ENHANCING STUDENTS' VERBAL REPRESENTATION SKILLS THROUGH *BENTHIK* TRADITIONAL GAME-INTEGRATED E-BOOK

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ABSTRACT

Verbal representation is an important component in physics learning that plays a role in concept understanding and problem solving. This study investigates the effectiveness of a *Benthik* traditional game-integrated e-book in enhancing students' verbal representation skills. The research employed a quasi-experimental design with a non-equivalent control group. The participants were selected using cluster sampling, involving Grade XI MIPA students at SMA Negeri 1 Piyungan. Data were collected using essay tests and subsequently analyzed using both descriptive and inferential statistics. Based on the Independent t-test, the results showed an Sig. 0.000, confirming a significant difference in verbal representation skills between the experimental and control groups. Furthermore, the experimental group achieved an average N-gain of 0.49 (moderate category), significantly higher than the control group's average N-gain of 0.21 (low category). By utilizing the familiar context of the Benthik traditional game, the e-book successfully enabled students to contextualize abstract physics concepts, whereby their ability to interpret and verbally communicate scientific ideas was strengthened. This approach additionally functions to both foster cognitive skills and support local cultural heritage preservation. Despite these benefits, the current level of improvement highlights the necessity for continuous innovation in instructional media and the adoption of varied teaching strategies to achieve optimal results.

Keywords : *Discovery Learning, E-Book, Verbal Representation*

INTRODUCTION

Problem solving is a major component in learning physics that involves various abilities in it such as representation skills. Learners' representation display their ability to analyze physics phenomena (Bego et al., 2019). Representation is a configuration that represents something in several ways, for example expressed in verbal, diagram, mathematical, and graphic forms (Kind et al., 2017; McPadden & Brewe, 2017). One form of representation is verbal representation which is always needed to accompany other representations so that the objectives can be conveyed properly. Verbal representation is needed when learners make interpretations.

Verbal representation ability is the ability to translate problems into spoken or written language that plays a role in the transfer of knowledge (Septiani et al., 2020). In learning physics, verbal representation is useful to improve students' understanding of physics concepts through understanding definitions, reasoning, interpreting, and communicating (Oktavia et al., 2019; Septiani et al., 2020). Verbal representation format is one way to explain a concept in physics learning and help students draw conclusions and explain an abstract concept using simple sentences so that it is easier to understand (Kurniasari & Wasis, 2021). Excellent verbal representation skills will make it easier for students to understand physics concepts (Murtianto et al., 2019). Physics learning must be done by emphasizing and developing concepts (Kurniasari & Wasis, 2021).. Therefore, students need to be trained to develop their verbal representation skills which will make them easier to learn physics.

Based on the observation of the learning process at SMA Negeri 1 Piyungan, it is known that there is a tendency to use only mathematical representations in physics learning. Students only focus on mathematical solutions without verbally defining the question based on physics concepts, so that students often experience difficulties in selecting the steps of completion and errors in distinguishing concepts due to lack of understanding of the problem. This is because during the physics learning process, teachers delivering material tend to focus on mathematical formulas or equations. This makes students tend to fixate on mathematical solutions only. From the observation, it was found that there were several reasons why efforts to train verbal representation skills in physics learning had not been maximally implemented which are because of the limited time for physics teacher to provide variety learning tools in training students' verbal representation ability. The lack of students' representation skills also caused by the students' habbit using only one representation in solving physics problem. Students have difficulty using other representation abilities because they only focus on mathematical representations.

