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Development of Learning Devices Using the Scientific Inquiry Learning Model Based on Malay Culture to Increase Student Self Efficacy

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ABSTRACT

The goal to be achieved is the increase in student self-efficacy through the development of learning tools using a scientific inquiry learning model based on Malay culture. This research is categorized into types of development research. The developed device uses a 4-D model. This research was conducted in the Mining Technology Study Program at the Ketapang State Polytechnic, class 1-B, with 28 students. According to the results of expert validation, the learning tools that have been developed in this research are of good quality and meet valid criteria by the validator, so they are suitable for use as learning tools. Implementation of learning tools in the practical category (very good). More than 80% of student responses were positive towards learning. The average student self-efficacy questionnaire results showed an increase from pretest to posttest in Trial II, with the pretest score being 83.43 and the posttest score reaching 119.32, out of a maximum score of 140. Based on these results, it can be concluded that student self-efficacy improved after implementing the learning devices using the scientific inquiry model based on Malay culture, as evidenced by the increase in scores from the pre-test to the post-test in Trial II.

Key Word *Scientific Inquiry, Malay Culture, Self-Efficacy.*

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INTRODUCTION

Physics is a fundamental subject in education. It helps students understand the natural world and the principles that govern it. Through physics, learners develop critical thinking and problem-solving skills. The subject lays the foundation for advancements in technology and scientific research. Its importance extends to various fields, including engineering, medicine, and environmental science. Good mastery of physics concepts is very necessary so that students can understand the physical phenomena around them and improve learning outcomes. However, based on initial observations, it is known that student learning outcomes are still low. It can be seen from the mid-semester exam scores where only 8 students (28.57%) got satisfactory

scores. Students still find it difficult to understand physics material. Many students give up when faced with physics questions. This has an impact on students' low self-efficacy. Low student self-efficacy is due to ineffectiveness in learning. It can be seen that in learning, the learning models used are less varied and tend to use mathematical equations. Incompatibility of learning devices can cause students to find it difficult to understand the material, which ultimately reduces their confidence in their academic abilities.

Another challenge in learning physics is the lack of integration between physics concepts and the culture and environment around students. In Malay culture, many aspects of daily life can actually be explained by the principles of physics. However, physics material in schools is often presented in a global or modern context, without linking it to local phenomena that are closer to students' lives. For example, the concept of heat transfer will be easier to understand if it is related to how heat is transferred in everyday life. For example, when cooking Kekicak (a typical Malay food), when the Kekicak is boiled and cooked, it will come to the surface. This occurs because of heat transfer which influences changes in the density of the food material. To respond to existing problems, the proposed solution is the development of Malay culture-based learning tools with the aim of increasing student self-efficacyTo respond to this problem, the proposed solution is the development of learning devices with the aim of increasing student self-efficacy.

Self-efficacy is very important in learning, because self-efficacy influences motivation, persistence and learning strategies (Syafitri et al., 2017). Students who have high self-confidence in their abilities tend to be more motivated to achieve academic goals, persist in the face of difficulties, and use effective learning strategies (Kamil et al., 2022). Thus, self efficacy acts as an important predictive factor in achieving optimal learning outcomes (Sen & Vekli, 2016). However, the ineffectiveness of the learning carried out and the incompatibility of learning tools with student needs results in a decrease in student learning outcomes, which in turn causes low student self-efficacy.

Learning tools play a crucial role in the learning process as they serve as essential instruments for achieving the objectives of the educational curriculum (Siregar, 2019). The purpose of this is to determine how effectively the learning material has been delivered, identify the indicators to be achieved, and outline the follow-up actions to be taken (Wida et al., 2024). So, with good learning tools, lecturers can more easily carry out innovations with various learning models as guidelines for classroom learning activities that can be combined with the students' culture. An effective learning model is the scientific inquiry approach rooted in Malay culture. Learning outcomes are greatly enhanced

through the scientific inquiry model, as students are trained to develop skills in acquiring and processing information by engaging in critical thinking activities that follow scientific procedures or methods. (Harahap et al., 2017). Integrating the scientific inquiry learning model with Malay culture into the learning process fosters a meaningful and enriched learning environment. This approach is expected to enhance students' self efficacy and character, empowering them to tackle problems more effectively.

