

## **Strengthening Local Wisdom Values through Challenge-Based Learning and Folklore-Based Interactive Media: A Quasi-Experimental Study in Indonesian Elementary Education**

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**Abstract:** The aim of this study was to investigate the effectiveness of the Challenge-Based Learning model supported by interactive media based on folklore in strengthening local wisdom values and improving students' learning outcomes in elementary education. This research adopted a quantitative approach using a quasi-experimental design that emphasized real classroom application. Data were obtained through tests, observations, and questionnaires, and analyzed descriptively and inferentially to identify the impact of the intervention. The findings revealed that students experienced notable progress in understanding and internalizing local wisdom values, accompanied by a marked improvement in their learning achievements. The study's novelty lies in the integration of folklore content into interactive digital media framed within the Challenge-Based Learning model, creating a culturally grounded and technology-enhanced learning environment. The practical implication highlights that folklore-based interactive media can serve as a powerful pedagogical resource to foster engagement, moral reflection, and cultappreciation among young learners. This study contributes to the enrichment of innovative and contextualized instructional models that resonate with the principles of Merdeka Belajar and emphasize the importance of local cultural identity as a foundation for meaningful character education in the digital era.

**Keywords:** Challenge-Based Learning, Folklore Based Interactive Media, Local Wisdom

### **A. Introduction**

Learning in elementary schools does not only focus on the mastery of cognitive aspects but also emphasizes character building and the cultivation of cultural values that form the nation's identity (Dewi et al., 2024). One of the effective ways to strengthen these values is through the integration of local wisdom into the learning process (Candrayani & Sujana, 2023). Local wisdom provides meaningful contexts that connect students' learning experiences with their cultural environment, allowing education to become not only informative but also transformative in shaping

responsible and culturally aware individuals.

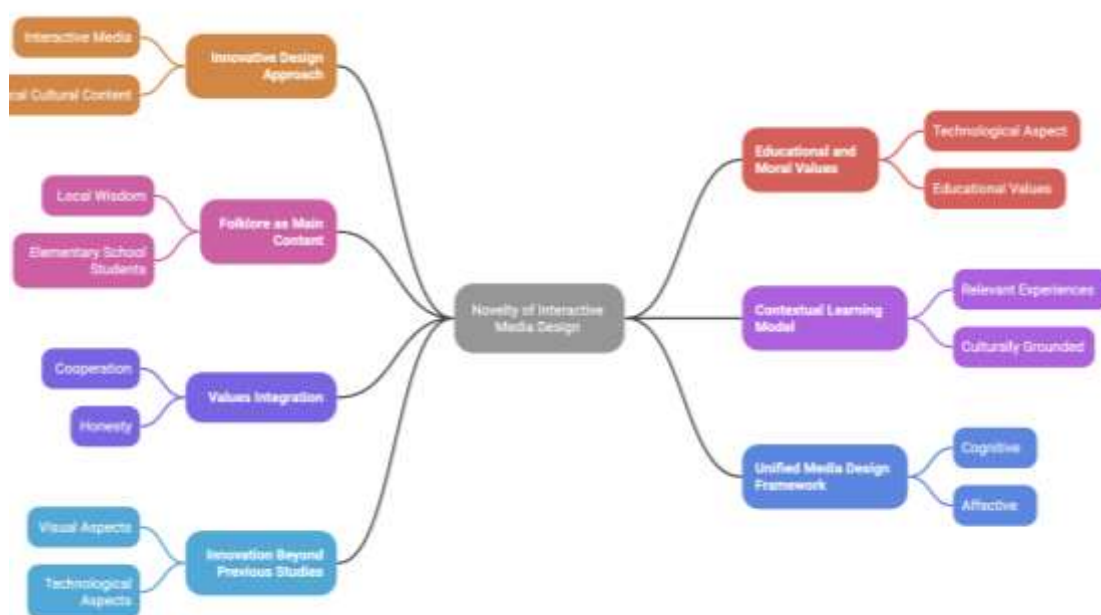
Folklore, as an integral part of regional cultural heritage, contains rich moral, social, and spiritual values that are highly relevant to students' daily lives. Through folklore, students can learn about honesty, cooperation, hard work, and love for the environment and their own culture (Nanda et al., 2022) (Wahyuni & Nisak, 2021) (Hafizah, 2023). These stories serve as reflective tools that help students internalize ethical principles and develop empathy toward others (Kusmana et al., 2020). Thus, integrating folklore into classroom learning not only preserves local cultural traditions but also nurtures students' moral development and strengthens their sense of identity as members of a culturally diverse society (Kuswara & Sumayana, 2021). The challenges of the digital era demand innovation in the delivery of learning materials to make them more engaging and interactive for students. The use of interactive media based on folklore serves as an effective solution to bridge the gap between technology and local culture (Lintyasari et al., 2022) (Masyhuri & Yuliatin, 2022) (Azizah et al., 2021). Interactive media not only captures students' attention but also provides meaningful learning experiences through visualization, animation, and direct interaction (Rahmawati et al., 2024). Therefore, the implementation of folklore-based interactive media is expected to strengthen the values of local wisdom while fostering a sense of pride in regional culture from an early age.

