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ENGKLEK GAME ETHNOSCIENCE-BASED LEARNING MATERIAL (EGEBLM) TO IMPROVE STUDENTS' CONCEPTUAL UNDERSTANDING AND LEARNING MOTIVATION

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ABSTRACT

Understanding concepts is essential in physics education, as this subject emphasizes the practical application of concepts over rote memorization. This approach helps prevent misconceptions from occurring among students. Moreover, learning motivation can raise enthusiasm for learning physics to achieve the expected goals. However, evidence suggests that both variables show low levels. Therefore, this study aims to develop valid, practical, and effective *Engklek* game ethnoscience-based edutainment learning materials (EGEBLM) to improve students' physics conceptual understanding and learning motivation. This research utilized the 4D type (Define, Design, Develop, Dissemination) to fulfill the quality test of the developed learning materials. The sample of this study involved 29 high school students at level XI. The EGEBLM test design used a non-equivalent control group design. Data were analyzed using descriptive and statistical tests, including N-gain, t-test, and MANOVA. The results reveal that EGEBLM is declared valid in content and construct in each component, including syllabus, lesson plans, teaching materials, student worksheets, test instruments, and response questionnaires. The observations indicate that each learning approach's syntax can be effectively implemented (> 3.00), rendering it suitable for educational applications. EGEBLM also meets effective criteria based on descriptive and statistical tests ($p < 0.05$) to enhance conceptual understanding and learning motivation, receiving positive feedback from students to this learning. This learning model combines collaborative discovery learning activities with traditional *Engklek* games that they have applied daily, enabling students to understand physics concepts easily and have meaningful learning experiences. This research has implications as an innovative method in learning physics edutainment, offering an accessible, cost-effective, enjoyable approach while also preserving the *Engklek* cultural context.

Keywords: EGEBLM; *Engklek*; ethnoscience; conceptual understanding; learning motivation

INTRODUCTION

Most students still consider physics one of the most challenging subjects, affecting their understanding of the concepts the teacher explains. Consequently, they feel they need to be more motivated, leading to a low understanding of physics concepts (Arista & Kuswanto, 2018; Puspitasari et al., 2021). Based on one of the facts in the field, some students consider physics material difficult (Bouchée et al., 2022). This tendency can be caused by learning experiences where students realize that physics lessons are lessons related to understanding concepts and problems or complex mathematical problems (Sari et al., 2022). Several empirical studies confirm that students still have a relatively low conceptual understanding of science and physics (Arista & Kuswanto, 2018; Marshman & Singh, 2017; Pratiwi et al., 2019). This problem must be a concern since a low understanding of the concept of physics may

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lead to misinterpretation of scientific findings, contributing to misconceptions and uninformed decision-making.

Variables, including learning motivation, can affect students' understanding of physics concepts (Mega et al., 2014). Research by Cicuto and Torres (2016) provides reinforcement that an active learning environment can affect student motivation to study harder and seriously. Velayutham et al. (2011) also mention that student learning motivation is crucial for subjects related to science categories. However, previous research discovers that students' learning motivation in physics lessons has a tendency to be low (Keller et al., 2017; Jufrida et al., 2019). In fact, most students need better learning motivation and a positive attitude toward physics subjects (Chetri, 2022). This can be seen based on students' lack of sincerity in the learning process and their negligence in completing the teacher's tasks, resulting in low learning outcomes. A sincere desire to learn coupled with strong motivation and enthusiasm can assist students in comprehending physics concepts effectively (Nikou & Economides, 2016; Bae & DeBusk-Lane, 2019; Xu et al., 2023).

An edutainment setting is one way to improve conceptual understanding and student motivation in learning physics (Dandashi et al., 2015; Fülöp et al., 2017; Hui et al., 2022; Othman et al., 2022). Creating a conducive environment while remaining aligned with the learning objectives allows students to get involved in observation, planning, interpretation, and hypothesis formulation (Ofoghi et al., 2016). Students can actively participate in the learning process in order to fully grasp the subject provided (Sieberer-Nagler, 2015; Murray, 2018). Therefore, physics learning is considered to have the potential to be fun learning in an edutainment setting. One example of edutainment-based physics learning is through ethnoscience by utilizing traditional *Engklek* games.

