E-LEARNING AND PHYSICS TEACHING MATERIALS BASED ON MALAY ETHNOSCIENCE ON THE EAST COAST

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ABSTRACT

This study aims to create and develop a Learning Management System (LMS) and teaching materials for General Physics courses as well as to see the effectiveness of using LMS and Ethnoscience-Based Teaching Materials for East Coast Malay Culture, which are closely related to the tradition of weaving pandan leaves as household products and decorations, in Supporting a Valid, Practical and Effective Blended Learning System. This research is included in the research and development method involving 38 students majoring in Physics. The development steps were adapted from the model developed by Thiagarajan, with the implementation stages consisting of (1) define, (2) design, (3) development, and (4) Disseminate. The findings that were obtained in the implementation of this study were that a team of students validated the instrument as a whole to obtain an average gain from cycle I 0.58 (Moderate) and then increased in cycle II 0.64 (Medium) and Cycle III at 0.73 (High). Several conclusions can be drawn that teaching materials based on ethnoscience and LMS improve student learning outcomes and, have met the criteria set for use in lectures and can be uploaded to the learning system using blended learning.

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Keywords: coastal Malay; e-learning; ethnoscience; teaching materials

INTRODUCTION

Learning is running in new normal conditions (Dziuban et al., 2018; Kemendikbud, 2020; Ellianawati et al., 2021). According to Prahani and Cheng (2020), educational institutions' teaching and learning process accommodates students by encouraging active and creative power (Purnama, 2020). It takes place in pleasant conditions for educators and students so that they can achieve learning objectives quickly, be fully understood by students, and be applied in everyday life. The achievement of learning objectives also has many determining factors, including cultural approaches, which are closer to the community, and equally important is technology in learning (Chiu, 2020). The learning concept that combines direct and technology-based learning currently developing is blended learning as an alternative (Utari et al., 2020; Benabentos et al., 2021). According to Kwon et al. (2021), to integrate identity changes in online learning and teaching with blended learning (Hrastinski, 2019), a learning management system must be designed and managed as a learning process (Ramdani et al., 2021). Likewise, in Pei and Wu (2019), teachers and stu-

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dents must be placed back as joint participants, and they should work together to build a post-learning community by practicing offline and online learning. It aims to ensure the continuity of the learning process during the pandemic and introduce online learning as a form of innovation in the world of education in Indonesia (Nastiti & Ni'mal'Abdu, 2020).

Sorge et al. (2019) stated, "In a large-scale study, students and teachers believed that, unlike some subjects where memorization was sufficient for their success, physics required understanding abstract ideas." It is reinforced by Nteere et al. (2017), who report that educational practices such as note-taking lessons and lectures are tedious, and students prefer active participation using strategies that involve more opportunities for interaction and discussion. It is not much different from the educational conditions in schools in North Sumatra (Irfandi et al., 2022). Although various learning methods have begun to be developed because they do not touch on the contextual conditions in the field, they only follow learning in general. At the national level, online and offline learning has been implemented but not optimal (Pohan, 2020; Putri & Adha, 2020)

According to Dewi et al. (2021), the ethnoscience approach can also help students understand physics concepts by presenting ethnic and local cultural contexts in learning physics. In this approach, students will be more involved in learning because they can see the connection between physics concepts and their daily lives (Wulansari & Admoko, 2021) and better appreciate their local culture. In addition, by integrating information technology and ethnoscience approaches in learning physics, students can be more skilled in applying physics concepts in their daily lives (Hikmawati & Syahidi, 2022). They can develop the ability to observe, reason, and evaluate physical phenomena in the context of their local culture and develop creativity and innovation in solving physics-related problems (Panggabean et al., 2022).

The main purpose of using basic physics teaching materials using ICT and an ethnoscience approach is to facilitate students' understanding of concepts (Dorobăț et al., 2019). Students can develop better abilities in understanding and applying physics concepts in their lives. Francom et al. (2021) revealed the concept of today's learning. It combines face-to-face learning and learning in the network or blended learning (Suana et al., 2017) after everything can be accommodated and accompanied by learning outcomes (Slikkerveer, 2019). It will improve the quality and competence of learners or students (Sudarmin et al., 2019). The development of Coastal Malay Ethnoscience-Based Teaching Materials, as stated by Lopez-Jimenez et al. (2021), must be implemented. It aligns with the government's program on the independent curriculum in preparing the Educational Unit Operational Curriculum or KOSP.