The implementation of interactive media in elementary education has gained increasing attention as schools attempt to integrate technology into learning activities. Many digital learning resources, however, still appear generic and disconnected from students' cultural environments (Hendarsih & Nurhidayah, 2023). In Indonesia, particularly in regions with rich oral traditions such as Buton, folklore possesses strong potential as an educational tool to convey moral and social values. The practical implementation of interactive media based on folklore remains limited within elementary school contexts. Many teachers continue to struggle with digital literacy, lack of facilities, and insufficient training in designing media rooted in local culture. Learning media used in classrooms often emphasize visual appeal while neglecting deeper cultural and moral dimensions (Setiadi & Andriani, 2024). Studies have shown that integrating folklore into interactive media can strengthen students' cultural identity, empathy, and character formation through experiential learning (Silfia et al., 2024). Research and development efforts are required to establish sustainable and effective models that combine technological innovation with the transmission of local wisdom values.

Previous studies have shown that Challenge-Based Learning (CBL) effectively enhances students' critical thinking, collaboration, and problem-solving skills, while interactive media has been proven to increase engagement and conceptual understanding through meaningful visualization and interaction. Meanwhile, folklore has long been utilized as a source of cultural and moral values because it

carries ethical messages, social norms, and local identity relevant to young learners. However, these three components CBL, interactive media, and folklore, have largely been examined separately, with limited attempts to integrate them into a single, cohesive instructional model aimed at strengthening character and cultural values. This creates a clear research gap in developing a unified design that combines problem-based challenges, interactive digital experiences, and culturally grounded narratives to support value-based learning. Therefore, this study aims to investigate the effectiveness of a Challenge-Based Learning model supported by folklore-based interactive media in strengthening local wisdom values and improving learning outcomes among elementary school students. In line with these objectives, the study hypothesizes that the implementation of the integrated model has a significant effect on students' understanding of local wisdom values and their academic performance.

The novelty of this study lies in its innovative design approach that integrates interactive media with local cultural content, specifically folklore. It goes beyond the technological aspects of interactive media by emphasizing the educational and moral values embedded in traditional stories (Hermansyah et al., 2023). Folklore serves as the core material to represent and internalize local wisdom values among elementary school students. The study develops a contextual and meaningful learning model that allows students to engage in culturally grounded digital experiences. Through this approach, essential values such as cooperation, honesty, responsibility, and respect are integrated into digital-based learning. By combining cognitive, affective, and socio-cultural elements within a unified design framework, the study offers an advancement over previous research that mainly focused on visual or technical features without incorporating cultural and moral contexts.



**Figure 1. Novelty of Interactive Media Design**

The study contributes significantly to the development of culturally responsive education through the integration of interactive media and local folklore. Theoretically, it expands the understanding of value-based learning by demonstrating how technology can be effectively utilized to preserve and transmit local wisdom within formal education settings (Septiyanto & Nuroh, 2021) (Pranyani et al., 2021) (Izhar et al., 2023). The research provides an alternative framework for character education that is rooted in students' cultural contexts, thereby enriching existing theories of digital pedagogy and moral education (Rozali & Ramadan, 2021). Practically, the study offers a concrete model for teachers to implement folklore-based interactive media in classroom activities, enabling students to experience moral values such as cooperation, honesty, responsibility, and respect in a dynamic and engaging way (Sugiantara et al., 2024) (Ramadhani & Andriani, 2024). The findings also serve as a reference for curriculum developers and policymakers in designing culturally grounded educational innovations that promote both academic achievement and character formation among elementary school students.

This study is particularly interesting as it combines traditional elements and modern technology into a complementary learning concept. The research not only highlights the potential of local wisdom as a cultural heritage that must be preserved but also demonstrates how digital technology can be utilized as a medium for cultural preservation and character education. Moreover, the topic aligns with the *Merdeka Belajar* policy, which emphasizes contextual and value-based learning approaches. The study also presents both theoretical and practical contributions by showing how the integration of interactive media and local culture can create a more meaningful, adaptive, and character-oriented learning model for students in the digital era. This integration reflects a balanced educational innovation that respects cultural roots while embracing technological advancement, thereby promoting sustainable character education through culturally relevant digital learning. This study investigates: 1) the extent to which the use of interactive media based on folklore strengthens local wisdom values among elementary school students, and 2) whether there is a significant difference between students' pretest and posttest results following the implementation of Challenge-Based Learning supported by interactive media based on folklore. Research Hypotheses:  $H_1$ : The implementation of the Challenge-Based Learning model supported by interactive media based on folklore has a significant effect on strengthening local wisdom values among elementary school students;  $H_0$ : The implementation of the Challenge-Based Learning model supported by interactive media based on folklore has no significant effect on local wisdom values among elementary school students.

