linda et al. (2018) developed an interactive e-module on acid-base equilibrium material in a chemistry magazine, successfully supporting teachers in becoming skilled ICT media users. Developing interactive e-module on Thermodynamics material has improved science literacy and environmentally friendly attitudes. Upskilling is also supported by the feasibility of the results of the development of electronic science module based on Problem-Based Learning and Guided Discovery Learning to improve critical thinking and problem-solving skills (Aswirna, Samad et al., 2022; Suryaningtyas et al., 2020). There are e-module available that focus on harmonic motion material and aim to enhance students' thinking skills. These modules are considered feasible and integrated with STEM (Sari et al., 2022). Syahfitri & Muntahanah (2023) state that 95.8% of students are needed for interactive e-module in science education. Previous research related to interactive media needs analysis has been conducted, but it is limited to the needs of students as application users (Agusningtyas et al., 2023). It is important to note that this research is limited in scope and needs to provide a comprehensive understanding of the topic.

Additionally, Perdana et al. (2017) found that student motivation is higher when using e-modules than conventional learning methods. Increasing student motivation can be the first step in maximizing student learning. Interactive e-module can also promote student learning independence. Therefore, the development of e-module is beneficial for learning in the Merdeka Curriculum era. However, it is essential to note that we are in the fourth industrial revolution era (Qadar et al., 2022). This rapid development of science requires teachers to improve their skills to produce more qualified human resources. Teachers play a critical role in enhancing the

quality of education (Linda et al., 2021). As the primary educational actors, educators are expected to optimize their potential to adapt to digitalization (Ma'rifatullah et al., 2021). While there are many skills teachers need to master, there is still a gap in understanding the research results on how teachers face the demands of the Merdeka Curriculum, particularly in practising critical thinking skills through interactive e-module.

Thus, this study aims to analyze the needs of teachers in depth. The results of this research are expected to provide a clearer view of the design and development of interactive e-module that can meet the expectations and demands of teachers in training critical thinking skills in the era of the Merdeka Curriculum. This research aims to contribute to developing a more adaptive and practical curriculum that prepares students to face the challenges of the 21st century, focusing on meeting the needs of teachers.

METHOD

The research conducted is quantitative descriptive research. The study focuses on chemistry and ICT teachers actively teaching at senior highschools in Balikpapan, Indonesia. The sample consists of 28 teachers who filled out questionnaires and five teachers who were interviewed. Non-test techniques, namely questionnaires and interviews, were used for data collection. The interview data will be described in detail, followed by quantitative processing (statistical analysis) of the questionnaire data. The research consists of three stages, as shown in Figure 1.

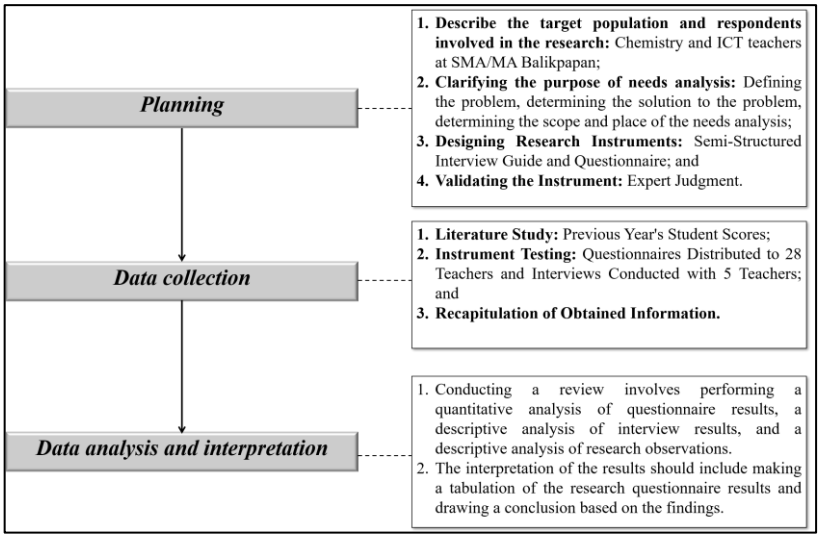

Figure 1. Stages of Research: Teacher Needs Analysis

The validity and reliability of the instrument are calculated using IBM SPSS Statistics 26. Question item criteria are considered valid if the significance value is less than 0.05 and invalid if it is more significant than 0.05. Table 1 presents the reliability criteria for the instrument.