Engklek is a traditional game performed by jumping on tiles drawn on a field. This game has various advantages when implemented, such as improving motor skills, body balance, creativity, and problem-solving skills (Hasibuan et al., 2022). However, the development of the modern era in current conditions has eliminated most of the traditional games (Furió et al., 2013). Therefore, this research is intended to preserve traditional game culture through integration with *Engklek* games in learning. Rizki et al. (2022) suggest that this game has the potential to be implemented in physics learning because it has relevant concepts. Hence, applying this game to physics learning can create a vibrant and fun learning atmosphere so students can be more excited and motivated when learning the concepts.

In accordance with research by Romanvican et al. (2020) and Sari et al. (2019), learning activities with the application of *Engklek* effectively improve student learning motivation because this method can create a comfortable and fun learning atmosphere. As a result, the students can focus more on the material taught. In addition, the results from another study mentioned that each increased learning motivation score will be accompanied by an enhancement in students' physics concept understanding scores even though they cannot be seen directly (Butler & Lumpe, 2008).

According to Rizki et al. (2022), *Engklek* games can be used in physics instruction because they are connected to the curriculum and Ethno-STEM subjects. Several research connected to physics concepts, such as parabolic motion, work and energy, momentum and impulse, and object equilibrium, can be evaluated using its application (Sari et al., 2019; Sari et al., 2020). The research can also provide a stimulating learning environment while conserving traditional games that are being phased out. Fun physics learning through *Engklek* games can affect the increase in conceptual understanding and learning motivation. Nevertheless, research on the implementation of physics edutainment utilizing the ethnoscience of the *Engklek* game is still very limited.

As a result, the goal of this research endeavor is to develop ethnoscience-based physics edutainment learning materials based on *Engklek* games (EGEBLM) that are valid, practical, and effective in boosting students' physics concept understanding and learning motivation (Nieveen, 1999). The present research is designed to boost student learning motivation and physics concept understanding. Furthermore, this research could be an effort to preserve the traditional *Engklek* game in this modern day.

METHODS

This research was classified as R&D research since it used the Define, Design, Develop, and Disseminate (4D) design (Creswell, 2017). The approach and method were chosen because it intended to generate *Engklek*-based physics edutainment learning materials. The generated product was then assessed for practicality and validity, as well as product trials, to determine the level of increased understanding of physics concepts and learning motivation following the use of these learning resources. Figure 1 depicts the stages of this investigation.