The solution to addressing ineffective learning models is to implement a scientific inquiry learning model rooted in Malay culture. This model is structured to engage students in authentic investigative challenges, guiding them to explore, Identify challenges or gaps related to concepts or methods within the field, and develop strategies to address these problems effectively (Harahap, 2024). Integrating the sciientific inquiry learning model with culture-based learning aims to help students construct meaning and foster creativity, leading to a deeper understanding of the material. The issue of learning tools being misaligned with students' character and cultural background can be addressed by designing tools that incorporate the sciientific inquiry model grounded in Malay culture. The organization and presentation of material within these tools will be carefully structured and designed to captivate students' interest and engagement (Ummi et al., 2017). Developing learning tools that incorporate the sciientific inquiry model based on Malay culture creates opportunities for pedagogical innovations rooted in local wisdom. This approach allows students to learn in ways that align with their own traditions, while staying connected to the culture inherent in their social system (Wijayanti & Sudrajat, 2018)(Wijayanti & Sudrajat, 2018). With the development of these learning tools, it is hoped that it can overcome low learning outcomes and student self-efficacy.

Muslim & Tapilouw (2015) it can be explained that science process skills are increased through the implementation of the scientific inquiry approach. Furthermore, Waziri (2018) concluded from his research Teaching Biology concepts to class IX students using the scientific inquiry learning model proved to be more effective compared to traditional methods. Harahap & Kalsum (2024) explained that scientific inquiry based on Malay culture can improve student learning outcomes. Students' cultural backgrounds have an influence on students' learning processes at school (Monoarfa et al., 2023). And Pratama et al., (2015) stated that students' physics learning outcomes can be improved by developing modules based on an approach to exploring the natural environment that is integrated with culture-based learning. (Purnamasari & Nur Wangid, 2016) explained that the development of learning devices based

on a scientific approach was effective in building students' caring and disciplined character.

RESEARCH METHOD

This research was conducted at Ketapang State Polytechnic during the odd semester of 2024/2025, from July to October 2024. The population in this research were all students in the Mining Technology Study Program. The sample for this research was taken from 1 (one) class. Sampling was carried out using class random sampling. The samples in this research were class B semester 2, totaling 28 students. This research is categorized as a type of development research in which the Thiagaraian, Semmel, and Semmel development models, known as the 4-D model, are used. Development research focuses on product development, where the process is thoroughly documented, and the final product is assessed for its effectiveness and quality (Sinaga et al., 2008). The development process involves activities at each stage of the product's creation. The final product is assessed based on predefined quality criteria. In this research, the product is a scientific inquiry model learning tool based on Malay culture, which is validated, deemed effective, and considered practical. These learning tools, including semester learning plans, learning outcomes assessments, and student self-efficacy questionnaires, are developed.

RESULT AND DISCUSSION

Validity of Learning Devices

The learning tools that incorporate the scientific inquiry model based on Malay culture were evaluated by a team of experts who acted as validators. Semester learning plan and student self-efficacy questionnaire instruments were validated by them. The quality of the learning tools, in the form of semester learning plans, as determined by the expert validation, is summarized in the table below.

Table 1.
Validity Results of Semester Learning Plan

No		Rated aspect	Validator Assessment I	Category
I		Format		
	1	Clarity of distribution of material	4	Good
	2	Clear numbering system	5	Very good
	3	Space arrangement/layout	4	Good
	4	Appropriate font type and size	5	Very good
II		Contents		

No		Rated aspect	Validator Assessment	Category
	1	The truth of the content/material	4	Good
	2	Grouped into logical sections	4	Good
	3	Conformity of Study Program Learning Achievements with Course Achievements	5	Very good
	4	The selection of approaches, models, methods and learning tools is carried out appropriately, thereby enabling students to actively learn	5	Very good
	5	Lecturer activities and student activities are formulated clearly and operationally, so that they are easy for lecturers to implement in the classroom learning process	4	Good
	6	Suitability for learning using a scientific inquiry model based on Malay culture	3	Very good
	7	Suitability of material sequence	3	Very good
	8	Suitability of time allocation used	4	Good
	9	Feasibility as a learning tool	4	Good
III		Language		
	1	Grammatical correctness	4	Good
	2	Simplicity of sentence structure	4	Good
	3	Clarity of instructions and directions	4	Good
	4	The communicative nature of the language used	5	Very good
		Average	**4,18**	Good

