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Validity of Science Process Skills Instrument in E-Modul Guided Inquiry Integration of Tapai Ketan Ethnoscience

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Abstract: The development of the Independent Curriculum demands contextual and meaningful learning, especially in science subjects that emphasize science process skills (KPS). The integration of ethnoscience in science learning is a potential solution to link science with local culture, as seen in the process of making sticky rice tapai, which incorporates elements of biotechnology and local wisdom. This study aims to develop and test the validity of the KPS instrument based on guided inquiry e-modules integrated with ethnoscience in biotechnology materials. The method used was Research and Development (R&D), with the ADDIE development model simplified into three stages: analysis, design, and development. The instrument was validated by seven experts using the Aiken index to assess the suitability of content, constructs, and language. The validation results showed that all questions had an Aiken index value ≥ 0.76, indicating high validity. Furthermore, the instrument was tested on 60 students to analyze reliability, difficulty level, and discrimination power. The empirical test results showed that the instrument had high reliability and met the criteria for question quality. Thus, this instrument was declared valid and feasible for use in measuring students' science process skills within the context of ethnoscience-based science learning and guided inquiry. This study supports the development of learning media that are not only scientifically profound but also rooted in local cultural values.

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INTRODUCTION

The Industrial Revolution 4.0 encourages the world of education to transform systemically by presenting a curriculum that is adaptive, flexible, and relevant to the changing times. The Independent Curriculum emerged as a strategic response to answer this challenge through a student-based, contextual, and integrated learning approach with Competencies in the 21st century, encapsulating analytical thinking skills, creativity, interaction skills, and cooperative capacity known as the 4C pillars (Thornhill-Miller et al., 2023). This curriculum design opens opportunities for students to explore their capacity autonomously, by optimizing digital technology as an attractive and interactive supporting media (Teo et al., 2021). Although the implementation is not evenly distributed, due to obstacles such as teacher readiness, inadequate infrastructure, and regional disparities in education quality. To ensure the effectiveness of the Merdeka Curriculum, collaboration among policymakers, educational institutions, and stakeholders is necessary to provide quality training and adequate facility support throughout Indonesia.

The Merdeka Curriculum prioritizes a learning approach rooted in real-life situations experienced by students, thereby presenting an authentic and meaningful learning experience (Antao & Morales, 2025). This approach does not solely focus on the cognitive realm, but also develops character, internalizes cultural values, and stimulates critical thinking through project activities that are in harmony with the local context. One of the main strengths of this curriculum lies in its integration of the noble values outlined in the Pancasila Student Profile—such as collaboration, honesty, and independence—which aim to shape students into resilient individuals who can adapt to change. With the freedom to choose a learning path, students feel valued and more motivated to participate actively (Sri Hanipah, 2023). Additionally, this flexibility creates opportunities for teachers to employ innovative learning strategies. However, the effectiveness of this approach is highly dependent on ongoing teacher training and the availability of resources across educational units.

The Merdeka Curriculum places the active role of students as the core of the learning process. Through this approach, students are given the flexibility to set methods, choose facilities, and adjust the learning tempo according to their individual preferences and personal interests (Astuti et al., 2024). This autonomy has a direct impact on increasing motivation, critical thinking skills, and creativity, that is more naturally developed. The collaborative projects designed in the curriculum also strengthen problem-solving and teamwork skills, two essential skills in the face of global challenges. With a learning atmosphere that supports active participation and personalization, students are no longer positioned as passive objects but rather as empowered active subjects. This curriculum encourages the growth of a generation of lifelong learners who are able to adapt flexibly to technological developments, social changes, and the dynamics of the future world of work (Issn et al., 2024).

The Merdeka Curriculum is designed as a strategic foundation for building a resilient and futuristic Indonesian education system, particularly in preparation for the Society 5.0 era. The curriculum encourages learning autonomy, experiential learning, and the exploration of students' interests that are integrated with technology and scientific approaches (Jahidi et al., 2024). Teachers are no longer just material presenters, but facilitators who guide students in finding meaning and effective learning strategies. A collaborative and communicative learning environment encourages the formation of students who are critical, creative, and solutive in facing real problems. Furthermore, the flexibility of the curriculum allows for simultaneous adaptation to local contexts and global developments. To optimize its implementation, a strong commitment from all stakeholders is needed in the form of teacher training, digitization of learning, and sustainable infrastructure and regulatory support (Munaf et al., 2025).