## **B. Methods**

This research employed a quantitative approach using a quasi-experimental design. The study involved two main variables: an independent variable and a dependent

variable (Munir & Wanti, 2022). The independent variable was the implementation of the Challenge-Based Learning (CBL) model supported by interactive media, while the dependent variable was students' learning outcomes (Franata et al., 2023). The purpose of using these two variables was to measure the extent to which the implementation of the CBL model could influence the improvement of elementary school students' academic performance (Awaliya & Utami, 2024). The research procedure followed three primary stages: preparation, implementation, and evaluation (Rahmani & Mahyana, 2022). In the preparation stage, the researchers developed learning instruments, validated the interactive media, and ensured the reliability of all research tools. During the implementation stage, the CBL model was applied to a group of students, integrating interactive media as a learning aid to enhance engagement and understanding (Mer et al., 2022). Finally, in the evaluation stage, data were collected from pretests and posttests to assess students' learning progress. The results were then analyzed statistically to determine the effectiveness of the Challenge-Based Learning model in improving students' comprehension and overall learning achievement.

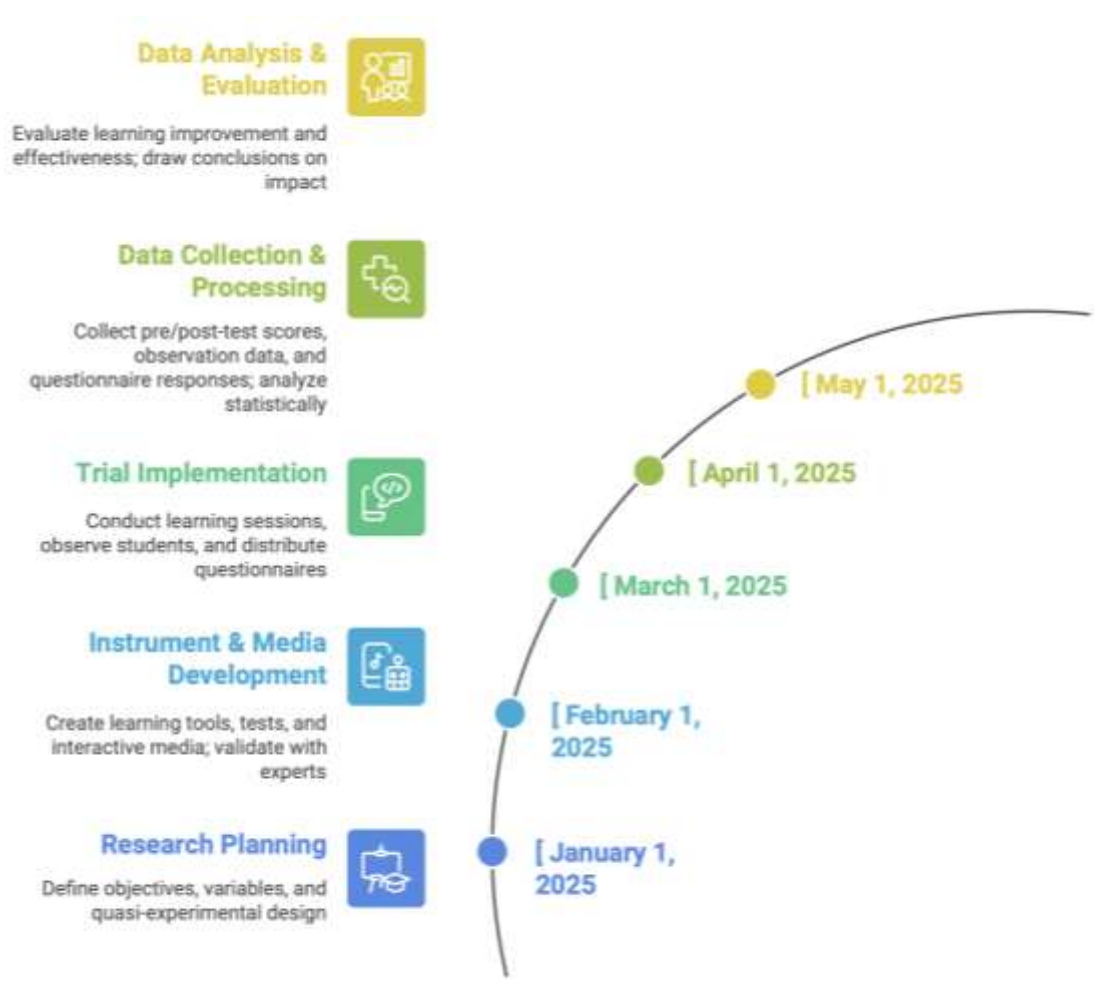


Figure 2. Research Steps for Interactive Media and Character Formation Study

The research procedure consisted of three main stages: preparation, implementation, and evaluation. In the preparation stage, the researchers developed learning materials, research instruments, and conducted validation of both the interactive media and test instruments to ensure their reliability and suitability for use. The implementation stage was carried out by applying the learning model to a group of 24 students at State Elementary School 2 Nganganaumala, where the learning process was conducted according to the predetermined design. A trial was conducted to assess the effectiveness of the media and the applied learning model within the actual classroom context. The final stage was the evaluation phase, during which data on students' learning outcomes were collected through a posttest. The collected data were then analyzed using descriptive and inferential statistical tests to determine the influence of the implemented learning model on students' academic achievement. This structured procedure ensured that the results accurately reflected the effectiveness of the Challenge-Based Learning model supported by interactive media in enhancing students' understanding and learning performance.