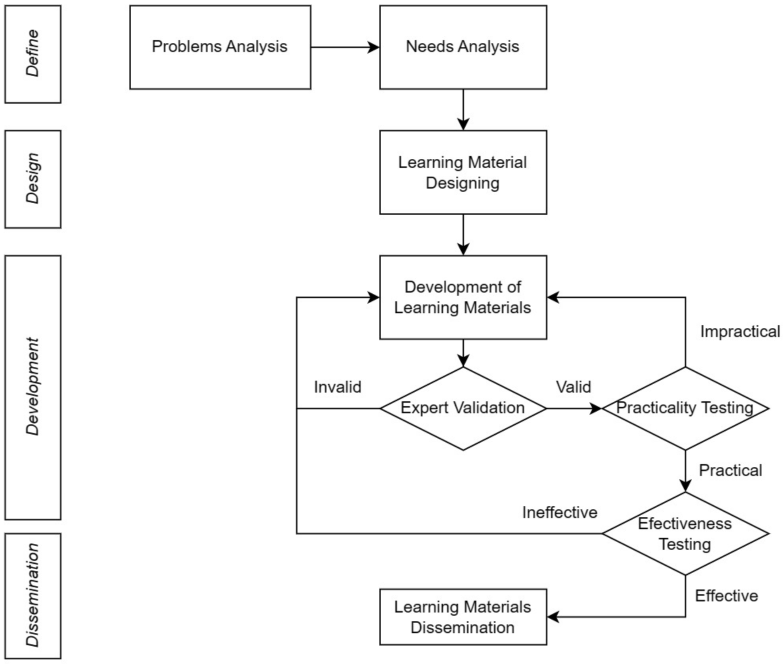

Figure 1. Research Steps

The number of samples involved 29 students divided into two classes, the experimental class (n = 12) and the control class (n = 17). This number was calculated using the Slovin equation related to the total population. Purposive sampling techniques were used to select XI grade because this research included the learning materials in the school curriculum.

The instruments developed in this study included lesson implementation plans, concept comprehension test instruments, and student motivation questionnaires. The lesson implementation plan consisted of several instruments: syllabus, lesson plans, teaching materials, and student worksheets. The learning curriculum in experimental and control classrooms was modified to reflect the present school curriculum. The learning approach was different in both classes' lesson plans. The experimental class employed the *Engklek* game edutainment-based learning in a discovery learning model. Meanwhile, the control class carried out conventional learning process, including lectures, discussions, and structured assignments.

Furthermore, test instruments to measure conceptual understanding consisted of two types: pre-test and post-test. However, both tests had the same substance of the questions tested. This was done to determine the increase in students' understanding of physics concepts in experimental and control classes. There were eight questions tested with the type of description questions using the dimensions of understanding concepts according to Anderson & Krathwohl (2001), namely Interpreting, Exemplifying, Classifying, Summarizing, Inferring, Comparing, and Explaining. In addition, the instruments to measure learning motivation using questionnaires for both classes adapted from Student Motivation Toward Science Learning were developed by Tuan et al. (2005). This questionnaire consisted of 25 questions with rubrics of learning motivation in Science learning: self-efficacy, active learning strategies, physics learning values, performance goals, achievement goals, and stimulation of the learning environment. Meanwhile, several other instruments used to evaluate the tools developed were learning implementation observation sheets and expert validation questionnaires.

The data collection procedure in this study started with the validation of two physics education experts and a physics teacher practitioner. Experts assessed all learning materials developed in terms of content and construct. The assessment results from validators were also used to determine the reliability of learning materials that had been developed. After obtaining valid assessment results, data collection continued on the practicality of the materials. Two observers, an in-service physics teacher and a pre-service one, observed the implementation of the learning process according to the lesson plan developed to find practicality. Observers recorded conformity with the implementation of learning with the learning syntax in the lesson plan prepared from the beginning to the end of learning. Then, the results of observations were recorded in observation sheets.

During the practicality test, effectiveness tests were also carried out simultaneously. This test was conducted to determine the effectiveness of EGEBLM in increasing the understanding of physics concepts and student learning motivation. The effectiveness test was conducted using a quasi-experimental method, specifically a non-equivalent control group design, as the school directly selected the class. At first, the experimental and control classes were provided a pre-test of conceptual understanding and learning motivation. Next, the experimental class was treated using EGEBLM learning, while the control class used conventional learning. At the end of the lesson, both classes were provided a post-test of conceptual understanding and learning motivation.

Data from validity testing results were used to determine the feasibility and reliability of learning materials. The assessment results of the three validators were then calculated descriptively (mean) and then adjusted to Table 1 (Ratumanan & Laurens, 2011). Meanwhile, the Cronbach Alpha (α) value was used to assess the component's reliability. If the value of $\alpha > 0.7$, the learning materials can be said to be reliable (Taber, 2018). The calculation of the α value was carried out using SPSS25. Moreover, a practical analysis of learning materials was determined using the level of learning implementation based on observations by two observers. The results of observations were calculated descriptively and then adjusted to Table 1 (Ratumanan & Laurens, 2011).

