

The development of *Engklek* Smart Quiz based on education through art to improve learning outcome

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Abstract: This study aims to develop the *Engklek* Smart Quiz learning medium based on Education Through Art and to determine its feasibility and effectiveness in improving the science learning outcomes of fourth-grade students on the topic of “Forces Around Us” at SD Negeri 1 Pendem. The method used is Research and Development (R&D) based on the ADDIE model. Data collection techniques included both tests and non-tests; tests were conducted via pre-tests and post-tests to measure improvements in student learning outcomes, while non-tests consisted of observations, interviews, questionnaires, and documentation. Data analysis utilized validity, reliability, and normality tests, paired t-tests, and N-Gain. The media was developed as a banner-based game integrating physical activities, art, “Do” and “Ask” question cards, floor patterns, and music barcodes. The validation results indicate that the teaching material is highly suitable, with an 89% approval rate from subject matter experts and a 96% approval rate from media experts. The material is also considered highly practical, based on a 92.65% approval rate from teachers and a 94.20% approval rate from students. The effectiveness test showed a significant improvement in learning outcomes with a significance level of <0.05 . The N-Gain values of 0.5634 for the small group and 0.6083 for the large group fall into the moderate category. Thus, this medium is considered appropriate, practical, and effective for IPAS learning, and the use of game- and art-based learning media can serve as an effective alternative learning strategy in creating active, creative, and enjoyable learning experiences for elementary school students

Keywords: *Engklek* smart quiz, education through art, learning outcomes

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Introduction

Education in Indonesia plays a strategic role in developing high-quality human resources, as mandated by the 1945 Constitution. To achieve this goal, a transformation of learning is needed, one that not only focuses on cognitive aspects but also fosters creativity, character, and 21st-century skills. However, in practice, various challenges persist, such as the limited use of innovative learning media, teacher-centered instruction, and low student engagement in the learning process. These conditions have resulted in learning that has not yet optimally fostered active participation and student autonomy (Amiruddin et al., 2023). This situation highlights the importance of developing learning media capable of creating meaningful and engaging learning experiences.

The implementation of the Merdeka Curriculum since 2022 emphasizes flexible, contextual, and student-centered learning. According to Murti (2023), the Merdeka Curriculum supports meaningful learning through an approach that is responsive to students' culture and real-world experiences in the learning process. Additionally, the implementation of the Merdeka Curriculum provides greater scope for developing independence skills and learning that adapts to the needs of elementary school students (Mulyasari et al., 2024). This curriculum encourages educators to design innovative learning experiences by utilizing a variety of learning resources and media. In this context, the teaching of Natural

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and Social Sciences (IPAS) in elementary school plays a crucial role in building science literacy and scientific thinking skills from an early age.

One of the key topics in IPAS is “Forces Around Us,” which is abstract in nature but closely related to students’ daily activities. The concept of force requires students to understand the connection between theory and real-world events, such as pushing, pulling, and changes in an object’s motion. According to Piaget’s theory of cognitive development, elementary school students are in the concrete operational stage, making it easier for them to grasp material through direct experience, physical activities, and the use of visual and concrete media that help them connect abstract concepts with real-life situations (Byrne et al., 2023). These conditions indicate that experience-based and concrete learning is essential at this stage of development. Students generally still struggle to understand abstract concepts without real-world examples and direct experience.

Additionally, constructivist theory explains that knowledge is actively acquired through interaction with the environment; therefore, the learning process must provide students with opportunities to try, explore, and directly experience the material being studied. Wulansari and Tyas (2025) state that the development of interactive learning media effectively improves student learning outcomes because it facilitates a learning process that is more engaging, active, and easier for students to understand. In line with this theory, the use of concrete and interactive learning media can help students understand concepts in a more active and meaningful way. The use of educational games effectively enhances elementary students’ critical thinking skills because they create interactive learning experiences that directly engage students (Fitriyadi & Wuryandani, 2021). Additionally, the use of game-based learning materials and enjoyable activities has also been shown to increase motivation and engagement, as well as foster a more conducive learning environment for elementary students (Sumindar & Setiawan, 2024).