The quality of the semester learning plan is assessed based on 3 aspects, namely format, content and language. The format section consists of clarity in the division of material, numbering system, space/layout arrangement, suitability of type and size of letters. The content section consists of the correctness of the content/material, grouped into logical parts, the suitability of the learning achievements of study program graduates with the course achievements, the selection of approaches, models, methods and learning facilities carried out appropriately, so as to enable students to actively learn, lecturers and other activities. Students are formulated clearly and operationally, so that it is easy for lecturers to implement in the learning process in class, suitability for learning using the Malay culture-based scientific inquiry model, suitability of the sequence of material, suitability of the time allocation used, suitability as a learning tool. Meanwhile, the language part consists of

grammatical correctness, simplicity of sentence structure, clarity of instructions and directions, communicative nature of the language used. Next, validation of the student self-efficacy instrument was carried out. The results can be seen in the following table.

Table 2.
Self-Efficacy Questionnaire Validation Results

Validator Assessment for Each Question Item													
1	2	3	4	5	6	7	8	9	10	11	12	13	14
V	V	R	V	V	V	V	V	V	V	V	V	V	V
15	16	17	18	19	20	21	22	23	24	25	26	27	28
R	V	V	V	V	V	V	V	V	V	V	V	V	V

Note:
V = Valid ; R = Revision

It can be seen that the validator provides an assessment of the validity of the content in the student self-efficacy questionnaire, namely with a valid assessment. Next, the recommendation is with a slight revision. These results show that all questions designed meet the valid criteria by the validator. The suggestions for revising student self-efficacy have been corrected in accordance with the validator's suggestions and scribbles. The conclusion from the validator assessment results can be seen in the following table.

Table 3.
Validity Results of Learning Devices

No	Device	Validation Results
1	Semester Learning Plan	4.18 (Good)
2	Self Efficacy Questionnaire Instrument	Valid (with minor revisions)

According to Table 3, the total average value of the Semester Learning Plan validation is 4.18. This value is then compared to the established validity criteria, placing it within the "good" category, indicating that the Semester Learning Plan meets the required validity standards. The validator concluded that the Semester Learning Plan could be used with minor revisions. Additionally, the validator evaluated the content validity of the student self-efficacy questionnaire, particularly the language and phrasing of the questions, and determined that they were highly understandable and appropriately written. The recommendations suggest only minor revisions. These results indicate that all the questions designed meet the valid criteria set by the validator. Based on the validation results for all the developed learning tools, it

can be concluded that the tools meet the validity criteria as determined by the validator.

The developed learning tools are deemed practical based on (1) evaluations from experts and practitioners, who confirmed that the tools are usable with little to no revisions needed; and (2) the observation results of the implementation of the learning tools, which achieved at least the "good" category. The average observation score for the implementation of the learning tools during Trial I was 2.92. According to the assessment scale used for evaluating the implementation of learning, the average score falls within the sufficient category ($2 \leq \bar{P} \leq 3$). This indicates that the Malay culture-based scientific inquiry model learning tools developed still require revision in terms of their implementation. Following this, Trial II was conducted, and the average observation score for the implementation of the learning tools was 4.39, which falls within the very high category ($4 \leq \bar{P} \leq 5$).

In Trial II, the results from the student self-efficacy attitude questionnaire were gathered. The questionnaire was administered at both the beginning and the end of the trial to evaluate any changes in students' self-efficacy attitudes. The data from the student self-efficacy attitude questionnaire in Trial II were analyzed to determine the increase in student self-efficacy. This was achieved by comparing the average scores of students before and after the implementation of the learning, as indicated by the results of the questionnaire. The improvement in student self-efficacy can also be evaluated using the N-gain formula. The table below shows whether there has been an increase in student self-efficacy and categorizes the magnitude of this improvement.