Table 2. Conceptual Understanding, N-Gain, and Effect Size Criteria

Concept Understanding Criteria		N-Gain Criteria		Cohen's d-effect size	
0-1.00	Low	< 0.3	Low	≥1.00	Very Large
1.01-2.00	Medium	0.3 – 0.6	Medium	0.8	Large
2.01-3.00	High	≥ 0.7	High	0.5	Medium
3.01-4.00	Very High			0.2	Small

RESULTS AND DISCUSSION

The syllabus, lesson plan, student worksheet, teaching materials, and test instruments are the five main instruments in the learning materials. The discovery learning model is used to execute learning because it is particularly relevant to learning activities to improve conceptual understanding. The discovery learning methodology is based on intuitively grasping concepts, meanings, and relationships. The discovery process occurs when an individual discovers some notions and principles primarily through mental processes. Students can identify physical concepts related to the game while they play the *Engklek* game. Previous research has revealed that the discovery learning model can boost students' understanding of physics concepts and learning motivation (Mukherjee, 2015; Kasmiana et al., 2020; Masani, 2022). Some displays of developed learning materials can be seen in Figures 2 and 3.

The theoretical rationales of EGEBLM are the learning theories of discovery, constructivism, and the experience of Edgar Dale. In discovery learning theory, Bruner emphasizes the active participation of each student and knows well the differences in abilities (Arends, 2011). To improve the learning process, it needs an environment called exploration, discoveries that are not yet known, or notions that are similar to those already known (Slavin, 2011). Therefore, students will later discover physics concepts while playing the *Engklek* game, both those they have not known and already know.

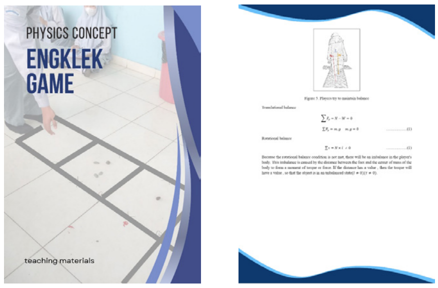

Figure 2. Preview of EGEBLM Teaching Material

In addition, according to constructivist learning theory, students construct or create knowledge by giving meaning to their knowledge according to their experience. According to Vygotsky, the constructivist approach to learning is the social interaction of individuals with their environment (Bada & Olusegun, 2015). In EGEBLM learning, students need the help of teachers to develop their knowledge, and students can interact with other students in solving problems in the *Engklek* game to develop their knowledge (Arends, 2011).

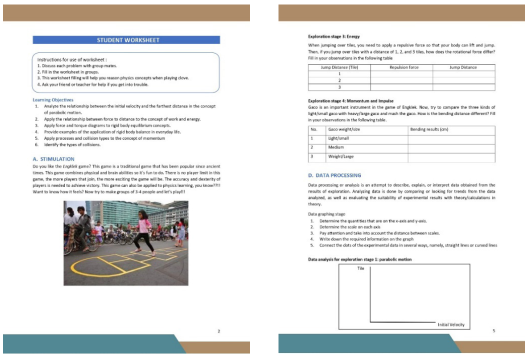

Figure 3. Appearance of EGEBLM Student Worksheet

The results of one's learning, according to Edgar Dale's experience cone theory, are received from direct experience (concrete), the reality that exists in one's life environment, then through artificial objects, to verbal symbols (abstract) (Davis & Summers, 2014; Marpanaji et al., 2018). Direct learning, such as role-playing, simulations, and doing real things, will help students learn and retain up to 90% more. As a result, EGEBLM learning can provide students with a direct learning experience that helps them understand and recall physics concepts.

The following are the benefits of EGEBLM: (1) based on local wisdom, the *Engklek* game may conserve culture and make learning activities more pleasurable because the implementation is outdoor-based; and (2) it aims to boost students' conceptual understanding and learning motivation; (3) it contains four physics materials at once, namely work and energy, rigid body equilibrium, momentum and impulse, and parabolic motion, teachers only need to adjust the requirements of the material taught with those concepts; (4) it can be adapted to a student-centered and scientific learning approach because it directs students to find their knowledge through investigation or experimentation activities. Thus, EGEBLM is one of the physics learning innovations that teachers use.