In line with this theoretical review, various studies indicate that students’ understanding of science concepts remains a significant issue requiring serious attention. Research shows that students still struggle to grasp science concepts, particularly in connecting theory to real-life contexts and developing meaningful conceptual understanding (Siantuba et al., 2023). These findings indicate that the current learning process has not yet fully succeeded in connecting abstract concepts with students’ real-life experiences. Furthermore, students’ low conceptual understanding in science learning is influenced by instruction that remains dominated by conventional, teacher-centered approaches, as well as by the lack of innovative learning media capable of facilitating students’ active engagement in the learning process (Tirtawati et al., 2025). This situation reinforces the assumption that a learning approach with limited variety and minimal active student engagement is one of the main factors contributing to low learning outcomes. Thus, instruction that relies solely on verbal explanations and static media has not been able to optimally facilitate conceptual understanding.

To address this issue, various studies have examined the use of innovative learning media as an alternative solution. Research findings indicate that interactive and contextual learning media can enhance student engagement and learning outcomes. Badawi et al. (2023) demonstrated that traditional game-based learning can boost student motivation, participation, and learning outcomes by providing a more enjoyable, active, and meaningful learning experience during the instructional process. These results are also supported by Devian et al. (2024), who state that traditional game-based learning media effectively helps improve students’ understanding through interactive and contextual learning activities that provide hands-on experiences, thereby making it easier for students to grasp learning concepts.

On the other hand, Schneider and Rohmann (2021) indicate that arts-based learning has a positive impact on students’ academic competencies, learning engagement, critical thinking skills, and skill development through more meaningful and contextual learning experiences. Widodo et al. (2021) also explain that education through the arts is capable of instilling learning values more meaningfully because students learn through creative activities, cultural expression, and direct experiences in the learning process. Furthermore, Zhou and Bakhir (2025) found that arts-based learning through interactive and contextual activities can provide more meaningful learning experiences, increase student engagement, and strengthen students’ understanding and learning outcomes through active and reflective learning processes.

However, these studies generally examine traditional games and arts-based approaches separately. In addition, the development of learning media that integrates physical activities, artistic

elements, and interactive assessment into a single medium, particularly for science topics such as the concept of force, remains limited. This indicates a research gap that warrants further investigation.

Preliminary research findings in the fourth-grade class at State Elementary School 1 Pendem, Grobogan Regency, indicate that science education still faces various challenges. Students struggle to understand and retain material when instruction relies solely on static images without incorporating hands-on activities. Furthermore, one-way instruction leads to low concentration and a lack of interest in learning among students. Teachers have also not yet developed interactive, game-based learning materials, even though the characteristics of elementary school students require an approach that involves movement, visual elements, and emotional engagement. The impact of these conditions is evident in students' low learning outcomes, as the majority of students have not yet met the learning mastery criteria.

Some alternative solutions include the use of interactive digital media, contextual learning, and game-based learning. However, given the limited access to technology in some elementary schools, there is a need for non-digital learning media that remains interactive and contextual. Therefore, this study developed the *Engklek* Smart Quiz learning medium based on Education Through Art, which integrates traditional games with physical activities, movement patterns, and interactive quizzes into a single learning system. Another innovation lies in the use of game cards designed to guide students in hands-on learning activities, either through physical movements that represent the concept of force or through critical thinking activities aimed at understanding the concept.

These activities are supported by the integration of floor patterns into the media and the use of music barcodes as accompaniment, making the learning process more contextual, interactive, and engaging by involving kinesthetic, visual, and auditory aspects simultaneously. This medium is expected to help students understand the concept of force through a more concrete and enjoyable learning experience. Based on this description, this study aims to develop the *Engklek* Smart Quiz learning medium based on Education Through Art and to determine its feasibility and effectiveness in improving the science learning outcomes of fourth-grade students at State Elementary School 1 Pendem, Grobogan Regency.