One of the important points is the presence of local content or the advantages and uniqueness of a region used as an approach to learning (Dargan et al., 2020). In coastal communities, education is not engaging because learning is not directly related to the lives of coastal fishing communities and affects their economic level. According to Achmad (2023), the education level of the people on the east coast of North Sumatra, specifically in the Belawan field, is dominated by fishermen only at the formal elementary and secondary school levels. It is also in line with Marpaung and Widyasari (2018) that most fishermen on the east coast of Sumatra, Deli Serdang district, have a basic education level from the existing educational data. Since there is development of teaching materials with a Deli Malay cultural approach, the East Coast of Sumatra has not been explored by researchers. It has become necessary where the Malay community, the largest ethnic group inhabiting the east coast of Sumatra, is closely related to the culture and customs inherent in life. Everyday life cannot be separated from life activities (Tanjung et al., 2022), so the learning approach implemented for coastal communities must hide a cultural anthropological approach by strengthening Malay culture, which is juxtaposed with learning content so that Malay coastal communities can easily understand learning material (Izharsyah et al., 2023). Teaching materials combined with local culture make students very close to the material with local culture. It becomes realistic and blends with the students. Therefore, the research objective is limited to using ethnoscience-based learning modules to improve physics learning outcomes at Medan State University, part of the east coast of Sumatra.

METHODS

This research was carried out at the Department of Physics, Universitas Negeri Medan, involving 38 students from batch 2023 In the General Physics Course with material on dynamics, stress, and strain. In this study, e-learning and the teaching materials developed are based on local Malay coastal content, namely in the case of making woven pandanus, which is used as household

equipment and accessories in the Malay Coastal community. From making pandanus matting activities, a purely scientific process will be developed in the form of teaching materials adapted to people's daily conditions. Which starts with the stages in the 4 D development research (Dwianto et al., 2017). "with the stages of implementation consisting of (1) define, (2) design, (3) development, (4) Disseminate". Below is a flow chart of the 4D development research stages adapted from the method developed by Thiagarajan.
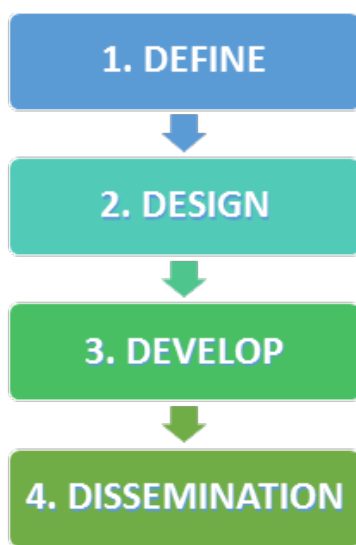

Figure 1. Research Implementation Procedures

     This model was developed by S. Thiagarajan (Al Hibra et al., 2019). The following are stages in the 4-D development model. The first stage is to "Define" the problem or need to be solved through research. At this stage, researchers identify and formulate research objectives and collect the necessary supporting data. The problem concerns learning by reviewing student analysis related to the specification of teaching materials (Wati et al., 2021), which can improve student learning on the east coast of Sumatra.

     The second stage is "Design." It involves planning and designing the solution to be developed. Researchers design approaches or methods that will be used in developing solutions and designing research instruments needed to collect data. At this stage, data on teaching materials is needed.

     Researchers "Develop" a product or solution based on a pre-made design in the next stage. Researchers implement development plans and produce products or solutions according to predetermined needs. What is being done is to make teaching material products based on Malay Ethnoscience and Culture on the East Coast with the

help of Photoshop, color, and C software, also equipped with ethnovlog videos.