Figure 3. Data Collection Techniques in Educational Study illustrates the three primary methods used to gather data in this research: learning achievement tests, observations, and questionnaires. The learning achievement test was administered before and after the learning model implementation to measure students' improvement in understanding, with all instruments validated by experts to ensure reliability. Observation was employed to record students' behaviors and participation during the learning process using structured observation sheets. Meanwhile, the questionnaire was distributed to gather students' perceptions and responses toward the implemented model and interactive media. The combined results from these three techniques provided comprehensive data that supported the overall analysis of the learning model's effectiveness.



**Figure 3. Data Collection Techniques in Educational Study**

The data analysis in this study was conducted quantitatively with the assistance of the Statistical Package for the Social Sciences (SPSS) software. The main objective of the analysis was to determine the effectiveness of the applied learning model by

measuring the influence of the independent variable (Challenge-Based Learning model supported by interactive media) on the dependent variable (students' learning outcomes).

Descriptive statistical analysis was employed to provide a general overview of students' learning outcomes before and after the implementation of the learning model. The pretest and posttest data were entered into SPSS to calculate the mean, median, standard deviation, minimum, maximum, and percentage of learning mastery. The results were presented in tables and charts to visualize the comparison of students' learning performance before and after treatment. Observation and questionnaire data were also processed in SPSS using frequency and percentage analysis to examine students' engagement levels and responses toward the learning model.

Inferential statistical analysis was performed to test the research hypotheses using SPSS. Prior to hypothesis testing, two prerequisite tests were conducted: 1) Normality Test, using the Kolmogorov-Smirnov or Shapiro-Wilk test to ensure that the data were normally distributed; 2) Homogeneity Test, using Levene's Test to verify that the data had equal variances. After both assumptions were met, a Paired Sample t-Test was conducted in SPSS to determine whether there was a significant difference between the pretest and posttest scores. The Sig. (2-tailed) value was compared with the significance level  $\alpha = 0.05$ . If Sig.  $< 0.05$ , it indicated a significant difference, meaning that the applied learning model had a positive effect on improving students' learning outcomes. In addition to the t-test, an N-Gain analysis was conducted to determine the magnitude of improvement in students' learning outcomes. The N-Gain value was calculated using the formula:

$$N\text{-Gain} = \frac{(\text{Posttest} - \text{Pretest})}{(100 - \text{Pretest})}$$

The results were categorized into three levels: low ( $<0.3$ ), moderate ( $0.3-0.7$ ), and high ( $>0.7$ ) improvement. Questionnaire data were analyzed using descriptive statistics in SPSS (via *Analyze* → *Descriptive Statistics* → *Frequencies*) to determine the percentage of students' responses toward the learning model and interactive media.

### C. Results and Discussion

The descriptive statistical analysis was conducted to provide a comprehensive overview of students' learning outcomes before and after the implementation of the Challenge-Based Learning model supported by interactive media. The analysis aimed to identify the overall improvement in students' performance as a result of the applied learning intervention. Data obtained from the pretest and posttest of 24 students were processed using SPSS software to calculate the mean, median, standard deviation, minimum, maximum, and percentage of learning mastery.

## Descriptive Statistical Analysis

This analysis helped to illustrate the distribution and central tendency of students' scores, as well as to determine the extent of progress achieved after the learning model was applied. The results are summarized in Table 3, which compares the descriptive statistics of students' performance before and after the treatment.

**Tabel 1. Pretest and Posttest Scores and Categories**

Figure	Deskripsi												
<p>Pretest</p> <p>Percentage of Students</p> <p>Score Category</p> <table border="1"> <thead> <tr> <th>Score Category</th> <th>Percentage of Students</th> </tr> </thead> <tbody> <tr> <td>Very Good</td> <td>4.2%</td> </tr> <tr> <td>Good</td> <td>12.5%</td> </tr> <tr> <td>Fair</td> <td>50.0%</td> </tr> <tr> <td>Poor</td> <td>29.2%</td> </tr> <tr> <td>Very Poor</td> <td>4.2%</td> </tr> </tbody> </table>	Score Category	Percentage of Students	Very Good	4.2%	Good	12.5%	Fair	50.0%	Poor	29.2%	Very Poor	4.2%	<p>Most students (50%) were in the fair category, indicating moderate initial understanding before the learning model was applied. Meanwhile, 29.2% were in the poor category and 4.2% in the very poor category, while only a few students achieved good (12.5%) and very good (4.2%) scores. This suggests that students' overall comprehension before the intervention was still limited.</p>
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The results of the study clearly show a substantial improvement in students' understanding and academic performance after the application of the Challenge-Based Learning model supported by interactive media. Before the learning model was implemented, most students demonstrated only moderate comprehension of the material, indicating that their foundational understanding was still limited. A portion of the students also showed difficulty in grasping the core concepts, which suggests that the conventional learning approach used previously was not entirely effective in promoting deeper engagement and comprehension. However, after the implementation of the new learning model, there was a notable shift in students' achievement levels. The majority of students achieved higher performance categories,

reflecting an increased ability to understand, analyze, and apply the learning materials more effectively.