Validation targets the content and construct of each component. Three experts carry out this validation process. The implementation of online validation was due to the Covid-19 pandemic. Table 3 presents the results of the validity assessment.

Table 3. Result of EGEBLM Learning Materials Validity Testing

Validation Components	Validation Score	Validity Criteria	α	Reliability
Syllabus	3,41	Very Valid	0,78	Reliable
Lesson Plan	3,36	Very Valid	0,82	Reliable
Student Worksheet	3,44	Very Valid	0,70	Reliable
Teaching Source Material	3,48	Very Valid	0,82	Reliable
Assessment Instrument	3,44	Very Valid	0,70	Reliable
Response Questionnaire	3,57	Very Valid	0,66	Reliable

The results of the validity assessment for all learning materials are declared very valid and reliable. According to validators, learning materials, and applications are suitable for use after minor revisions. Then, learning materials can be tested for practicality and effectiveness in improving students' conceptual understanding and learning motivation. The results of EGEBLM development are proven valid based on expert validation to improve students' conseptual understanding and learning motivation. Several studies reinforce that learning materials with an edutainment approach (Rafiqah et al., 2020) and traditional games (Furió et al., 2013) can effectively improve student learning outcomes and motivation in physics learning.

The practicality test involves two observers: an in-service teacher and a pre-service one. The results of the practicality assessment can be seen in Table 4. It can be seen that the implementation of EGEBLM learning with the discovery learning model has an average score of 3.29. This includes practical and reliable criteria so that it can be carried out immaculately, fulfilling practical criteria.

Table 4. Implementation of EGEBLM Learning

Syntax	Score	Criteria	α	
Opening	3,00	Practical	1,00	R
Stimulation	3,00	Practical	1,00	R
Problem Statement	3,00	Practical	1,00	R
Data Collection	3,33	Very Practical	0,90	R
Data Processing	3,50	Very Practical	1,00	R
Verification	3,50	Very Practical	1,00	R
Generalization	3,33	Practical	0,75	R
Closing	3,50	Very Practical	1,00	R

Thus, physics teachers can use EGEBLM learning to improve their students' conceptual understanding and learning motivation. This is corroborated by Hartini et al. (2018) and Suprapto et al. (2021), who argue that learning based on local wisdom can be employed in physics learning because it begins with the most familiar world to students. These local wisdom values will assist students in understanding every concept in the material so that students' knowledge is not limited to information but can also be utilized in the form of practice outside of school. Furthermore, learning processes based on local wisdom can help to preserve local culture, especially in cultures that have been extinguished by the community. The practical findings of EGEBLM learning align with Vygotsky's social constructivist theory with three main implications: scaffolding, Zone of Proximal Development, and social learning (Slavin, 2011).

This test focuses on the effectiveness of EGEBLM learning to increase students' conceptual understanding and learning motivation. Figure 4 shows that the student's understanding of physics concepts in the experimental class has an average value of 3.24 in the medium criterion, while the control class has 2.97 in the medium criterion. Meanwhile, learning motivation has a higher score after learning in the experimental class, while in the control class, it tends to decrease. Thus, learning outcomes in experimental classes are more significant because of the EGEBLM learning treatment.

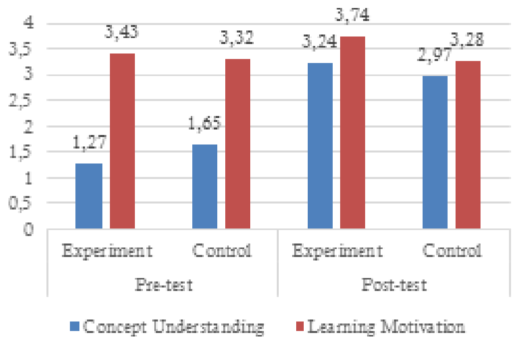

Figure 4. Average Pre-Test and Post-Test Scores of Conceptual Understanding and Motivation in Both Classes

Data analysis is continued by conducting normality and homogeneity tests for all data. The test results show that not all groups of conceptual understanding data have a normal and homogeneous distribution because several students cheat each other, so most students have the same score on the post-test. Therefore, the type of statistical test used is non-parametric, namely the Wilcoxon test, to determine the significance between pre-test and post-test results in both classes. Wilcoxon's test results for the concept understanding category can be seen in Table 5.