Figure 2. General Physics Teaching Materials Based on Coastal Malay Ethnoscience

     In this study, researchers focused on developing teaching materials in the form of teaching modules that promote Malay culture entitled the processing of Pandan as a tool for everyday life and accessories. All processes are related to scientific processes that are not widely known by the public (Sudarmin et al., 2018). From this, teaching materials can be disseminated. "By disseminating research results limited to one class, data on student learning outcomes using teaching materials based on Malay Ethnoscience and Culture can be obtained" (Izharsyah et al., 2023).

     In the development process, materials were validated by media experts. An attractiveness test was carried out on the students to see the extent to which students assessed the appearance, presentation of material, and the benefits and applicability of the LMS and the material used. After the teaching materials and LMS are validated and ready for use, small group tests and limited trials are conducted on students in the General Physics Course.

RESULTS AND DISCUSSION

     The instruments of this study were the Learning Management System and Teaching Materials modules before collecting respondents' data. The instrument is validated using the media validation instrument and method by a lecturer or expert qua-

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lified in his scientific field and has research related to the instrument as an expert validator. The assessment of the teaching materials used includes assessment instruments for the feasibility of the content, delivery system, display, quality of learning strategies, accuracy of the material, and use of language. The assessment of e-learning or LMS includes software, learning system, and communication aspects.

The mechanism for conducting this research is the development of e-learning and teaching materials in the form of ethnoscience-based teaching modules. The assessment was carried out by the validator and tested on students. Then, the questionnaire results were validated by material experts who constructed the appropriateness of material content, delivery system, appearance, quality of learning strategies, material accuracy, and language use (Festiyed et al., 2022), with 26 question items. The media expert validator constructed software, learning, and communication aspects with 25 questions. Next, the observation sheet for the attractiveness of learning media for students includes the quality of appearance, presentation of material, implementation, and benefits, with 22 question items.

In addition, after conducting a reliability test on the material analysis instrument sheet, which includes the feasibility of the content of the material, the delivery system, the display, the quality of the learning strategy, the accuracy of the material, and the use of language (Istiyono et al., 2019), with 26 question items the result is an instrument with a value of 0.997 or above 0.60 coefficient Cronbach Alpha is a reliable material analysis instrument to use. Likewise, for the media instrument that uses LMS Mood-

le (Widyaningsih et al., 2021) on software aspects, learning aspects, and communication aspects, with 25 question items, a reliability value of 1.00 is obtained so that the instrument is reliable. The attractiveness of learning media instruments for students includes display quality, presentation of material, implementation, and benefits with 22 question items, a reliability value of 0.994 is obtained, which indicates that the instrument is reliable.

Results of the research carried out by taking several analyses were obtained validation data, student response questionnaires giving assessments, positive responses from respondents who thought that learning using e-learning used the Moodle they used, as well as participant attractiveness questionnaires for the e-learning based learning process (Winarto et al., 2022).

The results of the research instruments are sufficient to provide a very good assessment when examining the substance of the material, which is closer to the culture that exists in the people of the east coast of Sumatra, and the material presented is relevant to everyday life. This content is around students and is very familiar. Among them, the concept of e-learning deepens and adapts to the ethnic values of East Sumatra's coastal communities, which are mostly Malay (Zidny & Eilks, 2022). Ethnoscience is developed not only in teaching materials but also in the media used so that they can synergize and elevate the abandoned values of traditional society so far, such as the culture of weaving pandan so that it can be more firmly integrated with science, which has been carried out by the community so far can be contained in learning.

Table 1. Average Data on the Results of an Assessment of E-Learning by the Expert Validator

No	Aspect	Average percentage	Remarks
1	Content	83.3%	Very Good
2	Delivery	80%	Very Good
3	Appearance	85 %	Very Good
4	Learning Strategy Quality	80 %	Good
5	Material Accuracy	89 %	Very Good
6	Language Use	75%	Good
	Average	82 %	Very Good (Arikunto, 2016)

From the projected data that appears in Table 1, the results of the assessment were carried out on various aspects, starting from the feasibility aspect Fill, System Delivery, Display, Quality Strategy Learning, Accuracy Material, use of language in the e-learning that has been validated, a unanimous accumulated presentation of 82 % is obtained. This indicates that the e-learning project designed is in the Very Good category. However, researchers can still find several problems expressed by validators and respondents who are still confused about the language

in the validated e-learning. The operational language in the LMS still uses a lot of programming language in Moodle, so not all respondents will understand, but if the language used has been modified with familiar language, it will be easier for the user. Besides that, in the material, several parts of writing do not use standard language, so it is quite awkward when used in education. The validator also still responds well to the language, which is 75 because the user is a physics student familiar with programming language. The average percentage of the results of the assessment of *e-learning media* using *Moodle* (Hakim, 2018).