The contextual approach in science learning is one of the crucial strategies in 21st-century education, as it highlights the relevance between science concepts and the real experiences of students. Through this approach, students are no longer just passively memorizing scientific concepts, but are encouraged to build understanding through exploration, experimentation, and active reflection (Redjeki, 2024). Teachers play a key role in relating the subject matter to familiar local situations, such as explaining the concept of ecosystems with field studies in the surrounding environment. This approach deepens the meaning of the learning process while honing critical thinking, analytical, and problem-solving skills. Furthermore, context-based science learning helps shape a scientific mindset and fosters students' sensitivity to environmental issues. This strategy also addresses challenges in the digital era by harmonizing the mastery of science literacy with character building. The implementation of science learning that is relevant to the context of life and full of meaning is urgent in forming a generation that is intellectual, empathetic, and able to adapt to the dynamics of the times (King & Henderson, 2018).

The integration of local wisdom into science learning presents both a challenge and an opportunity in the development of the national curriculum. Local wisdom encompasses a variety of traditional practices relevant to scientific principles, such as herbal medicine, nature conservation techniques, and weather predictions based on natural signs (Homsombat, 2025). Unfortunately, this potential has not been fully realized due to policy limitations, a lack of teacher training, and a shortage of locally based teaching materials. Many teachers lack the necessary competence or resources to incorporate local culture into scientific learning materials. In fact, culture-based learning can enrich students' learning experiences while strengthening local identity. For this reason, teacher training, the development of culture-based e-modules, and regulatory support are necessary to ensure that this strategy can operate systematically and sustainably. Through proper integration, local wisdom does not simply function as additional content, but becomes a key element in the implementation of contextual and diversity-oriented education (Pearnpitak et al., 2024).

The values of local wisdom contain strong pedagogical potential as a reference for science learning that is authentic, relevant to the local context, and in harmony with the real experience of students. According to Usmeldi dan Amini (2020), the integration of local culture into the learning process is able to strengthen the relevance of the material while increasing student involvement. As an illustration, the concept of biotechnology can be conveyed through the activity of making sticky rice tapai, which introduces the principle of fermentation, also inserting cultural and spiritual values that are rooted in people's lives. This approach brings together modern science with traditional knowledge, creating a wellrounded learning experience. In addition, culture-based activities increase students' emotional engagement because the material feels real and meaningful. The use of local wisdom in science learning also helps students recognize and appreciate ancestral heritage, strengthen national identity, and cultivate a sense of pride in their own culture. Thus, designing science learning media that elevates the richness of local culture is an important strategy to present contextual education, embrace diversity, and be based on local wisdom values (Usmeldi & Amini, 2020).

Culture-based curriculum is a strategic solution in the face of globalization, which often erodes local values and the identity of the younger generation. Education plays an important role as a bulwark in cultural preservation, especially through the integration of local wisdom in science learning (Al Dwakat et al., 2023). The integration of cultural elements in science learning not only enriches the substance of the material but also contributes to the formation of students' character based on the noble values of the nation. This effort is in line with the orientation of the Merdeka Curriculum, which prioritizes contextual and differential learning based on students' backgrounds and environments. The development of teaching media, such as science e-modules that promote local culture, enables students to experience meaningful learning that is both scientifically and culturally engaging. A culture-based curriculum strengthens national identity while creating a generation that is resilient, globally competitive, and still maintains its identity. Contextual science education is not only a vehicle for knowledge transfer, but also a medium for the inheritance of values and cultural preservation (Chowdhury et al., 2020).

Schools have a strategic role in instilling local cultural values in students, especially through a science-based learning approach. This is in line with the spirit of the Merdeka Curriculum, which emphasizes meaningful, contextual, and focused learning on essential materials (Yafie et al., 2024). Local culture is not solely an ancestral relic, but also a rich source of learning that is relevant to the reality of students' lives. When these cultural elements are integrated into the educational process, students not only gain scientific understanding but also foster an appreciation for their national identity. This kind of approach has proven effective in shaping the character of students who are not only academically superior but also deeply rooted in the values of local wisdom. Therefore, strengthening the cultural dimension in the world of education needs to be realized through contextual and interactive learning. The Merdeka Curriculum itself provides a space for educators to design materials that are oriented to the needs of students and in harmony with local potential in the school environment (Tapung, 2025).