Table 5. Results of Wilcoxon Test on Concept Understanding

Group	Z	Sig.
Experiment	-3.062	0.002
Control	-3.433	0.001

The significance value < 0.05, so there is a significant difference between the results of the pre-test and post-test understanding of concepts in both groups. Regarding learning motivation, the normality and homogeneity test results show that all data are normally distributed and homogeneous. Hence, the type of analysis used is parametric, namely paired T-tests. The results for the learning motivation category can be seen in Table 6.

Table 6. Results of Paired T-Test on Learning Motivation

Group	t	df	Sig.
Experiment	-2.37	12	0.03
Control	0.42	14	0.68

The significance value for the experimental class is 0.03 < 0.05, indicating a significant difference between student learning motivation before and after learning. Meanwhile, in the control class, the significance value is 0.68 > 0.05, so there is no significant difference. EGEBLM learning treatment significantly influences student learning motivation in physics learning activities. The following analysis is to calculate the N-gain value in both groups, determining the increased conceptual understanding after treatment, as seen in Table 7.

Table 7. Calculation of N-gain on Conceptual Understanding

Group	Average N-Gain	Criteria
Experiment	0.517	Middle
Control	0.378	Middle

The criteria for N-gain values in both classes being middle, the experimental class turns out to have a greater N-gain value than the control class. This shows that EGEBLM learning treatment has a higher influence on increasing students' conceptual understanding. Regarding the improvement of each indicator, it can be seen in Table 8, showing the N-gain on each indicator. The increase that is classified as high in the experimental class is found in the summarize, conclude, and exemplify indicators. In contrast, the increase is low in the compare dimension. In the control class, the increase in the highest is in the infer and interpret indicators. At the same time, the low-classified increase lies in summarizing, exemplifying, comparing, and explaining indicators.

Table 8. Increase of Concept Understanding in Each Indicator

Group		Indicator													
		S		C1		I1		E1		C2		E2		I2	
Experiment	O1	0.42	L	0.67	L	2.25	M	2.50	M	0.83	L	0.75	M	1.50	L
	O2	3.67	H	4.58	H	3.08	M	4.58	H	2.00	M	2.58	M	3.08	M
	<g>	0.71	H	0.90	H	0.30	M	0.83	H	0.28	L	0.43	M	0.45	M
Control	O1	2.44	M	1.08	L	3.14	M	3.28	M	0.50	L	0.44	L	0.72	L
	O2	2.47	M	2.53	M	4.65	H	3.71	H	1.41	L	1.65	L	4.41	H
	<g>	0.01	L	0.37	M	0.81	H	0.25	L	0.20	L	0.26	L	0.86	H

Note: S: Summarize; C1: Conclude; I: Interpret; E1: Exemplify; C2: Compare; E2: Explain; I2: Infer; O1: Pre-test; O2: Post-test; <g>: N-gain; L: Low; M: Medium; H: High

Table 9 presents the results of the calculation of the effect size value, increased conceptual understanding, and learning motivation in the experimental class. In conceptual understanding, the value of effect size is on a very large criterion, while learning motivation has a large criterion. This means that EGEBLM learning treatment has a large field operational impact on the sample.

Table 9. Calculation of Effect Size

Conceptual Understanding		Learning Motivation	
5.20	Very Large	0.70	Large

The Mann-Whitney test is performed on the N-gain values of the two classes to determine the significance of the difference between the experimental and control classes. The MANOVA test results are shown in Table 10. The significance level is 0.003 < 0.05, indicating that there is a significant difference in conceptual understanding and learning motivation between both classes at the same time. As a result, EGEBLM learning appears to be successful in enhancing students' conceptual understanding and learning motivation in physics classes.