The data presented in Table 2 can be seen and analyzed from the assessment given by the

media expert validator on the Learning Management System (LMS) currently being developed. The expert validator assesses the validity of the media in the software aspect with an average rating of 91%, or this is in the very good category. Meanwhile, the learning system using e-learning has increased from other aspects, namely with an average value of 93% or Very Good criteria. According to the media validator, this aspect will bring a different learning experience with various video, audio, and multimedia features and, most importantly, paperless, making learning more interesting (Ahied et al., 2020). The last aspect regarding e-learning communication is that the score is quite high, 92% with Very Good criteria.

Table 2. Average Percentage of Assessment Results of E-Learning Media by Media Experts

No	Aspect	Average	Information
1	Software	91 %	Very Good
2	Learning System	93 %	Very Good
3	Communication	92 %	Very Good
Average		92 %	Very Good (Arikunto, 2016)

The data presented in Table 2 can be seen and analyzed from the assessment given by the media expert validator on the Learning Management System (LMS) currently being developed. The expert validator assesses the validity of the media in the software aspect with an average rating of 91%, or this is in the very good category. Meanwhile, the learning system using e-learning has increased from other aspects, namely with an average value of 93% with Very Good criteria.

In this aspect, according to the media validator, it will bring a different learning experience with a variety of video, audio, multimedia

features, and, most importantly, *paperless*, which makes learning more enjoyable. In e-learning communication, the score is quite high, 92% with Very Good criteria. Communication patterns in local culture-based e-learning make it more communicative (Muhammad et al., 2020). Therefore, the overall assessment results by two expert validators in media and computer technology can be categorized as very good, with a general total score of 92%. For a general description of the average percentage of ratings from media experts and computer technology science.

Table 3. Data of E-Learning Interesting Test Results by Participants

No	Aspect	Percentage	Information
1	Quality Appearance	80%	Good
2	Presentation Material	90%	Very Good
3	Benefit	100%	Very Good
4	Execution	75%	Good
Average		86.2%	Very good (Arikunto, 2016)

From the description shown in Table 3, we can see the average results of the attractiveness test in e-learning (Hartini et al., 2018). Based on the data provided, the following is an analysis of display quality, presentation of material, benefits, and implementation. Display quality is categorized as good, with a satisfaction level of 80%.

Although it is not said to be "very good," it is still in the satisfactory category. The display quality is in a very good category because the appearance also includes cultural elements (Sudarmin et al., 2019) closely related to the people of the east coast of Sumatra, namely a little ornament and Malay ethnicity. Furthermore, the Presentation

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of Material obtains a satisfaction level of 90%, which indicates a high level of satisfaction.

The presentation of the material is considered very good and meets expectations, so when students use it, it can provide a learning experience (Dewi et al., 2019) to increase student understanding. In addition to the Benefits (100% - Very Good), get a 100% satisfaction level, meaning the benefits are very good. It shows that the data provides maximum benefits for users. The last component is the implementation aspect (75% - Good): Implementation gets a satisfaction level of 75%, which is still included in the good category. While there is room for improvement, the performance remains up to the mark (Dewi et al., 2021). In general, based on the data provided, the appearance, presentation of the material, benefits, and implementation were obtained from good to very good categories. In comparison, some aspects could be improved. Overall, the data provide a satisfactory level of satisfaction.