Methods

This study falls under the category of Research and Development (R&D), aiming to develop an educational media product the *Engklek* Smart Quiz based on the Education Through Art approach, and to test its feasibility, practicality, and effectiveness in improving elementary school students' learning outcomes in Natural Sciences. This study employs a mixed-methods approach that integrates qualitative and quantitative data to obtain a comprehensive understanding of the development process and the results of using the educational media. The qualitative approach was used in the needs analysis stage, classroom observations, interviews, and media validation. Meanwhile, the quantitative approach was used to measure the feasibility, practicality, and effectiveness of the media through questionnaire results, pretests, and posttests. Thus, the use of a mixed-methods approach allows researchers to obtain more in-depth and accurate data regarding both the process and the outcomes of media development.

This research design employs the ADDIE model, which comprises five stages: analysis, design, development, implementation, and evaluation, as outlined by (Sugiyono, 2019). The ADDIE model was selected because it provides systematic and targeted steps in the development of learning products, ranging from needs analysis to the evaluation of product effectiveness. The research stages using the ADDIE model are illustrated in Figure 1.

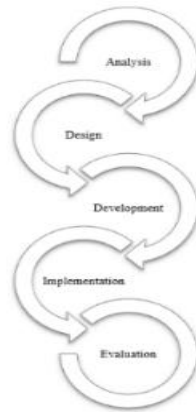


Figure1. ADDIE Model Research Stages

The research process followed the five stages of the ADDIE model, namely: (1) In the analysis stage, needs were identified through observation, interviews, and questionnaires administered to teachers and students. This stage includes an analysis of the material, student needs, and the curriculum as a basis for developing learning media appropriate for the characteristics of elementary school students. (2) The design stage involves designing the *Engklek* Smart Quiz learning media, developing the game flow, designing learning based on Education Through Art, and preparing research instruments; (3) The development stage, which is the process of creating and refining the media product, including the design of the *Engklek* banner, game cards, and other supporting components, which are then validated by subject matter experts, media experts, and practitioners to determine the product's feasibility; (4) The implementation phase was conducted through small-group and large-group trials with fourth-grade students to assess the practicality and effectiveness of the media through observation, questionnaires, pretests, and posttests; and (5) The evaluation phase was conducted to evaluate the entire process and the results of the learning media development. The evaluation included an analysis of the media's validity, practicality, and effectiveness, as well as product revisions based on feedback from validators and users. Quantitative data analysis was performed using feasibility percentages, normality tests, paired sample t-tests, and N-Gain tests to determine improvements in student learning outcomes. Meanwhile, the qualitative data were analyzed descriptively to inform the refinement of the instructional materials. Thus, through the application of the ADDIE model and a mixed-methods approach, this study is expected to produce instructional materials that are valid, practical, and effective in improving elementary school students' learning outcomes in science.

Results and Discussion

Results

The product developed in this research is the “*Engklek* Smart Quiz” learning tool, based on the “Education Through Art” approach, designed to help elementary school students understand the “Forces Around Us” unit in the Integrated Science, Technology, and Mathematics (IPAS) curriculum in a more concrete, active, and enjoyable way. This medium was developed to improve learning outcomes and student engagement in elementary school through the integration of the traditional *Engklek* game with physical movement, art, and the use of “Do and Ask” question cards that engage cognitive, affective, and psychomotor aspects. The *Engklek* Smart Quiz is designed by combining games, questions, and conceptual analysis challenges so that students not only understand the material but also engage in interaction, discussion, and collaborative problem-solving. This educational tool features an engaging and interactive interface tailored to the characteristics of elementary school students, helping to address low participation and learning outcomes in IPAS instruction. The development process followed the ADDIE model, encompassing the stages of analysis, design, development, implementation, and evaluation.