One of the subjects that is particularly well-suited for integrating local culture is Natural Sciences (IPA). The context-based science learning approach not only transfers scientific concepts theoretically but also encourages students' active involvement in exploring their environment and local culture. According to Atush Sholihah et al. (2020), Science provides a great opportunity to develop science process skills (PPP), which is a set of abilities that students use to acquire, process, and communicate scientific information (Deta et al., 2020). Activities such as observing, classifying, measuring, collecting data, and drawing conclusions train students to think logically and critically from an early age. Through direct observation of local phenomena, such as traditional fermentation processes or the processing of natural resources, students learn to understand science concepts in a real context. This approach makes science learners more alive, closer to their lives, and gives deeper meaning to the learning process.

With the right learning approach, science can be an effective medium to foster students' love for science as well as their local culture. When learners are engaged in scientific activities that are in harmony with the traditions and social realities of society, they not only strengthen their academic capacity but also internalize the cultural and social values inherent in the lives of their communities. As conveyed by Rivera & Tenorio, (2023), science is not a process separate from culture, but rather an integral part of life. In the context of the Merdeka Curriculum, this is a golden opportunity to combine scientific knowledge and local wisdom. Students learn to understand natural phenomena while absorbing the noble values inherited by their community. Synergy between educators, local communities, and learning resources based on local wisdom is a crucial element in realizing science learning that is contextual, full of cultural values, and directed at strengthening science process skills comprehensively (Erman & Wakhidah, 2024).

Fermentation materials, especially in the process of making sticky rice tapai, are often considered difficult and lacking context by students. In fact, if packaged with the right approach, this topic has great potential to strengthen science process skills (PPP). The fermentation process is not only concerned with chemical reactions and the role of microorganisms, but also with local cultural values inherent in people's lives (Qiao, 2020). Unfortunately, in practice, learning still tends to focus on theoretical aspects without linking them to real-world practices and the surrounding culture. This causes students to have difficulty understanding the concept in its entirety. Connecting contextual biotechnology learning with students' daily activities—such as the practice of making sticky rice tapai—is a potential strategy in deepening understanding of concepts and encouraging students' active participation in the learning process (Hermansyah et al., 2019).

In the midst of efforts to provide meaningful learning, ethnoscience in science is a promising approach. Ethnoscience refers to local knowledge that develops from the experiences and traditions of a community, encompassing hereditary practices that have proven beneficial. In the context of science learning, ethnoscience can enrich the material by presenting a local perspective that is closer to students (Nisa' et al., 2024). For example, in fermentation materials, students not only learn about enzymes and microorganisms but also understand the process of fermentation as part of their cultural heritage. Unfortunately, many teachers still do not consistently integrate elements of local culture into learning (Mavuru & Ramnarain, 2020). Precisely through this approach, students can develop a stronger attachment to the teaching material, as the learning process is presented in a contextual and realistic manner, aligning with the realities they face. Therefore, it is important for teachers to utilize the richness of local culture as a bridge in conveying modern science concepts.

Associating the fermentation process of sticky rice fermentation with science activities in the classroom can be a great opportunity in developing students' science process skills (SPS) (Chengere et al., 2025). In this activity, students can be invited to observe the process of changing texture and taste, measure the storage temperature, collect data on fermentation time, and draw scientific conclusions from their observations. These activities reflect the SPS indicators in real-life situations: observing, measuring, collecting data, and drawing conclusions. Moreover, the cultural context surrounding the making of tapai makes learning feel more intimate and meaningful. When students understand that local practices such as making tapai have a scientific basis, they will appreciate science and culture more at the same time (Ilango & Antony, 2021). This is the essence of ethnoscience-based science learning: grounding science in students' lives so that they not only learn science but also develop scientific attitudes that respect their traditions and environment.