Table 1. Criteria for Instrument Reliability (Arikunto, 2010)

Correlation Coefficiency	Criterion
$0,81 \leq r \leq 1,00$	Very high
$0,61 \leq r \leq 0,80$	Tall
$0,41 \leq r \leq 0,60$	Enough
$0,21 \leq r \leq 0,40$	Low
$0 \leq r \leq 0,20$	Very low

The questionnaires follow the Likert scale assessment, which consists of five alternative answers. The scores for each indicator on the questionnaire were calculated using Equation 1. The interview results were analyzed qualitatively (Nuraisyah et al., 2020).

$$P = \frac{F}{N} \text{ x } 100\% \quad (1)$$

Information:
P = Percentage
F = number of responses "Strongly Agree" respondents
N = number of respondents

The percentage obtained has the criteria listed in Table 2.

Table 2. Assessment Criteria for Research Questionnaire

Criteria for Evaluation	Interval
Very high	85% - 100%
Tall	69% - 84%
Low	53% - 68%
Very low	0 - 52%

RESULTS AND DISCUSSION

Based on the stages of research conducted, there are three stages described as follows:

1. Planning

At this stage, the research participants are described and identified. The participants were selected from School E and Subject Teacher Forum in Balikpapan, Indonesia. The criteria for selecting participants were teachers who actively teach chemistry and ICT subjects, as both subjects are related to the research topics analyzed. Furthermore, the teacher's expertise in research can significantly contribute to the study's outcomes. Please refer to Table 3 for a list of the participating schools.

Table 3. List of Schools Participating in the Research Study

No.	School Name	Number (Teachers)
1.	School A	2
2.	School B	2
3.	School C	2
4.	School D	2
5.	School E	3
6.	School F	3
7.	School G	3
8.	School H	3
9.	School I	3
10.	School J	1

No.	School Name	Number (Teachers)
11.	School K	2
12.	School L	1
13.	School M	1
	Total Number of Respondents	28

Furthermore, needs analysis research aims to identify the fundamental problems that must be addressed in product development (Nilyani & Ratnawulan, 2023). This knowledge is valuable for developing better products. It is worth noting that one of the fundamental problems is the lack of integrated teaching materials in the 21st century (Uma'iyah et al., 2023), and the average 21st-century student skills are still in the sufficient category (Varghese & Musthafa, 2021). Therefore, teaching materials are necessary to support the development of e-module, a world of technology that enables independent student learning (Hamid et al., 2017; Rusmanto & Rukun, 2020). In order to improve the e-module, a needs assessment has to be carried out. The needs analysis focuses on students' learning difficulties regarding atomic structure, the advantages of nanomaterials, and the need for interactive e-module as learning resources and readiness to operate media. The research instruments consist of a structured interview guide and a questionnaire with 38 questions, both validated by an expert in the field of education.

2. Data Collection

The data collection stage begins with the literature study. Researchers observed the grades of first-year students who underwent the Merdeka Curriculum and studied atomic structure materials and the advantages of nanomaterials in the previous year. The results showed that the percentage of students who achieved the minimum criteria of 73 was relatively low, with only 38% meeting the criteria (Suryelita et al., 2019). A literature review examined the significance of atomic structure and the advantages of nanomaterials. The study found that 54% of students had misconceptions about the atomic shell subconcept, 34% about the electron configuration subconcept, 50% about the orbital subconcept, and 48% about the quantum number. Generally, students have a perception at the particle level. However, most students fall into the medium category when understanding discourse.

Students' imagination abilities are also in the medium category (Majid & Suyono, 2018). It is common for students to replace the term 'atom' with 'molecule' (Zarkadis et al., 2021). Furthermore, when the number of protons is the same, atoms are reported to be similar in size to molecules or even ions (Eymur et al., 2013; Griffiths & Preston, 1992).

The instrument was tested by distributing questionnaires to 28 teachers and conducting interviews with five teachers. Of the 38 question indicators, 35 valid questions were obtained with a high reliability of 0.929. This questionnaire indicates that the 35 questions are both valid and reliable.

3. Data Analysis and Interpretation

The following section explains the results of the distribution of questionnaires and interviews based on the given indicators.