This stage was conducted to identify learning issues and student needs as a basis for developing instructional media. The results of observations and interviews with fourth-grade teachers indicated that science instruction still largely relies on conventional methods with limited use of media, resulting in a

lack of variety in the learning process and students tending to be passive. Teachers also noted that students easily lose concentration and struggle to understand the “Forces Around Us” material due to its abstract nature and lack of hands-on activities. Additionally, the results of the teacher needs survey indicate a need for innovative, interactive learning media capable of enhancing student engagement in learning. Meanwhile, the results of the student survey show that students prefer learning that involves games, physical activities, group work, and engaging visual media. These results align with research indicating that teachers and students require engaging and interactive learning media to support science education, as 21st-century learning demands the use of media capable of creating more innovative and meaningful learning experiences (Sari & Atmojo, 2021). This need is also consistent with the view (Da Ary, 2019) that educational models utilizing art as a learning medium can foster students’ creativity and imagination and enhance their sensitivity to the environment, thereby making learning more meaningful and contextual. Therefore, the *Engklek* Smart Quiz educational media, based on the “Education Through Art” approach, was developed to integrate elements of games, art, and physical activities tailored to the needs of teachers and students, with the aim of enhancing student engagement and learning outcomes.

During the design phase, the researcher designed the *Engklek* Smart Quiz educational media based on Education Through Art, integrating the traditional *Engklek* game with interactive learning activities. The design process included creating a banner-based game board, organizing instructional materials, and developing “do” cards containing practical activities and “ask” cards assessing conceptual understanding. Additionally, the media was designed to incorporate artistic elements such as movement, floor patterns, and rhythmic activities as part of the learning experience. During this phase, an initial prototype of the media was also created to represent the design that would be further developed in the subsequent phase. This prototype was used to assess the alignment between the media design and the learning objectives, as well as to serve as a basis for revisions prior to entering the development phase. In addition, research instruments were developed, including a validation questionnaire, observation sheets, and pretest and posttest questions. A prototype of the media design can be seen in Figures 2 & 3.

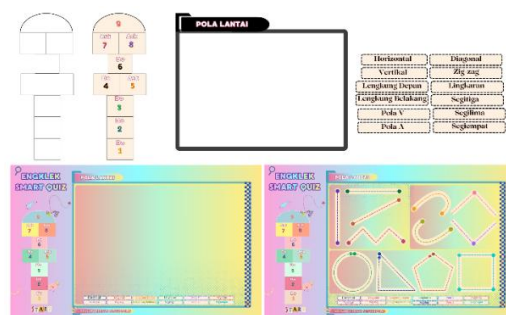


Figure 2. *Engklek* Smart Quiz Banner Prototype



Figure 3. Question Card Prototype

In the development stage, the *Engklek* Smart Quiz learning media based on Education Through Art was developed according to the prototype designed in the previous stage. The initial product was then reviewed to identify aspects of the media that still needed improvement before final validation by subject matter experts and media experts was conducted. The media before revision can be seen in the following figure.



Figure 4. Media Before Revision

Figure 4. shows that the learning materials prior to revision still had several shortcomings in terms of appearance and presentation. The instructions on the “Do” question cards were unclear and lacked clarity, so they needed to be revised to make them easier for students to understand. Additionally, the “Do” cards did not include music barcodes to support movement- and art-based learning activities. The *Engklek* Smart Quiz banner also still features a floor pattern that is too large, limiting students’ movement space during learning activities. In the guidebook, the cover design lacks a logo as the media’s identifier, necessitating design improvements. Based on the analysis results and improvement suggestions, revisions were made to several components of the learning media. The revisions involved clarifying the instructions on the “Do” question cards to make them clearer and easier for students to understand. Additionally, a music barcode was added to the “Do” cards to support more interactive and enjoyable learning activities. The *Engklek* Smart Quiz banner was also revised by reducing the size of the floor pattern and adding more space for students to move, making the play activities more comfortable and flexible. Furthermore, the guidebook was improved by adding a logo to the cover to make the media’s appearance more complete and interesting. The results of the media after revision can be seen in Figure 5.