Table 10. Results of MANOVA Multivariate Tests

Effect	Value	Sig.
Pillai's Trace	0.392	0.003
Wilks' Lambda	0.608	0.003
Hotelling's Trace	0.645	0.003
Roy's Largest Root	0.645	0.003

EGEBLM learning utilizes a discovery learning model that requires students to discover physics concepts through Engklek games. By its design, students must find concepts in groups to form discussions between them. Discussion is an excellent technique to learn and build conceptual understanding because it involves an exchange of viewpoints that students can consider and reject or embrace (Zarifsanaiey et al., 2016; Bean & Melzer, 2021; Shuhong, 2023). In addition, through discussion, students can reduce disagreements between themselves and other students (Kager et al., 2022; Yang et al., 2022). Due to the integration between these learning models by considering the cultural and ecological environment along with the community values contained in the Engklek game to produce a science-literate generation with innovative skills and scientific attitudes (Sudarmin, 2014). In this situation, education must bridge the gap between mainstream knowledge and local wisdom by using aspects of ethnoscience in learning (Sotero et al., 2020).

EGEBLM learning can increase students' conceptual understanding and motivation in the exaperimental class more than in the control class. This is due to the fact that the experimental class requires students to discover and implement concepts in the Engklek game. This application was carried out in the form of real practice and demonstration by students so that their mastery of concepts becomes better than the control class, which only conducts direct learning in class. These findings are consistent with Ardianti and Raida (2022), Dewi et al. (2021b), and Sudarmin et al. (2019) research, which proves that the application of ethnoscience-based learning can successfully strengthen students' conceptual understanding.

Based on learning motivation, there is a significant difference in the experimental class with higher learning motivation because they are more actively involved in learning through traditional Engklek games than in the conventional class, where the learning process only focuses on teacher explanations. The findings align with Nurmaliati et al. (2023) and Sulistyaningtyas & Fauziah (2019) research that learning involving traditional games or ethnoscience can be considered to increase student learning motivation, especially in physics learning, which has a more difficult perception compared to other subjects.

Each indicator, especially in the summary and exemplify indicators in the experimental class, gets higher scores. This is because, in the experimental class, students can understand and practice directly how the initial speed affects the motion of the parabola to the farthest distance by throwing Gaco in the Engklek game. While in the control class, students do not receive these facilities directly. Students can only imagine and analyze the data provided. Based on the results obtained, students still need to be presented with quantitative data provided to analyze well. As a result, this affects the value of the summary indicator increase. Likewise, the exemplify indicator with specifications provides examples of applying rigid body equilibrium in everyday life. This will be easier to capture for students in the experimental class because students practice directly on the balance of their bodies through EGEBLM learning. This finding supports Gunawan et al.'s (2020) claim that learning through direct practice with a mutant model can improve students' conceptual understanding. Hence, it can stimulate students directly by applying the equilibrium in the surrounding environment.

The use of ethnoscience-based learning is linked to knowledge obtained from the culture surrounding students, which can serve as a foundation for creating a reality that prioritizes cultural interactions above cutting-edge scientific knowledge (Okechukwu et al., 2014). EGEBLM links learning with Engklek culture by extracting students' original views on the culture and then translating them into physical knowledge and concepts. This can improve students' conceptual understanding by increasing their appreciation of culture and creating a contextual and meaningful learning atmosphere (Ardianti et al., 2019; Dewi et al., 2021). Students can discover indigenous science principles that will help them understand the learning material. Students' assumptions about the complexity of science content can be reduced or eliminated (Parmin et al., 2016). Through these exercises, conceptual comprehension skills start to develop, which is crucial for learning physics. In addition, natural science is better taught using cultural approaches, customs, and traditional techniques (Gasat et al., 2017; Yoon & Martin, 2019).