In the implementation stage of small and limited group trials, this process was carried out as part of the dissemination process of the results of research products carried out on teaching Physics materials and LMS based on Malay ethnoscience culture on the coast of Sumatra. From the existing data, we can analyze the suitability between the initial product of teaching materials (Sarwi et al., 2020) and the aspects being assessed. Among other aspects are the depth of the material, the availability of sample questions, relevance, the language used, the appearance of teaching materials, and the adequacy of material to achieve goals. These aspects were tested on five student respondents who were used as samples in the data collection process. From the data obtained

The five respondents filled out a questionnaire about e-learning and Malay cultural ethnoscience-based teaching materials on the East Coast, comprising six questions (Ilhami et al., 2021; Riyani et al., 2022). In the questionnaire with the specification of the answers with four answer points, student respondents will fill in. The four answers include Complete/ Interesting/ Good/ In accordance with a maximum point of 4 points. The results of the data collected will be calculated cumulatively so that the value of the points collected will be converted into percentages with the results of the data, namely, for the relevance of teaching materials and LMS, many student respondents consider teaching materials and LMS to be very relevant in the teaching and learning process with a score of 88 points. As for the appe-

arance of the LMS, it also gets a fairly high point, namely 88. where learning using e-learning and teaching materials based on Ethnoscience of the Coastal Malay Community of East Sumatra is very relevant and interesting for respondents, as well as language and adequacy also touches 85%.

As for the depth and sample questions in these two aspects, they look quite low, touching the numbers 80 and 78 because there are not many physics learning materials (Ardianti et al., 2019) related to coastal Malay culture because they are limited to the existing culture, so what culture is sorted Relevant such as sea tides, pandan processing in pandan woven crafts which are limited to drying to reduce water content and also stress and strain strength so do not cover all materials.

The limited test was carried out in a class of 38 students with questions in the form of a questionnaire sheet with a Likert scale. The questionnaire sheet was adapted from several studies on module relevance, material adequacy, material depth, language in the module performance module, and examples of questions developed in the General Physics teaching module based on Malay ethnic culture on the East Coast of Sumatra.

There are high, medium, and low groups, and the relevance and appearance components still top the assessment, although with different values, 89% and 90%. The middle group, namely adequacy, depth, and language, with respective percentages of 86%, 83%, and 84%, and the latter, which is quite low even though improvements and revisions have been made to the sample question components, are still considered difficult by respondents or students because they use (McCarty & Deslauriers, 2020). Many students consider high-order thinking skills difficult (Ebere & Appolonia, 2017) because the questions are almost the same quality as the normally tested questions but require sequences and rationality of answers (Parmin & Fibriana, 2019). This stage still produces data on the average pre-test scores of each student with different material in the General Physics Course with material on dynamics, stress, and strain (Wiratma & Yuliamiastuti, 2023).

From the data above, we can see that at the first meeting with dynamics material, the pre-test score of the students was 35.5, and the post-test score after being given material using teaching materials based on Ethnoscience and Malay Culture in the East Coast and LMS, the post-test scores were obtained of 73. There was a significant increase of more than 100% from the initial test scores.
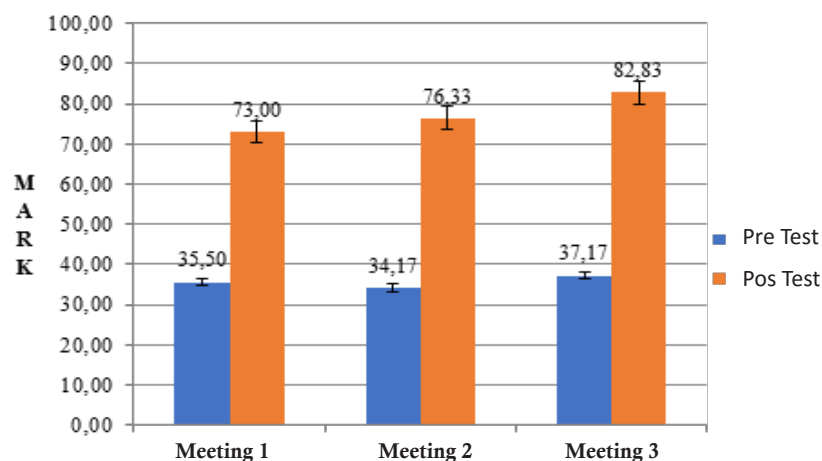
Figure 3. Pre-test and Post-test Scores