The lack of ethnoscience integration in science learning has a direct impact on the low mastery of students' science process skills (SPS) in the field (Mudana, 2023). This is exacerbated by the dominance of conventional learning methods such as lectures, which have been proven to limit students' active participation in the learning process (Ssemugenyi, 2023). When science learning is not connected to the local cultural context, students tend to have difficulty in building a thorough and meaningful understanding of concepts. Without a contextual and culture-based approach, science learning becomes abstract, passive, and lacks meaning. Thus, it is necessary to innovate learning strategies that combine ethnoscience elements in order to encourage the development of students' science process skills (PPP) through activities such as observation, measurement, and interpretation of real phenomena that are familiar in their daily lives. One potential approach to overcoming low PPP and a lack of local cultural integration is through guided inquiry. Guided inquiry is an active learning model that invites students to discover concepts through questions, investigations, and data analysis, with mentoring from teachers (Kusuma et al., 2019). This model is considered more effective than the lecture method because it provides space for students to experience the scientific process directly. In addition, the inquiry approach allows the integration of ethnoscience values into learning, such as linking biotechnology materials to local practices of fermentation. Through direct involvement in the exploratory process, students not only gain conceptual understanding but also develop the ability to observe, classify, and infer, which are fundamental elements in science process skills (SPS). The application of the guided inquiry model is the right strategy in designing science learning that is contextual, participatory, and in line with the demands of 21st century competencies (Kimonen et al., 2017).

The success of a guided inquiry strategy is highly dependent on the learning media used. Passive conventional media certainly do not support the exploratory process needed. Therefore, ethnoscience-based interactive e-modules are one of the innovative solutions to create meaningful science learning.

The e-modules enable students to access the material independently at their convenience, allowing them to interact with local culture-based content, such as traditional fermentation processes (Kuhlthau et al., 2015). By utilizing e-modules, teachers can integrate inquiry-based activities, observation, and reflection, drawing on local wisdom. This condition makes learning activities more attractive and fun, personal, and effective. In addition to increasing student participation, e-modules also support flexibility in differentiated learning as emphasized in the Independent Curriculum. Thus, e-modules are not only complementary but also a key catalyst in the transformation of inquiry-based science learning and ethnoscience (Kurniawan & Syafriani, 2020).

E-modules as digital teaching media that are systematically designed to accommodate students in understanding concepts independently and flexibly (Dewi et al., 2019). In the context of digital-based science learning. The use of e-modules has high potential in strengthening student engagement and fostering independent learning skills. Its main advantage lies in its interactive design, which allows for multimedia integration, automatic evaluation, and access that is not limited by space or time. More than just a means of delivering material, e-modules also support the implementation of various pedagogical approaches, including guided inquiry models. When combined with contextual approaches such as ethnoscience, e-modules transform into learning mediums that are not only instructionally effective but also culturally relevant. The development of today's e-modules is intended not only as a learning resource, but as a strategic tool in strengthening science process skills (PPP) and supporting holistic learning that is aligned with the demands of the 21st century (Nedungadi et al., 2015).

The guided inquiry model is a learning strategy that positions students as active agents in building knowledge through a series of systematic stages, starting from formulating problems, formulating hypotheses, collecting information, and concluding findings (Kuhlthau et al., 2015). The integration of the guided inquiry model into the science e-module encourages a more active and reflective learning process, focusing on strengthening students' scientific skills. In the context of digital-based learning, the stages of inquiry can be presented through exploratory guides, experimental video shows, and virtual-based observation activities. This gives students the opportunity to develop a scientific mindset, even when they are studying independently. E-modules with a guided inquiry approach also support the Merdeka Curriculum, which emphasizes differential and contextual learning (Kurniawan & Syafriani, 2021). The collaboration between scientific content, inquiry approaches, and learning technology in the form of e-modules is the right pedagogical solution in the era of digital education.