Table 4.
Student Self-Efficacy N-gain

	Pre Test	**Post Test**
Total	2336	3341
Average	83.43	119.32
N-gain	0.63	
Category	Medium	

The analysis of the pretest and posttest scores revealed a moderate increase in students' self-efficacy. Based on Table 18, it can be concluded that the average score of the student self-efficacy questionnaire increased from the pretest to the posttest in Trial II. The pretest score was 83.43, while the posttest score was 119.32, with a maximum score of 140. These findings clearly demonstrate that there was a significant improvement in student self-efficacy from the pretest to the posttest, which can be attributed to the implementation of the learning tools specifically designed using the Malay culture-based

scientific inquiry model during Trial II. This improvement highlights the effectiveness of integrating cultural elements with an inquiry-based learning approach in fostering students' confidence and belief in their abilities to engage with and master the learning material.

Discussion

The results of the validation for the learning tools using the developed Malay culture-based scientific inquiry model revealed that the learning tools, including the Semester Learning Plan and selfefficacy questionnaire, were deemed valid and demonstrated a good level of validity. This indicates that the developed learning tools have met the required validity criteria, which were determined through expert evaluations. The validity of the learning tools was achieved due to several factors, including the fact that the learning tool, utilizing the scientific inquiry model based on Malay culture, fulfilled the content validity requirements. This indicates that the development of the learning tools aligns with the requirements of the existing curriculum. These requirements are related to the learning outcomes that students are expected to achieve, which are tailored to the lesson content and adapted to the steps of the Malay culture-based scientific inquiry model.

Second, the learning tools developed using the Malay culture-based scientific inquiry model have met construct validity. This indicates that the development of the learning tools aligns with the concepts and indicators of self-efficacy, which are then integrated with learning activities following the scientific inquiry model based on Malay culture.

The novelty of the research is to develop A strategy for organizing and delivering material in learning tools is designed to ensure it is well-structured and engaging for students. It is expected that meaning will be created and creativity will be fostered through the combination of the scientific inquiry learning model with Malay culture-based learning, leading to a deep understanding of the material studied.

Moreover, the practicality of the learning tools was evaluated through assessments from experts and practitioners, who concluded that the developed tools could be used with minimal or no revisions. The expert evaluations indicated that the components of the learning tools, such as Semester Learning Plan and student self-efficacy questionnaires, are practical and can be effectively used with only minor revisions.

To evaluate the practicality, the implementation of the learning tools in the classroom was observed, and the results were categorized as either high ($3 \leq \bar{P} < 4$) or very high ($4 \leq \bar{P} < 5$). The instrument is considered effective if it has a reliability coefficient of ≥0.75 or ≥75%. The practicality criteria based on the

implementation of the learning tools in this research were met. In Trials I and II, the implementation of the learning tools reached the very high category ($4 \leq \bar{P} < 5$). Additionally, the reliability of the learning tool instruments in both trials achieved the required standard, with a reliability coefficient of ≥0.75 or ≥75%, indicating the instrument's good quality. While some students in the first trial were initially surprised by the learning tools, which required active participation, by the second trial, students had adjusted and found the tools more engaging and enjoyable.

The results of the posttest analysis of the student self-efficacy attitude questionnaire in Trial II indicate an increase in student self-efficacy. This improvement is reflected in the average scores from the self-efficacy questionnaires completed by students. The increase is also evident in each of the following indicators: (1) personal ability judgment (self), (2) regulation of mastery and skills, and (3) self-discipline indicators. Mentoring programmes based on cultural values have also proved effective in providing support and guidance to students in dealing with academic and social challenges. Besides, a culturally inclusive school environment also plays an important role in strengthening self-efficacy (Faizah et al., 2024). Self-efficacy relates to students' beliefs in their own ability to complete school assignments. Self-efficacy influences the use of students' skills and influences students' critical thinking skills (Sukma & Priatna, 2021). Incorporating cultural values into learning can clearly explains the details of the learning material, classroom, environment learning, learning methods, and culture-based learning approaches (Ratih et al., 2024).

Lestari et al., (2024) applies the IB NOSA learning model in 8th grade junior high school learning. IB NOSA is "inquiry based nature of science argumentation. Based on the results of the research, it was found that the IB-NOSA learning model is more effective in improving students' scientific literacy skills compared to the discovery learning model. It is suggested that science teachers should have a deep understanding of the Nature of Science (NOS) and how to teach NOS through explicit reflective learning within an instructional model. Developing learning tools using the PMRI approach can improve student learning outcomes. Student learning outcomes are taken by providing worksheets with a total of 10 questions. So the score obtained from group A is 100 while group B is 90 (Zahara et al., 2020).