Likewise, the second meeting used the face-to-face method but still used the LMS in testing and providing material. In the pre-test of the second meeting, there was a decrease in score of 34.17 on the initial test before the lecture was held. At the end of the lecture, there was an increase in the assessment, reaching 76.33. Likewise, at the third meeting in the General Physics course with strain material, during the pre-test, students experienced an increase in scores from the previous initial tests of 37.17, and after the teaching and learning process was carried out, a post-test was carried out (Khoiri et al., 2023). Students were tested with a score of 82.83, where students are familiar with the pattern of the program provided plus teaching materials containing local and friendly content and using blended learning that is not rigid to create a new learning experience for students.

Furthermore, calculating the gain value from each student's first to third meetings. The result is that the first meeting has an average gain of 0.58, and the second meeting has an average value of 0.64, both of which are in the moderate improvement category (Martawijaya et al., 2023). In the third meeting, the average gain value is 0.73, included in the high increase category (Kurniawan et al., 2016). From the first to third meetings, there is an increase in the average gain value, showing an increase in learning outcomes using General Physics teaching materials based on Malay ethnoscience on the East Coast (Atmojo et al., 2019). In summary, the average gain value can be seen in Figure 4.
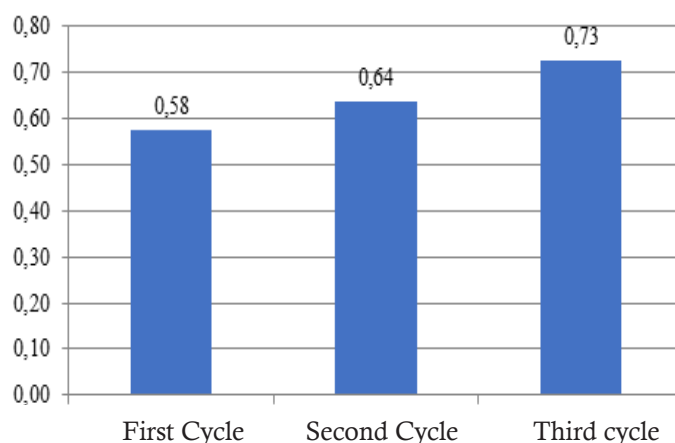

Figure 4. Average Gain Value

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From these data, there was an increase in each cycle where the increase in the gain value showed an increase in the quality of learning (Sumarni, 2018) using General Physics teaching materials based on Malay ethnoscience on the East Coast. This increase indicates that learning uses teaching materials (Siagian & Manurung, 2016). teaching General Physics based on Malay ethnoscience on the East Coast with the assistance of e-learning with gain values in cycles I and II in the Moderate category and cycle III High Category, this can have a positive impact (Irfandi et al., 2020) for students taking General physics courses followed by physics education students (Fasasi., 2017).

CONCLUSION

The research concluded that the developed e-learning showed a positive side where the results of validation by Media and ICT experts were in very good categories, and expert validation carried out by material experts showed that it is generally in the very good category. In addition, General Physics teaching materials based on Malay ethnic culture on the East Coast, with the help of e-learning, are feasible and can be applied to students. Students are so friendly with the culture of respondents and students on the East Coast. There is an increase in the results and quality of student learning in General Physics teaching materials based on Malay ethnoscience on the East Coast with e-learning. For the first and second meetings, the category is moderate increase. For the third meeting, the category of high increase can be seen from the change in the gain value in the first cycle of 0.58. Then, there was a significant increase in the second cycle, increasing to 0.64. It rose to 0.73 points in the third cycle, so the increase in each cycle is evident. From the findings, the teaching modules and LMS used are relevant to the Educational Unit Operational Curriculum, which the government promotes in independent learning. The increase in learning outcomes is not only increasing at the student level but also for primary and secondary education students. Learning based on excellence and uniqueness in educational units must be developed and combined to improve education. In the future, teaching modules and LMS based on Malay coastal ethnoscience will be very appropriate as teaching materials with a unique approach to the East Coast of Sumatra.

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