Students' lack of representation ability in solving physics problems can be overcome by providing students with new and challenging experiences(Garzón & Acevedo, 2019; Nuha et al., 2021). Providing new and challenging experiences requires innovative learning models and resources that can actively engage students while grounding the abstract concepts of physics in concrete, real-world contexts (Lampropoulos et al., 2022). One powerful approach to achieve this is by integrating local culture and traditional elements into the learning process. Traditional games, which are inherently engaging and rich in tacit knowledge, offer a unique pedagogical bridge between cultural context and scientific principles (Sukma et al., 2019; Yelensi et al., 2020). When appropriately integrated, these games can serve as excellent tools for developing conceptual understanding and, consequently, improving students' verbal representation skills by providing a tangible phenomenon they must describe, interpret, and explain

Bethink is a traditional game from the areas around Yogyakarta. *Benthik* is form of local wisdom highly relevant to physics learning. This game, which utilizes two wooden sticks, clearly demonstrates various physics concepts, including parabolic motion, Newton's laws, and momentum, as it involves the interaction of force, acceleration, and changes in momentum (Maghfiroh & Kuswanto, 2022; Rohmah et al., 2024). By dissecting the actions within the *Benthik* game, students are compelled to move beyond simply applying mathematical formulas and instead verbally interpret the underlying physical principles governing the game's outcome. The dynamic and repetitive nature of the game offers concrete examples that students can use as a foundation to practice verbalizing their understanding of the physics concepts involved.

Learning process can be carried out optimally if facilities and infrastructure can be fulfilled adequately in assisting students' learning activities. Interactive e-books contain digital information in the form of text and even multimedia that can provide interactive experiences to users. E-books have the advantage of being easy to access and carry, and can contain a lot of information, both text and multimedia (Azmanita & Festiyed, 2019; Rosida et al., 2017). Interactive e-books actively engage readers and have the potential to enhance learning (Prameswari et al., 2022). E-books equipped with multimedia can foster students' thinking skills through interactions obtained from using e-books, especially in physics material that requires a lot of representation in learning (Hasan et al., 2018; Schnotz & Wagner, 2018). By embedding Benthik's concepts in e-book, students are systematically guided to connect the practical phenomena of the game with the formal physics concepts, thereby training and developing their verbal representation skills in a sustained and engaging manner. Therefore, this research aims to investigate the effectiveness of the Benthik traditional game-integrated e-book in enhancing students' verbal representation skills in physics. The findings of this study are expected to provide empirical evidence for the potential of local wisdom integration in developing high-level cognitive skills essential for physics problem-solving.

METHOD

Research Design

A quasi-experimental pretest–posttest design with non-equivalent control groups was adopted for this study. In this design, a single group of subjects was observed before and after the intervention to measure the effect of the treatment (Cohen et al., 2007). The experimental class implemented an e-book integrating the traditional game *Benthik* as a contextual learning medium for teaching the concept of momentum and impulse. A pretest was conducted for both classes to measure initial student knowledge, while a posttest was conducted after the learning process.

Participants and Sampling Procedures

The subjects of this research consisted of students from Grade XI MIPA at SMA Negeri 1 Piyungan. The experimental and control classes were selected using a cluster sampling technique. As a result, Class XI MIPA 1 was designated as the experimental class with 30 students, while Class XI MIPA 3 served as the control class with 30 students.

Instrument and Data Analysis Technique

Data were collected using a test technique. The instrument utilized was an essay test designed to measure verbal representation indicators that used to collect pretest and posttest data. Pretest and posttest data from both the experimental and control groups were analyzed using descriptive and inferential statistics via SPSS software. Descriptive statistics were utilized to

outline the data distribution, calculating the mean, standard deviation, and minimum/maximum scores to classify the levels of students' conceptual understanding.

To determine the appropriate hypothesis testing method, assumption checks were conducted using the Shapiro-Wilk test for normality and a homogeneity test for variance. Parametric tests were selected when these assumptions were met, while non-parametric tests were employed if the data violated normality or homogeneity. Specifically, the Independent Samples t-test and Paired Samples t-test were used for parametric comparisons. Finally, the improvement in students' conceptual understanding was measured using N-Gain analysis, with categories adopted from Hake (1998). The N-gain score that has been obtained is then interpreted based on Table 1 below.