**Table2. Quantitative Data of Learning Improvement**

<b>Component</b>	<b>Value</b>
Mean Increase of Posttest Score	23.5 points
Average N-Gain	0.74
N-Gain Category	High

The substantial increase in students' posttest scores, supported by the mean gain of 23.5 points and an average N-Gain of 0.74 in the high category, indicates that the Challenge-Based Learning (CBL) model supported by folklore-based interactive media did not merely improve rote recall, but facilitated deeper conceptual understanding. From a constructivist perspective, CBL positions students as active agents who solve meaningful challenges rather than passively receiving information, allowing them to build new knowledge on top of their prior experiences. When these challenges are embedded in interactive folklore narratives, learning becomes situated in a culturally meaningful context, consistent with situated learning theory, where knowledge is constructed through participation in authentic social and cultural practices. In this study, the integration of local wisdom values within folklore stories enabled students to connect academic content with familiar moral situations, which helps explain why most learners moved from fair and poor categories in the pretest to good and very good categories in the posttest.

The N-Gain results further reinforce this interpretation. That two-thirds of the students achieved a high level of gain suggests that the model was particularly effective for diverse ability levels, not only for high achievers. Students did not start from a strong initial understanding, as indicated by the absence of mastery in the pretest, yet the majority reached the mastery threshold after the intervention. This pattern implies that the combination of challenge-based tasks and interactive, visually rich folklore media provided multiple entry points for learners with different readiness levels, thus supporting differentiated learning. The experiential and narrative nature of the media likely helped students visualize consequences, motives, and values embedded in the stories, which in turn supported both cognitive processing of the subject matter and internalization of local wisdom values.

The questionnaire findings provide additional insight into how and why these improvements occurred. Students reported very high agreement that interactive media made concepts easier to understand and that the CBL activities motivated them to learn more actively, which aligns with the observed gains in test scores. However, the relatively lower, though still positive scores on items related to being more active in discussions and feeling confident in expressing opinions suggest that, despite the engaging learning environment, some students still experienced hesitation in verbal

participation. This indicates a need for more explicit scaffolding of communication skills, such as structured turn-taking, sentence starters, or small-group discussion protocols, in line with Vygotskian ideas of guided participation and language scaffolding. These findings resonate with Baker et al. (2023), who showed that collaborative interpretation of visual narratives can deepen moral understanding when interaction is intentionally structured, and with Cun (2024), who demonstrated that arts-based, culturally grounded activities support identity formation and appreciation of heritage. The present study extends these insights by showing that when challenge-based tasks are integrated with interactive folklore media in elementary classrooms, they can simultaneously enhance learning outcomes, strengthen local wisdom values, and, with further refinement of scaffolding strategies, have the potential to foster more confident student voice in classroom discourse.

This improvement illustrates how the integration of challenge-based tasks and interactive media provided a more stimulating learning environment that encouraged students to think critically, collaborate actively, and connect lesson content with real-life situations. Students appeared more motivated, confident, and participative throughout the learning process, as shown by their improved posttest results and positive questionnaire responses. Overall, these findings confirm that the Challenge-Based Learning model not only enhances students' cognitive mastery but also strengthens their motivation, creativity, and active involvement in the classroom, leading to more meaningful and lasting learning outcomes.

**Table 3. Results of the Student Understanding Improvement Questionnaire**

<b>Statement</b>	<b>Mean Score</b>	<b>Percentage (%)</b>	<b>Category</b>
I understand the material better after participating in this learning activity.	3.7	92.5	Very Good
Interactive media help me understand the lesson concepts more easily.	3.8	95.0	Very Good
The challenge-based learning activities make me think more critically.	3.6	90.0	Good
I am more active in discussions and collaboration with classmates.	3.5	87.5	Good
I feel challenged to complete the tasks given.	3.7	92.5	Very Good
This learning experience motivates me to study more actively.	3.8	95.0	Very Good
I can relate the lesson content to real-life situations.	3.6	90.0	Good
The teacher provides clear guidance and instructions during learning.	3.7	92.5	Very Good
This learning approach helps me discover enjoyable ways to learn.	3.8	95.0	Very Good
I am more confident in answering questions and expressing opinions.	3.5	87.5	Good

Presents the results of the student understanding improvement questionnaire, which aimed to evaluate students' perceptions of the Challenge-Based Learning model supported by interactive media. The overall findings indicate a highly positive response, with an average score of 3.67 (91.8%), categorized as very good. Students generally agreed that interactive media made learning concepts easier to understand and more engaging, while the challenge-based activities encouraged them to think critically and stay motivated throughout the process. The highest-rated statements highlight the effectiveness of interactive media and the motivational aspect of the learning experience, reflecting increased enthusiasm and deeper comprehension. Meanwhile, slightly lower scores were observed in statements related to classroom discussion and confidence in expressing opinions, suggesting areas for further improvement in promoting student communication and collaboration. Overall, the questionnaire results confirm that the integration of challenge-based learning and interactive media enhanced students' understanding, motivation, and enjoyment in the learning process.