Culture-based learning brings local culture which has not had a place in the school curriculum, including in the learning process of various subjects at school. The Banten Culture-based learning tool developed is suitable for use in learning on theme 5 in grade 5 in elementary schools (Syafani & Wuryastuti,

2023). Researchers develop ethnomathematics-based learning tools in the culture of the Tulehu community, so that students are interested because what they learn is in their daily activities (Rahim et al., 2016).

Development of Banten culture-based learning tools in the form of learning implementation plans, teaching materials, student worksheets, and test instruments (grids, test questions, scoring guidelines, and answer keys). The advantage of the resulting product is that it presents learning tools based on local wisdom, so that students can learn through presenting the culture in their own region and learning becomes meaningful (Sarta & Wuryastuti, 2023).

The development of role-playing method learning tools based on local culture "Sirondo-Rondoi" at Fathinah Kindergarten, Majene Regency has met the criteria for validity, practicality and effectiveness. This research confirms that the development of learning tools based on local culture can help in achieving learning goals, especially in building healthy social relationships in early childhood (Ulfah et al., 2024). The application of culture-based learning can provide many benefits. This can create a sensitive learning environment so that every student feels respected and heard (Akmalia et al., 2023). Culture-based learning can make a major contribution to forming a generation with character and respect for Indonesia's cultural diversity (Hayati et al., 2024).

Coastal culture-based learning tools for teachers were developed. The learning tools introduced become a reference for implementing the Independent Curriculum in order to prepare syllabi, Learning Implementation Plans, teaching materials, learning media, and evaluation, according to school characteristics. This activity aims to improve the competency of teachers who teach at the Karimunjawa Island Elementary School (Zaenuri et al., 2023). Cultural based learning or cultural responsive education is a positive thing in developing character and cognitive values. This is in line with the diversity that exists in Indonesia, so that a variety of learning content can be implemented (Patras et al., 2023).

Mathematics education that incorporates cultural elements is gaining attention as a potential way to enhance students' math skills. However, prior studies have not shown any conflicting results about its effectiveness when compared to traditional teaching methods (Zuliana et al., 2025). The research findings, derived from a random effects model, reveal a significant overall effect size of $g = 0.93$ and $p = 0.00$. The data strongly supports the conclusion that culture-based learning significantly enhances the mathematical learning process, proving to be a more effective alternative to traditional teaching methods. The findings from the heterogeneity analysis of moderator variables reveal that factors such as the type of skill, education level, country, year of

publication, and the diversity within culture-based learning all play a role in the variance observed in the results.

This highlights that implementing learning tools designed with the Javanese culture-based scientific inquiry model positively influences the improvement of student self-efficacy. From the explanation above, it can be concluded that collaboration encourages students to stay motivated in tackling complex tasks, enhances opportunities for shared inquiry and discussion, and supports the growth of independent learning skills. In summary, the scientific inquiry learning model significantly improves students' self-efficacy compared to conventional teaching methods. Thus, it can be concluded that learning tools integrating the Malay culture-based scientific inquiry model are effective in boosting student self-efficacy.

CONCLUSION

The integration of Malay culture in the scientific inquiry model creates a learning environment that is more contextual, meaningful and relevant for students. Through this approach, students not only understand scientific concepts in more depth, but also develop self-confidence in solving academic problems. The main factors that contribute to increasing self-efficacy include cultural links to learning experiences, the use of inquiry methods that encourage active exploration, and social and emotional support that is strengthened through Malay cultural values. Thus, the learning tools developed are able to increase students' self-confidence in applying scientific skills in various contexts, both academic and everyday life.

The advantages of this research include the fact that the developed learning tools have met the validity criteria. This is reflected in the validator assessments, where all validators confirmed that the tools were of good quality and suitable for trials. Additionally, the learning tools produced were based on Malay culture, further enhancing their relevance and applicability.

This model was developed in the Malay cultural context, so the results may not be completely generalizable to other cultures. Further research can explore the application of this model in different cultures to see the extent of its effectiveness in increasing student self-efficacy. Other actors such as differences in student learning styles, socio-economic backgrounds, and lecturers' readiness to implement this model have not been fully explained. Further studies can investigate how these external factors influence the effectiveness of the Malay culture-based scientific inquiry model.

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