Table 1. Interpretation of N-gain

N-gain score	Category
$g \leq 0{,}30$	Low
$0{,}30 \leq g \leq 0{,}70$	Moderate
$g \geq 0{,}70$	High

RESULTS AND DISCUSSIONS

The learning outcomes of the XI MIPA students at SMA Negeri 1 Piyungan are presented using descriptive statistics based on the pretest results, which include the mean score, the highest score, and the lowest score. The descriptive statistics for both the experimental and control classes are shown in the following table.

Table 2. Descriptive statistic results

Class		Minimum	Maximum	Mean	Std.Deviation
Experimental	Pretest	45.00	58.00	50.60	3.737
	Posttest	65.00	85.00	74.70	3.800
Control	Pretest	45.00	60.00	51.80	4.037
	Posttest	55.00	75.00	61.97	4.506

The analysis indicates that both the experimental and control classes showed improvement from pretest to posttest, but the magnitude of the increase differs substantially. The mean score of the experimental class rose from 50.60 to 74.70, while the control class increased from 51.80 to 61.97. The pretest mean scores of both classes were comparable, indicating a relatively equivalent baseline prior to the instructional intervention. The larger gain observed in the experimental class suggests that the instructional intervention may have contributed to this improvement.

In terms of score variability, the experimental class maintained a relatively stable standard deviation, indicating that learning gains were achieved fairly evenly across students with varying initial abilities. In contrast, the increased variability observed in the control class posttest scores may reflect differences in individual learning strategies and prior knowledge in the absence of structured instructional support provided through the e-book integrated with the traditional game *Benthik*.

Table 2. Normality test results

Class		Shapiro-Wilk			Category
		Statistic	df	Sig.	
Experimental	Pretest	.971	30	.560	normally distributed
	Posttest	.954	30	.215	normally distributed

Control	Pretest	.963	30	.364	normally distributed
	Posttest	.981	30	.860	normally distributed

Before conducting hypothesis testing, a normality test was performed using the Shapiro-Wilk method. As shown in Table 2, bothh the data for the experimental class and control class were normally distributed (Sig. > 0.05). It is continued with the Paired t-test to determine whether there is an effect of using an an e-book integrated with the traditional game Nglarak Blarak on students' learning outcomes. The results are presented in Table 3.

Table 3. Paired t-test results

	Paired Differences				**t**	**df**	**Sig. (2-tailed)**
	Mean	**Std. Error Mean**	**95% Confidence Interval of the Difference**				
			Lower	Upper			
Control Class	-10.17	.17343	-10.52136	-9.81197	-58.622	29	.000
Experimental Class	-24.10	.63127	-25.39110	-22.8089	-38.177	29	.000

Analysis of pretest and posttest differences (within-group) aimed to determining the significance of the improvement in verbal representation skills within each group. The paired samples t-test results indicate a statistically significant difference between pretest and posttest scores in both the experimental and control classes (Sig. 2-tailed > 0.05). It can be concluded that there is a significant difference between the pretest and posttest scores and significantly improved in students' verbal representation skills. For the experimental class, the results show a mean difference of 24.10, while in control class the mean difference of 10.17.

In the experimental class, the significant improvement suggests that the instructional intervention contributed to enhanced learning outcomes. The narrow confidence interval indicates that the learning gains were relatively consistent across students. Similarly, the control class also showed a significant increase from pretest to posttest; however, the wider confidence interval suggests greater variability in students' learning gains. It should be noted that the paired samples t-test examines within-group differences and does not provide a direct comparison of effectiveness between the experimental and control classes. After establishing that both groups experienced significant improvement internally as shown in Table 3, a further analysis was conducted to compare the posttest scores between the two groups to determine the effectiveness of the intervention.