One of the more valuable aspects of ethnoscience-based e-modules lies in their ability to bridge scientific concepts with local cultural wisdom that resides within the community. For example, the fermentation process in the manufacture of glutinous rice fermentation can be used as contextual material in the topic of biotechnology. This practice not only teaches scientific principles such as the role of microorganisms and chemical changes, but also introduces students to traditional practices that contain cultural and spiritual significance (Yaman et al., 2018). E-modules have a dual role: not only as a medium for learning science, but also as a vehicle for the preservation of local culture. This collaboration makes the learning process more contextual, attractive, and meaningful for students because it is based on experiences that are close to their lives. This idea aligns with the principles of the Merdeka Curriculum, which emphasizes the importance of education based on the context and potential of the surrounding environment. Therefore, the development of science e-modules based on inquiry and ethnoscience can be an important innovation to realize humanist and cultured scientific learning (Sari & Yustika, 2023).

In order to measure the success of the development of inquiry-based e-modules and ethnoscience, a valid assessment instrument is needed and in accordance with the learning context (Yayuk Srirahayu & Arty, 2019). A good instrument serves as an objective measurement tool to assess the achievement of students' science process skills, which include the ability to observe, measure, process data, and draw conclusions (Anderson & Rogan, 2020). The validity of the instrument is the primary aspect in ensuring that the question items accurately measure the intended competence, rather than just testing factual knowledge (Muliana et al., 2020). One of the commonly used methods to assess the validity of content is Aiken's validity, which is an approach that measures the degree of suitability of an instrument item based on expert assessments (Bahaudin et al., 2019). Without strong validity, the assessment results of an instrument have the potential to be biased and cannot serve as a basis for the scientific evaluation of learning effectiveness.

Aiken's validity is the right choice for testing the quality of the instrument item because it involves an expert assessment of the suitability of each item in relation to the measured indicator. In the context of the development of science process skills (SPS) instruments for science e-modules, this validity ensures that all aspects of SPS are represented accurately and proportionately. This study specifically tested the validity of an instrument developed from a guided inquiry-based e-module with ethnoscience integration, focusing on biotechnology topics, particularly the process of making sticky rice tapai. This topic was chosen because it has high contextual and cultural value, as well as being rich in scientific potential for strengthening students' SPS. Through validation using the Aiken index, the developed instrument is expected to have reliable measurement power in revealing the influence of learning media on the development of science skills, while maintaining the relevance between science and local wisdom in the educational process.

METHOD

This study used the Research and Development (R&D) method, which aimed to develop and validate a Science Process Skills (SPS) instrument based on an integrated guided inquiry e-module of ethnoscience on biotechnology materials, especially the production of sticky rice tapai. This approach was used to produce a product in the form of a valid instrument device that is suitable for use in the context of science learning in junior high schools. The development model used referred to the ADDIE model (Analysis, Design, Development, Implementation, Evaluation), but was simplified into three main stages, namely analysis, design, and development.

Analysis

The analysis stage was carried out through literature studies, initial interviews with teachers and students, and needs analysis to compile science process skill indicators that are appropriate to the context of guided inquiry and ethnoscience integration.

Design

The design stage included selecting biotechnology materials that were relevant to local culture (glutinous rice tapai), compiling question indicators, and compiling assessment grids and instruments.

Development

The development stage included the creation of KPS instrument items, preparation of scoring guidelines, implementation of content validation by experts, revisions based on validator input, and limited trials to ensure the clarity and understandability of the instrument.

Instrument validation was conducted by seven expert validators, consisted of science education experts, evaluation experts, and education practitioners. The validation process used the content validity method with the Aiken index to assess the level of suitability of items to science process skill indicators from the aspects of content, construct, and language. The calculation of the Aiken index uses the formula:

$$V=\frac{\sum S}{n(c-1)} \qquad (1)$$

Description:

V = Aiken's V validity index
S = Validator score minus the lowest score (r-lo)
R = Score given by the validator
lo = Lowest score in the assessment scale (1)
c = Highest score in the assessment scale (4)
n = Number of validators (7 people)

The Aiken index value was considered satisfactory if ≥ 0.76, in accordance with the minimum validity criteria for the number of assessors of seven people (Aiken LR., 1985). In addition to quantitative analysis, qualitative data were obtained from validator comments and input regarding language clarity, the integration of ethnoscience context, and suitability with the guided inquiry approach. These data were analyzed descriptively to support the process of revising and refining the instrument.