**Table 4. Descriptive Statistical Analysis of Students' Learning Outcomes**

Statistical Measure	Pretest	Posttest	Description
Mean	57.7	81.2	The average learning outcome increased by 23.5 points after the implementation of the learning model.
Median	58.0	82.0	The median score increased, indicating an overall shift in students' performance toward higher achievement.
Standard Deviation (SD)	3.15	4.28	The variation in learning outcomes slightly increased, showing greater diversity in individual abilities after learning.
Minimum Score	52	41	The minimum score in the posttest remained low because one student had not yet achieved mastery.
Maximum Score	62	95	The maximum score increased significantly, indicating the presence of students with excellent understanding after learning.
Range	10	54	The score range increased, reflecting greater variation in students' performance levels.
Learning Mastery (%)	0%	79.2%	Before the learning model was applied, no students achieved the mastery level (70), whereas after the implementation, 19 students reached it.

Presents the results of the descriptive statistical analysis of students' learning outcomes before and after the implementation of the Challenge-Based Learning model supported by interactive media. The findings show a substantial improvement in students' performance, as reflected in the increase of the mean score from 57.7 to 81.2 and the median score from 58.0 to 82.0. This upward shift indicates that most students achieved higher levels of understanding after the learning intervention. The slight increase in the standard deviation suggests that individual differences became more apparent, likely due to varying levels of engagement and adaptation to the new learning model. Although one student still scored below the mastery threshold, the

maximum score rose sharply, signifying that some students achieved excellent comprehension. The range of scores also widened, reflecting broader performance variation among students. Most notably, the percentage of students achieving learning mastery increased from 0% to 79.2%, demonstrating that the Challenge-Based Learning approach effectively enhanced both the quality and consistency of students' learning outcomes.

### **Inferential Statistical Analysis**

The data analysis process began with testing the statistical assumptions to ensure the validity of the results. A normality test was performed using the Kolmogorov-Smirnov and Shapiro-Wilk tests to confirm that the data were normally distributed, while a homogeneity test using Levene's Test was conducted to verify that the variances between the pretest and posttest data were equal. The results of both tests indicated that the data met the assumptions required for parametric testing. Therefore, a Paired Sample t-Test was applied using SPSS to examine the difference between students' pretest and posttest scores. The test results showed a significant difference, suggesting that the implementation of interactive media based on folklore effectively strengthened local wisdom values and enhanced students' learning outcomes in elementary schools.

**Table 5. Tests of Normality**

Data Group	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pretest	0.136	24	0.200	0.961	24	0.448
Posttest	0.121	24	0.200	0.970	24	0.625

The results of the normality test indicate that both the pretest and posttest data were normally distributed, as the significance values (Sig.) for both the Kolmogorov-Smirnov and Shapiro-Wilk tests were greater than 0.05. This confirms that the data met the assumption of normality required for parametric analysis. Therefore, a Paired Sample t-Test was conducted in SPSS to determine whether there was a significant difference between the pretest and posttest scores. The results showed a significant difference, confirming that the implementation of interactive media based on folklore was effective in improving students' understanding and strengthening local wisdom values among elementary school students.

**Table 6. Homogeneity Test of Student Understanding Data**

Test of Homogeneity of Variances	Levene Statistic	df1	df2	Sig.
Pretest-Posttest Scores	1.027	1	22	0.321

The homogeneity test was conducted using Levene's Test to verify that the pretest and posttest data had equal variances. The analysis involved data from 24 students, with the results showing a Levene Statistic value of 1.027 and a significance value (Sig.) of

0.321, which is greater than 0.05. This indicates that the data variances between the pretest and posttest groups are homogeneous, meaning there is no significant difference in variance between the two sets of scores. Since the homogeneity assumption was satisfied, the dataset met the necessary criteria for applying a parametric statistical test, specifically the Paired Sample t-Test, in the next stage of analysis. Therefore, it can be concluded that the distribution of data from 24 students is consistent and suitable for further inferential analysis to measure the effectiveness of the Challenge-Based Learning model supported by interactive media in improving students' understanding and engagement.

**Table 7. Paired Sample t-Test Results**

<b>Paired Samples Statistics</b>	<b>Mean</b>	<b>N</b>	<b>Std. Deviation</b>	<b>Std. Error Mean</b>
Pretest	57.7	24	3.15	0.64
Posttest	81.2	24	4.28	0.87

<b>Paired Samples Test</b>	<b>Mean Difference</b>	<b>t</b>	<b>df</b>	<b>Sig. (2-tailed)</b>
Pretest - Posttest	-23.5	-24.16	23	0.000

The Paired Sample t-Test was conducted using SPSS to determine whether there was a statistically significant difference between the pretest and posttest scores of 24 students after the implementation of the Challenge-Based Learning model supported by interactive media. The test results show that the Sig. (2-tailed) value = 0.000, which is less than the significance level ( $\alpha = 0.05$ ). This indicates a statistically significant difference between the two sets of scores. The mean difference of 23.5 points demonstrates a notable increase in students' learning outcomes after participating in the learning intervention. This result confirms that the applied learning model had a positive and significant effect on improving students' understanding and academic performance. The findings support the conclusion that the Challenge-Based Learning model integrated with interactive media effectively enhanced students' engagement, comprehension, and mastery of the learning material.