Table 4. Independent sample t-test

	Mean rank	**t(df)**	**Mean difference**	**95% Confidence Interval of the Difference**		**Sig.**
				Lower	**Upper**	
Experimental Control	74.70 61.96	10.135 (58)	12.73	10.21843	15.24823	.000

The comparison of posttest scores between the experimental and control classes was performed using the Indipendent sample t-test. The analysis yielded an Sig value of 0.000, which is significantly lower than the alpha level of 0.05. This confirming a significant difference in verbal

representation skills between the two groups. The effectiveness of learning improvement in each class is further supported by the normalized gain (N-gain) analysis, as presented in table below.

Table 5. Normalized gain score

Class	Minimum	Maximum	Mean N-gain	Category
Experimental	0.36	0.64	0.49	Moderate
Control	0.18	0.38	0.21	Low

The results of the N-gain analysis for each class. The experimental class had a minimum N-gain of 0.36, a maximum of 0.64, and an average of 0.49, which falls into the moderate category. The control class, on the other hand, had a minimum of 0.18, a maximum of 0.38, and an average of 0.21, categorized as low. These results indicate that both classes experienced improvements in learning outcomes after the treatment. However, the experimental class showed a higher level of improvement compared to the control class. This suggests that the instructional approach applied in the experimental class was more effective in enhancing students' verbal representation skill, even though fall within the moderate gain category.

The superior improvement observed in the experimental class (N-gain 0.49) compared to the control class (N-gain 0.21) aligns strongly with the existing body of literature, confirming the effectiveness of implementing local wisdom-based learning in significantly enhancing students' verbal representation skills. The use of the *Benthik* traditional game-integrated e-book provided a crucial, relevant, and familiar context that successfully helped students translate abstract physics concepts into understandable verbal interpretations. This integration is vital for strengthening verbal representation abilities, as studies show that local wisdom contexts allow students to more effectively articulate and reinforce their conceptual understanding (Damayanti & Kuswanto, 2021; Sumarni & Kadarwati, 2020). Furthermore, utilizing the e-book format allowed for systematic guidance and interactive content, optimizing the benefits of the traditional *Benthik* game in training analytical thought, problem-solving skills, and the subsequent improvement of verbal representation (Maghfiroh & Kuswanto, 2022; Ridho et al., 2021)

Beyond the core cognitive improvements, the integration of *Benthik* into a structured e-book offers several vital pedagogical and cultural benefits. By linking physics directly to the Benthik game, the learning process becomes highly relevant and inherently more motivating for students, increasing their engagement with the subject matter (Liliarti & Kuswanto, 2018). As an accessible resource, the e-book achieves two major outcomes. It enhances conceptual understanding while simultaneously contributing to the preservation and appreciation of cultural heritage (Astuti et al., 2021). By experiencing physics through the concrete, familiar example of the *Benthik* game, students gain confidence and develop a stronger, more articulated connection between abstract physical theory and real-world application, directly impacting their verbal communication of scientific ideas.

CONCLUSIONS

The findings of this study indicate that implementation of an e-book integrating the traditional game *Benthik* as a contextual learning medium for teaching the concept of momentum and impulse is effectively enhances students' verbal representation skills. Both the experimental and control groups showed significant improvement from pretest to posttest, yet the experimental

group consistently achieved higher results across statistical analyses and N-gain scores. With a moderate level of improvement, the study highlights that integrating the traditional Benthik game's context into digital learning materials can effectively support students in understanding physics concepts, interpreting information, and communicating these scientific ideas more clearly.

Several limitations should be acknowledged, such as the small sample drawn from a single school and the absence of qualitative data, which limit the generalizability of the findings and constrain interpretations of the learning processes involved. Therefore, future research should employ designs that ensure baseline equivalence, include larger and more diverse samples, and incorporate mixed-method approaches to better capture students' representational processes. Additionally, continued pedagogical innovation, both in terms of varied learning media and instructional methods used by teachers, is essential to maximize the sustained improvement of students' verbal representation skills. The integration of local wisdom, such as the Benthik traditional game, is strongly recommended as a valuable instructional approach in physics, given its proven effectiveness in contextualizing abstract concepts, enhancing verbal representation skills, and serving the important purpose of cultural heritage preservation.

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