RESULT AND DISCUSSION

The analysis stage was conducted to obtain a solid foundation for creating an inquiry-oriented e-module integrated with ethnoscience on the topic of making sticky rice tapai. This analysis process included two main activities: preliminary interviews with teachers and students, and an analysis of learning needs. Preliminary interviews were conducted with 5 science teachers and 10 grade IX students at SMP Negeri 1 Kasiman Bojonegoro. The results of teacher interviews are presented in Table 1.

Table 1. Results of teacher interviews

No	Question	Answer 1	Answer 2
1	Have you ever used ethnoscience-based e-modules in science learning?	No (80%)	Yes (20%)
2	What is the most frequently used learning model in teaching science?	Lectures and discussions (100%)	Others (0%)
3	What are the characteristics of science teaching materials that have been used so far? (80%)	General and non-contextual (80%)	Contextual and locally based (20%)

From the interview results, it was revealed that the majority of teachers had not applied the ethnoscience approach or inquiry model in their science teaching. Around 80% of teachers stated that the teaching materials used tended to be general and less relevant to the students' context. This happened because the teaching materials used did not contain local examples or phenomena, making it more difficult for students to connect science concepts to their daily lives. Integrating local wisdom and phenomena into science education can make learning more relevant and interesting for students (Harris et al., 2025). Meanwhile, 100% of teachers said that the most widely used teaching methods were lecture methods and Q&A. The lecture and Q&A methods were still dominant because they were considered practical, but they did not actively involve students in the scientific thinking and exploration process. Traditional learning is effective in delivering material, but often fails to actively involve students (Kloepper, 2017). The results of student interviews are presented in Table 2.

Table 2. Student interview results

No	Question	Answer 1	Answer 2
1	Do you understand the science material taught in school?	Not really understanding, because it is difficult to imagine (70%)	Understand, because it is easy to understand (30%)
2	Are you interested in learning science if it is related to local culture or real practice?	Interested (90%)	Not interested (10%)

Students found it difficult to understand science lessons (70%) because there was no connection with their daily lives. Students had difficulty because the science material was presented abstractly without being linked to real life. The lack of contextual examples makes it difficult for students to understand the application of their knowledge, the use of contextual problems has been shown to improve students' understanding and ability to connect concepts to real-life situations (Nasrulloh et al., 2021). In addition, 90% of students were more interested in learning if the material was taught by linking it to local culture or practices around them. This was because students feel that learning will be more real, interesting, and easier to understand if it is linked to experiences or environments they are familiar with. Local content in teaching materials can improve academic achievement (Mubarok et al., 2025)

The needs analysis to formulate indicators of science process skills (SPS) that will be focused on in the development of the e-module was carried out based on the results of observations in the field. There were six main indicators of SPS that aligned with the guided inquiry approach and the process of making sticky rice tapai. Namely, observing, identifying variables, measuring, collecting and processing data, communicating, and concluding.

The above indicators were placed in each phase of the guided inquiry syntax, so that all activities in the e-module can be organized to systematically develop students' KPS using a familiar local cultural context. The results of the analysis stage showed that both teachers and students need teaching materials that are contextually appropriate, interesting, and can train scientific thinking skills. An e-module based on guided inquiry with the integration of ethnoscience in the material of sticky rice tapai is an ideal choice to increase student engagement and their science process skills (Yunianti et al., 2019).

At the design stage, several plans were developed to create an e-module based on guided inquiry integrated with ethnoscience. The topic chosen was biotechnology, specifically the process of making sticky rice tapai, which is closely tied to local wisdom. Furthermore, the question indicators were collected based on learning outcomes and science process skill indicators. The question grid was also compiled to cover aspects of material, indicators, cognitive levels, and question types. The assessment instrument was prepared to evaluate the effectiveness of the e-module in improving students' science process skills (Simamora et al., 2020).

In the development stage, the main objective is to produce a valid and usable science process skills (SPS) instrument. The first activity in this phase was to formulate the SPS instrument items according to the established indicators. Furthermore, scoring guidelines were prepared so that the assessment can be carried out with objectivity and consistency. Following this, content validation was conducted by experts in the field of science learning and instrument development. The results of this validation served as a reference for revising the instrument to comply with the principles of compiling good measurement instruments. The refined instrument was then tested on a group of students to assess the level of clarity, understanding, and readability of the instrument items. Feedback from this trial was used for final improvements before the instrument was used in the main study. This stage ensured that the instrument could measure students' science process skills with good validity and reliability.