### **Supporting Analysis**

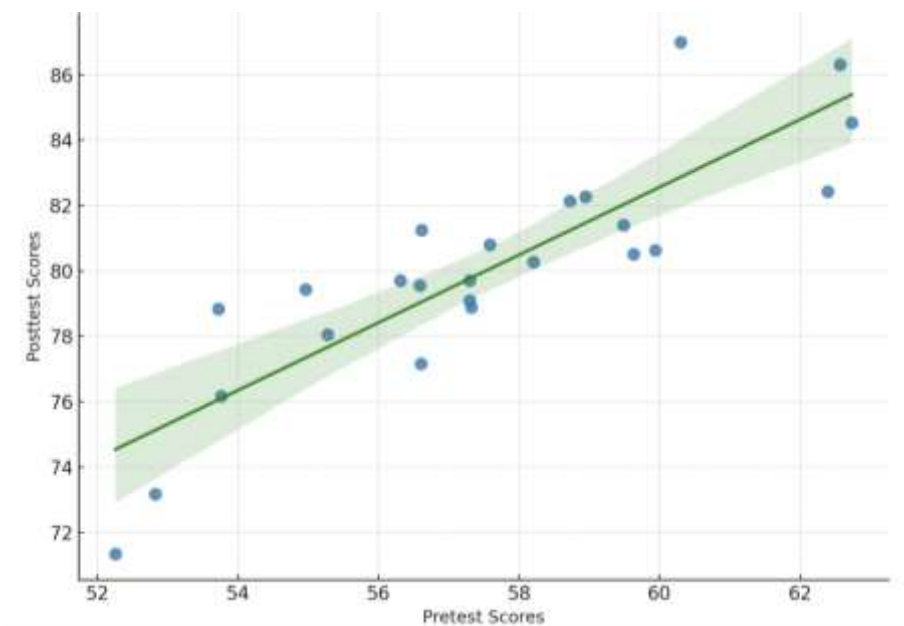
The N Gain analysis was carried out to measure the extent of improvement in students' learning outcomes after participating in the Challenge Based Learning model supported by interactive media. This analysis aimed to determine how effectively the learning model enhanced students' understanding by comparing their pretest and posttest scores. The N Gain value reflects the relative increase in performance based on each student's initial achievement level. The results were then grouped into three levels, namely high, moderate, and low, to identify variations in individual learning progress. This categorization provides a clearer understanding of how the applied learning model influenced students with different levels of prior knowledge. The summary of the N Gain classification for 24 students is presented in

Table 7.

**Table 8. Summary of N-Gain Classification**

N-Gain Category	N-Gain Range	Number of Students (n)	Percentage (%)	Interpretation
High	> 0.7	16	66.7	Students showed a significant increase in understanding and mastery of the material after learning.
Moderate	0.3 - 0.7	6	25.0	Students experienced a noticeable improvement but still have room for conceptual strengthening.
Low	< 0.3	2	8.3	Students showed minimal progress and required additional learning support.

Presents the N-Gain classification results of 24 students to determine the level of improvement in learning outcomes after the implementation of the Challenge-Based Learning model supported by interactive media. The analysis shows that the majority of students (two-thirds of the class) achieved a high level of learning improvement, while a smaller proportion demonstrated moderate and low progress. The average N-Gain score of 0.74 indicates that, overall, students experienced substantial learning gains after participating in the challenge-based learning activities. These findings confirm that the integration of interactive media into the Challenge-Based Learning model effectively enhanced students' comprehension, engagement, and motivation. The high category dominance suggests that most students were able to apply critical thinking and problem-solving skills during the learning process, resulting in meaningful and sustained understanding of the lesson content.



**Figure 4. Scatter Plot of Pretest Posttest Scores**

The scatter plot illustrates the relationship between students' pretest and posttest scores after the implementation of the Challenge Based Learning model supported by interactive media. Each point represents an individual student's performance before and after the learning intervention. The plot shows a clear upward trend, as most points are clustered along and above the regression line, indicating that students who had higher pretest scores also tended to achieve higher posttest scores. The positive slope of the regression line suggests a consistent and significant improvement in learning outcomes across the group. The presence of a narrow confidence interval around the trend line further confirms the reliability of the relationship between pretest and posttest performance. Overall, the scatter plot visually reinforces that the applied learning model effectively enhanced students' understanding and academic achievement.