A. Student Learning Difficulty Indicators

Learning difficulties refer to obstacles or disorders that impede students' achievement of learning objectives (Fitriana et al., 2022). These difficulties can manifest as problems with understanding or emotional regulation that affect students' learning abilities (Febliza & Yulis, 2018). Students with learning difficulties may experience suboptimal results in the learning process (Sanjiwani et al., 2020). Learning difficulties can significantly impede students' comprehension and emotional engagement with academic material. These challenges may include difficulties understanding concepts or skills and emotional obstacles hindering learning. Students with learning difficulties often experience suboptimal learning outcomes, making it challenging to achieve their academic goals. Therefore, educators must understand and address students' learning difficulties to enhance their learning quality and academic development.

The analysis of teacher needs for interactive e-module starts with identifying students' learning difficulties, particularly in atomic structure materials, and the benefits of nanomaterials. Table 4 presents the percentage results obtained from the distribution of questionnaires on student learning difficulty indicators that teachers directly monitor.

Table 4. Teacher Needs Analysis Results on Indicators of Student Learning Difficulties

No.	Statement	%
1	Chemistry is often perceived as a challenging subject by many students.	92%
2	Students frequently seek clarification from their peers or myself when encountering difficulties with chemistry concepts.	78%
3	The topic of 'Atomic Structure and Advantages of Nanomaterials' can be particularly challenging for students.	70%
4	The topic of 'Atomic Structure and Advantages of Nanomaterials' can be particularly challenging for students. Many students resort to memorization when studying this material.	72%
5	During the formative test on 'Atomic Structure and Advantages of Nanomaterials' students learning objectives completeness criteria score at least of 73.	55%
6	Many students struggle to comprehend the concepts of 'Atomic Structure and Advantages of Nanomaterials' without visual aids.	84%
7	Additionally, problem-solving in this subject proves to be challenging for most students.	76%
8	Therefore, I always incorporate learning media when teaching 'Atomic Structure and Advantages of Nanomaterials.'	77%
9	The topic 'Atomic Structure and Advantages of Nanomaterials' can be taught more effectively with interactive digital teaching media.	87%
	Average	77%

The indicator yielded an average percentage of 77%, placing it in the high category according to the criteria in Table 2. Based on the statements in Table 4 and the results of interviews, it can be concluded that many students find the material on Atomic Structure and the Advantages of Nanomaterials in chemistry lessons elusive. Students tend to rely on memorization methods when learning this material. Formative test results indicate that many students have yet to reach the Learning Objectives Completeness Criteria with a score of 73, suggesting suboptimal understanding. Additionally, most students struggle to visualize the material without media and encounter difficulties solving related problems. Interactive digital media is considered a more effective teaching method to address this. Therefore, a more innovative and interactive learning approach is required to enhance students' understanding of Atomic Structure and the Advantages of Nanomaterials. A more diverse range of teaching methods and media should be employed to address this issue.

According to the interview results, some teachers still use the lecture method to teach this material. At the same time, media assistance is limited to videos and PPTs, which fail to engage students. Table 5 presents the outcomes of teacher interviews regarding their teaching methods and the resulting student learning outcomes.

Table 5. Teacher Interviews' Results on Indicators of Student Learning Difficulties

No.	Question	Respondent's Response
1	How can the material 'Atomic Structure and the Advantages of Nanomaterials' be taught?	Usually, I first speak and then illustrate on the board.
		The order of energy levels can be taught.
		The lecture method and videos from YouTube or PowerPoint presentations will be used.
		I use a whiteboard, followed by a video, and also share a PowerPoint presentation.
		- (ICT Teacher)
2	Will students be able to rephrase the material 'Atomic Structure and the Advantages of Nanomaterials' in their own words after learning it?	If a topic has been discussed for a long time, it should be remembered as it is not applicable in real life.
		While some students can remember the material, others forget.
		The majority of students struggle to rephrase the material in their own words.
		The approach is decent, but it needs to be repeatedly emphasized to ensure that students understand it and do not misinterpret it.
		- (ICT Teacher)

Teachers have made various efforts to teach Atomic Structure and the Advantages of Nanomaterials. However, according to interview results, most students still need help rephrasing the material in their own words. Although some can recall the material, most still

need help, mainly when the material is not applied in everyday life. Therefore, additional efforts are required to ensure that students fully comprehend and apply the concept, enabling them to articulate it in their own words and prevent forgetting the material taught.

B. Indicators for Interactive Media Needs

Learning media refers to hardware and software designed specifically for educational purposes to enhance learning effectiveness (Uy et al., 2016). Technology in education can be applied to learning media (Khoiorni et al., 2023). Chemistry is one subject that can benefit from using technological media, as it can help students better understand challenging material (Putra et al., 2020). Nanomaterials possess an atomic structure that requires visualization media for better comprehension. Table 6 presents the percentage results of the questionnaire on teacher interactive media needs indicators.