Question validity was carried out to ensure that the question items were in accordance with the material and abilities being measured, and met the appropriateness of the material content and language in accordance with the science process skills indicators (Fahmina et al., 2022). The results of the e-module validation were reviewed from two main aspects, namely material experts and language experts. Validation was carried out by seven validators using an assessment scale converted using the Aiken Validation formula, and the results were compared with the minimum table value of 0.76, which is the V-table value with 7 validators (Aiken LR., 1985). The test items were declared valid if the V value ≥ 0.76. There were 6 test items validated by 7 validators, consisting of material experts and language experts. The calculation of the validity index of each test item used the Aiken Validity formula (Adhiguna & Yamtinah, 2025). The results of the validation of the learning instrument are presented in Table 3.

Table 3. Results of the validation of the learning instrument

Aspect	Validation Index	Validity Aiken	Category
Material	0.83	0.76	Valid
Language	0.85	0.76	Valid

The calculation results showed that all questions had an Aiken index value greater than 0.76. The instrument was considered valid if the Aiken V value is above the threshold value listed in Table V (Sukardiyono et al., 2020). The instrument was declared valid and suitable for use in measuring science process skills. Questions that have been declared valid were then tested on two classes with a total of 60 students. This trial aimed to determine the empirical characteristics of the test items, including reliability, level of difficulty, and discrimination power. Reliability testing was conducted using the SPSS version 25 program and calculated using Cronbach's Alpha formula. Meanwhile, the analysis of the level of difficulty and discrimination power was carried out using the Anates application version 4.0.5. The results of the Cronbach's Alpha reliability analysis can be seen in Table 4.

Table 4. Results of the Cronbach's Alpha reliability analysis

Cronbach's Alpha	Number of items	Category
0,749	6	Quite high

Based on the results of the Cronbach's Alpha reliability analysis, a Cronbach's Alpha value of 0.749 was obtained using a total of 6 question items. A Cronbach's Alpha value> 0.70 or higher indicates that the instrument is classified as reliable or consistent (Sukardiyono et al., 2020). The results showed that the instrument was classified as reliable and consistent, and it was declared reliable and suitable for use. The results of the analysis of the level of difficulty and discrimination power can be seen in Table 5.

Table 5. Results of the analysis of the level of difficulty and discrimination power

No. Question	Difficulty level (%)	Interpretation	Discriminating power (%)	Category
1	73.44	Easy	50.00	Good
2	67.97	Average	48.44	Good
3	66.41	Average	54.69	Good
4	69.53	Average	45.31	Good
5	61.72	Average	45.31	Good
6	63.28	Average	42.19	Good

Based on the results of the analysis of the level of difficulty and discriminating power of the six items, it is known that the level of difficulty of all questions was in the easy to moderate category. The criteria for the level of difficulty of questions were based on the proportion value (P), which is categorized into three levels. Questions with a value of $0.00 < P \leq 0.30$ are categorized as difficult questions, a value of $0.30 < P \leq 0.70$ as moderate questions, and a value of $0.70 < P \leq 1.00$ as easy questions (Purwati et al., 2021). Meanwhile, for the discriminating power, all questions were included in the "good" category. The discriminating power of questions with a value range of 0.70–1.00 is interpreted as very good, while values between 0.40–0.69 are interpreted as good (Magdalena et al., 2021). Thus, these questions are suitable for evaluating the effectiveness of e-modules in improving students' science process skills in the material on making sticky rice tapai.

CONCLUSION

The results of the validation of the question instrument showed that all questions had an Aiken index value > 0.76. The instrument was declared valid and suitable for use. The results of the Cronbach's Alpha reliability analysis yielded a value of 0.749, based on a total of 6 question items. The instrument was declared reliable or consistent. The analysis of the level of difficulty of all questions was in the easy to moderate category. Meanwhile, the discriminating power, all questions were included in the "good" category. Thus, these questions are suitable for use to evaluate the effectiveness of the e-module in improving students' science process skills in the material on making sticky rice tapai.

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