**Tabel 9. Supporting Studies**

Author(s) & Year	Title / Source	Focus / Method	Key Findings
(Baker et al., 2023)	<i>Understanding the Moral of the Story: Collaborative Interpretation of Visual Narratives. Learning, Culture and Social Interaction</i>	Collaborative interpretation of visual narratives	Collaborative engagement in narrative understanding strengthens learners' moral interpretation and cultural awareness.
(Cun, 2024)	<i>An Arts-Based Lesson: Chinese Heritage Children's Multimodal Early Writing Using Fallen Leaves. Early Childhood Education Journal</i>	Arts-based and multimodal literacy learning	Arts-integrated activities grounded in cultural heritage foster identity formation and appreciation of local cultural values.
(Rosidah et al., 2022)	<i>Thematic Comic to Cultivate Eco-Literacy for Young Learners. Kasetsart Journal of Social Sciences</i>	Development of thematic comics for eco-literacy	Thematic visual media effectively promote eco-literacy and social responsibility among young learners.
(Masykuroh et al., 2024)	<i>Teaching Environmental Literacy in Early Childhood Education to Improve the Character of Environmental Care. Educational Administration: Theory and Practice</i>	Environmental literacy and character development	Character education integrated with environmental themes enhances students' sense of care and responsibility.
(Lei & Bakar, 2025)	<i>Language Scaffolding Strategies Based on Vygotsky's Zone of Proximal Development in Early Reading Education. Forum for Linguistic Studies</i>	Scaffolding strategies in literacy education	Cross-cultural language scaffolding supports comprehension and internalization of moral and social values.
(Marttinen et al., 2022)	<i>Latina Elementary School Girls' Experiences in an Urban After-School Physical Education and Literacy Program. Journal of Teaching in Physical Education</i>	Qualitative study on literacy and community programs	Context-based programs enhance collaboration, motivation, and cultural engagement among students.
(Ordoñez et al., 2021)	<i>"The Best Way to Learn Language Is by Not Doing Language": Incorporating Funds of Identity for Learning Spanish in a Shared</i>	Incorporating identity and culture in	Integrating learners' cultural identities enriches engagement and cultural value internalization.

	<i>Education Unit. International Journal of Bilingual Education and Bilingualism</i>	language learning	
(Saux et al., 2021)	<i>From Simple Agents to Information Sources: Readers' Differential Processing of Story Characters as a Function of Story Consistency. Acta Psychologica</i>	Cognitive analysis of story comprehension	Understanding story characters facilitates internalization of moral messages and social norms.

**Tabel 10. Non-Supporting Studies**

Author(s) & Year	Title / Source	Focus / Method	Key Findings
(Dong & Yin, 2025)	<i>Visual-Motor Integration and Handwriting Development in Chinese Primary School Children: An Analysis Across Different Grade Levels. Infant and Child Development</i>	Study of motor and handwriting development	Focused on visual-motor coordination and handwriting skills, not on cultural or moral education.
(Haim & Ravid, 2022)	<i>The Language of School Writing: A Developmental Comparison of Genres Across the School Years. Stem-, Spraak- En Taalpathologie</i>	Comparative linguistic study of school writing genres	Concerned with linguistic development rather than value-based or culturally grounded learning.
(Schmittwilken et al., 2024)	<i>Aligning Extracurricular School Activities with Physical Literacy: Pilot Evaluation Through Self-Study of Practice. Frontiers in Sports and Active Living</i>	Evaluation of extracurricular physical literacy programs	Addresses physical activity and self-study, without connection to folklore or local wisdom education.

The studies summarized in Table 8 reveal strong theoretical and practical evidence supporting the integration of cultural, moral, and environmental values in education through interactive and context-based learning methods. The findings demonstrate that narrative interpretation, art-based learning, and identity development help enhance students' moral understanding, cultural appreciation, and engagement. Visual and thematic media also play a crucial role in promoting environmental awareness and character formation, while structured learning strategies further strengthen students' moral and social comprehension. Community- and service-based learning activities are shown to nurture empathy and culturally responsive teaching practices. In contrast, the studies presented in Table 9 mainly emphasize technical, linguistic, or physical literacy aspects, without addressing moral or cultural dimensions, thus offering non-supportive evidence for value-oriented and folklore-based educational approaches.

#### D. Conclusions

The findings of this study indicate that the integration of Challenge-Based Learning with folklore-based interactive media significantly enhances students' understanding

of local wisdom values and their overall learning outcomes, as reflected in the improvement of posttest scores, N-Gain values, and positive student perceptions. These results highlight that combining challenge-driven tasks, digital interactivity, and culturally meaningful narratives creates a more engaging, contextual, and character-oriented learning environment. Theoretically, this study contributes to the advancement of culturally responsive digital pedagogy, while practically offering a replicable instructional model for elementary school educators. Despite these promising results, several limitations must be acknowledged, including the small sample size, the single-school implementation, the absence of a control group, and the short duration of the intervention. Future research is recommended to involve larger and more diverse samples, adopt experimental designs with control groups, conduct longitudinal studies to examine long-term impacts, and explore the integration of immersive technologies such as augmented reality (AR) or virtual reality (VR) to further enrich students' cultural and character learning experiences.

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