Table 6. Results of Teacher Needs Analysis for Interactive Media Needs Indicators

No.	Statement	%
1	Students may experience difficulty concentrating during lectures that do not incorporate multimedia aids.	93%
2	Students are interested in learning that incorporates media.	97%
3	Learning media are crucial for facilitating the learning process.	88%
4	The available learning media in schools could be more efficient and comprehensive.	67%
5	Learning through media is highly beneficial in motivating student learning.	98%
6	I use video learning materials whenever I teach.	87%
7	I use the Learning Media website every time I teach.	52%
8	I use learning media applications every time I teach.	36%
9	I learned about interactive digital teaching materials.	67%
10	Interactive digital teaching materials greatly aided me in the teaching process.	73%
11	Interactive digital teaching materials facilitate students' comprehension of the lesson.	98%
12	Interactive digital teaching materials enhance student engagement in the learning process.	87%
13	Interactive digital teaching materials can enhance student motivation in learning.	93%
14	Interactive digital teaching materials can enhance students' thinking skills and facilitate learning.	97%
	Average	81%

The indicator shows an average percentage of 81%, which falls under the high category. Table 6 results indicate that students struggle to focus when learning without media assistance (93%) but show a high interest in learning that involves media use (97%). The use of interactive digital teaching materials is recognized as a critical element in improving learning effectiveness. Although there are some areas for improvement in the availability of learning media in schools, interactive digital teaching materials have received a positive response. Although there are several areas for improvement in the availability of learning media in

schools, the use of interactive digital teaching materials has received a positive response because it facilitates comprehension, increases students' learning activity and motivation, and trains their thinking skills. Integrating learning media, primarily through interactive digital teaching materials, can enrich and improve classroom learning quality.

Based on the results of interviews, teachers tend to prefer interactive media due to its clear and engaging visualization, ease of use, and time efficiency in teaching. Although some teachers have used interactive media, they have yet to use interactive e-module made with Flip PDF Corporate. Table 7 presents the results of teacher interviews on how this interactive media facilitates and can train students' thinking skills.

Table 7. Results of Teacher Interviews on Indicators for Interactive Media Needs

No.	Question	Respondent's Response
1	How can interactive digital teaching materials facilitate classroom instruction?	Interactive digital teaching materials provide students with instant feedback.
		It can be adjusted to their level of understanding.
		These materials typically include images, text, videos, and quizzes presented clearly and engagingly. It is important to note that the language used should be concise, objective, and accessible from ornamental or figurative language.
		They offer flexibility in learning, as students can access them anywhere at any time.
		Digital teaching materials enable the integration of multimedia elements, such as images, videos, and animations.
2	How can interactive digital teaching materials enhance the development of thinking skills, increase student motivation, and promote active learning in the classroom?	The criteria for evaluating teaching materials include their ability to guide collaborative projects.
		The criteria for evaluating teaching materials include their ability to promote independent learning.
		The criteria for evaluating teaching materials include their ability to enhance critical thinking skills through explicit and straightforward language and relevance to the content being taught.
		Interactive digital teaching materials can be designed to practice thinking skills by presenting challenges that require analysis, synthesis, and evaluation.
		This learning media is suitable for various types of children's learning, making it suitable for differentiated learning. Unlike conventional learning, not all children are suitable for it. This media is exciting and requires student activity.

Interactive digital teaching materials have proven to be effective in facilitating the teaching process in various ways:

1. They provide instant feedback to students, allowing teachers to offer corrections and guidance in real time.

2. They can be adjusted to the individual's level of understanding, thereby increasing the effectiveness of personalized learning.
3. Interactive digital teaching materials can become more exciting and easier to understand by presenting information through images, text, videos, quizzes, and simple language. Students can increase their independence in learning by accessing the material from anywhere and at any time. Integrating multimedia elements, such as images, videos, and animations, provides a visual dimension that enriches the learning experience.
4. Interactive digital teaching materials can enhance students' thinking skills, increase motivation, and encourage activeness by inviting them to engage in collaborative projects and self-study while promoting critical thinking. These materials are designed to be challenging and cater to various learning styles, making them an effective solution for creating more dynamic and directed learning. Therefore, interactive media is necessary for teachers to enhance learning effectiveness.