The integration of cognitive processes in EGEBLM learning also contributes to the effectiveness of this teaching material because it utilizes Engklek games to seamlessly integrate various cognitive processes (Rizki et al., 2022). Students, while immersed in the game, naturally engage in summarizing complex patterns, drawing conclusions from observed moves, interpreting sequences, exemplifying strategies, comparing outcomes, explaining their decisions, and inferring future moves (Anderson & Krathwohl, 2001). This holistic approach ensures a comprehensive development of cognitive skills. Engklek games also provide a contextual framework for learning. As students play, they summarize game patterns, draw conclusions about effective strategies, interpret the evolving dynamics, exemplify their understanding through gameplay, compare different moves, explain their decisions to peers, and infer future moves. This contextualized learning environment facilitates a deeper and more nuanced understanding of abstract physics concepts (Banda & Nzabahimana, 2021).

Regarding motivation, EGEBLM learning can make learning activities engaging because it contains games that motivate students. Game intervention in the learning process can make the atmosphere more comfortable and enjoyable (Koster, 2013). Such learning does not cause boredom in students so they can focus their full attention on the subject matter (Kao et al., 2017). Hence, to decrease students' learning saturation, it is necessary to incorporate games into the classroom. Gamification of learning integrates cognitive, emotional, social, and learning environment aspects in a way that is highly adaptable to the learning process (Greipl et al., 2020). This is congruent with the findings of Toharudin et al. (2021) study, which demonstrates that learning approaches based on local wisdom combined with educational games significantly enhance learning motivation and student engagement in the learning process at all levels of education.

The constructivism learning theory, which emphasizes the active role of learners in developing their own understanding of knowledge, supports the effective implementation of EGEBLM (Mann & MacLeod, 2015; Krahenbuhl, 2016). In this context, using Engklek games as a learning material aligns with the principles of constructivism. The hands-on, experiential nature of the game allows students to actively engage with the physics concepts, leading to a deeper understanding. Additionally, cultural-historical activity theory supports the development of EGEBLM learning since it emphasizes the role of cultural and social contexts in learning (Postholm, 2015; Grimalt-Álvaro & Ametller, 2021). Engklek, a traditional Indonesian game, is embedded in the cultural context. Using culturally relevant activities can enhance students' engagement and understanding by connecting the learning material to their own experiences (Dewi et al., 2019).

Student responses after implementing EGEBLM learning can be seen in Table 11. Students respond positively that they tend to believe that EGEBLM learning can improve their conceptual understanding and learning motivation. They also feel that this learning is relevant to apply to physics lessons and is a new experience for them.

Table 11. Students' Responses

Average Responses		
Disagree	**Neutral**	**Agree**
1.0%	28.5%	70.5%

The execution of EGEBLM learning creates meaningful, fun, and exciting learning, creating new learning experiences for them. According to Risdianto et al. (2021), most of them respond positively to ethnoscience-based physics learning since it is related to everyday life, which can help them understand physics material more simply. EGEBLM learning materials can be an innovation in physics learning that involves edutainment and local wisdom while preserving the Engklek game that is starting to be abandoned due primarily to the massive development of digital games.

CONCLUSION

To boost students' conceptual understanding and learning motivation, a valid, practical, and effective EGEBLM learning has been designed. EGEBLM is a learning tool that incorporates a discovery learning approach with the *Engklek* game as one of the local wisdom. Based on the validity assessment results, EGEBLM is declared valid and reliable for use in physics learning. Furthermore, EGEBLM has met practical criteria because it has a high level of implementation when used during the learning process. Additionally, the designed learning tools significantly boost students' understanding of physics concepts as well as their learning motivation. Students positively respond to these learning activities, resulting in a novel learning experience. However, this study has drawbacks, including a small sample size, thus future research must raise the sample size or perform research on a wider scale. Furthermore, the use of ethnoscience in education is influenced by the environment in which students live. As a result, while using ethnoscience in the classroom, teachers must comprehend their local knowledge.

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