C. Readiness Indicators Using Interactive Media

The survey results indicate that teachers are generally ready to use interactive media as a learning tool and have strategies to overcome obstacles that students may face. The average percentage obtained was 83% in the high category. Teachers consistently emphasize the importance of preparation in utilizing interactive media to improve the quality of learning. In addressing challenges that students may encounter, teachers offer guidance on strategies that can be employed to ensure that interactive media is not only practical but also accessible and comprehensible to all students. The questionnaire results offer a complete overview of teacher preparedness in creating inclusive and compelling learning experiences through interactive media, as shown in Table 8.

Table 8. Results of Teacher Needs Analysis on Readiness to Use Media

No.	Statement	%
1	I own a smartphone or tablet with Android specifications of Kitkat 4.4 or higher, released in 2013 or later.	97%
2	I have sufficient battery capacity, including a power bank, to keep my device on standby during school hours.	95%
3	My device has ample memory space (RAM) to install new applications with a capacity of approximately 80 Mb.	87%
4	I have stable and adequate internet access to use digital-based teaching materials.	89%
5	I have prior experience using digital devices.	96%
6	I have prior experience using online learning platforms.	79%
7	Using digital devices for teaching makes it easier for me than whiteboard media.	70%
8	Technological learning is more efficient than conventional lecture methods.	75%

No.	Statement	%
9	Technological learning is often more efficient than conventional learning methods such as lectures.	86%
10	Students are more active in class activities using digital learning media.	98%
11	I have experience creating interactive digital teaching materials.	46%
12	I am prepared to address any obstacles students may face while learning with digital media.	73%
	Average	83%

Based on the results presented in Table 8, most teachers are prepared to use technology in the learning process. The respondents have access to suitable devices with sufficient battery capacity and recognize the benefits of digital learning (98%). While many teachers prefer technology-based learning and find it more efficient (86%), some acknowledge the limitations related to memory availability and internet connection that can affect the use of digital teaching materials. However, only a tiny percentage of respondents have created interactive digital teaching materials (46%), and most expressed readiness to overcome obstacles students may experience while learning digital media. These conclusions reflect how teachers are prepared and open to integrating technology in the classroom.

The interview results indicate that the teacher's smartphone is at least 2020 with 4GB of RAM, which supports their readiness to utilize interactive media, particularly e-module. Most teachers can use technology well, although a small number, particularly those nearing retirement, may have difficulty operating gadgets. Table 9 presents the results of interviews regarding teacher readiness for technological learning.

Table 9. Results of Teacher Interviews on Indicators of Readiness Using Interactive Media

No.	Question	Respondent's Response
1	What is your opinion on technology-based learning? Do you prefer it over traditional learning methods or vice versa?	I appreciate it, but I need more capabilities to adjust.
		Intriguingly, I am more inclined towards conventional methods, which are faster and require less preparation.
		It depends on the subject matter, as some chemistry topics require whiteboard media and conventional learning, while others benefit from interactive media.
		Although more engaging, it requires additional preparation. Digital technology is preferred due to its time efficiency in teaching, allowing for quicker completion of materials.
		Additionally, it enables students to learn independently and offers more flexible learning times.
2	Based on your experience, do students engage more in learning activities	Yes, the approach is more active.
		The results are satisfactory.
		There is no significant impact.
		The approach is highly active.

No.	Question	Respondent's Response
	when technology is incorporated?	It may not enhance concentration if the content is limited to videos, slides, or bare children's materials. However, even a simple whiteboard can improve concentration by highlighting key points.

It is important to note that opinions on this matter vary among teachers. However, others prefer conventional learning as it may be easier to assess and may not require extra preparation. Some teachers prefer technological learning due to its time efficiency and the ability for students to learn independently. Additionally, teachers frequently attend training during teaching hours, resulting in inefficient teaching time and leaving students with non-interactive tasks. In conclusion, the results of this interview reveal varying perspectives among teachers regarding technology in education, with some recognizing its benefits while acknowledging the challenges that come with it.

CONCLUSION

Interactive e-module is crucial in training students' critical thinking skills, and teachers play a vital role as facilitators. According to a needs analysis, 77% of teachers believe that students struggle with learning about atomic structure materials and the benefits of nanomaterials. Furthermore, 81% of teachers require interactive media for teaching, and 83% are willing to use it during learning. These high percentages indicate a positive response to innovation in education, particularly interactive media such as e-module. This conclusion could serve as the foundation for creating e-module that meet the requirements of educators and enhance the quality of education during the Merdeka Curriculum era.

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