Figure 5. Media After Revision

Figure 5. shows that the learning materials, following the revision, have been improved in terms of content, appearance, and completeness, in accordance with the validators’ suggestions. The revisions included clarifying the instructions on the “Do” question cards to make them clearer and easier for students to understand, adding music barcodes to support movement-based learning activities, adjusting the size of the floor patterns on the hopscotch banner to allow for more flexible movement, adding a logo to the guidebook, and refining the color scheme in the design. These improvements make the media more suitable for the characteristics of elementary school students and support more interactive and contextual learning. After the revision process was completed, the learning media was then validated by subject matter experts and media experts to determine the product’s suitability. The results of the subject matter experts’ validation can be seen in Table 1 below:

Table 1. Material Validation Results

Assessment Criteria	Maximum Score	Final Score
Alignment of Material with Learning Outcomes	20	16
Alignment of Material with Questions	15	14
Alignment of Material Content	15	13
Alignment with Student Characteristics	15	15
Integration in Learning	20	17
Language and Readability	15	14
Presentation of Material in Media	15	13
Learning Evaluation	15	14
Total Score	130	116
Percentage	100%	89%
Criterion	Very Worthy	

The table above shows the validation results by material experts, indicating that the media received a score of 89%, categorized as very appropriate. This assessment indicates that the material presented aligns with learning outcomes, is conceptually correct, and is easily understood by students. Furthermore, the results of the media expert validation can be seen in Table 2 below.

Table 2. Media Validation Results

Assessment Criteria	Maximum Score	Final Score
Objective Alignment	20	20
Media Display Quality	20	19
Teacher Skills in Operating Media	20	19
Suitability to Student Characteristics	20	19
Feedback and Flexibility	20	19
Total Score	100	96
Percentage	100%	96%
Criterion	Very Worthy	

The table above shows the validation results by media experts, indicating a percentage of 96% in the “highly suitable” category. The media was assessed as having an attractive appearance, being easy to use, and capable of supporting active and enjoyable learning for students. Based on product suitability criteria, learning media is deemed highly suitable if it falls within the range of $81 \leq P \leq 100\%$. Thus, the *Engklek* Smart Quiz media based on Education Through Art is deemed highly suitable for use as an IPAS learning medium in elementary schools.

The implementation phase of this study was conducted through a pilot test involving 26 fourth-grade students using a pretest–posttest design. In this phase, the learning sessions were designed to take place over two meetings, each allocated 35 minutes. Prior to the pilot test of the learning medium, students were first given a pretest to assess their initial proficiency regarding the topic “Forces Around Us.” This pretest served as a baseline for comparison to assess improvements in learning outcomes following the use of the *Engklek* Smart Quiz learning media. The pilot test was conducted in two phases: a small-group phase and a large-group phase, held on different days. The small-group pilot test was first conducted with 6 students to evaluate the media’s feasibility, the clarity of the game rules, and the students’ initial responses to the learning media. Next, on a different day, a large-group trial involving 20 students was conducted. At this stage, the learning implementation was carried out on a wider scale, with all students participating in the *Engklek* Smart Quiz game activities using both “do” and “ask” question cards. Documentation of the learning process is shown in Figures 6 and 7.



Figure 6. Learning Media Practice



Figure 7. Learning in the Classroom

Figure 6. Learning Media Practice and Figure 7. Learning in the Classroom illustrate the process of implementing learning using educational media both outside and inside the classroom. Students were divided into several groups and took turns participating in the game according to established rules. During the activity, students engaged in learning activities through the *Engklek* game, answered Do and Ask question cards, discussed in groups, and performed physical activities according to the instructions on the learning media. After the learning process was completed in each cycle, students were given a posttest to measure improvements in learning outcomes following the use of learning media. The pretest and posttest data were then analyzed using the Shapiro-Wilk normality test with the assistance of the SPSS program. The test results showed that the pretest and posttest data were normally distributed because they had a significance value greater than 0.05. Thus, the data met the assumption of normality and could therefore be analyzed using a parametric analysis in the form of a paired sample t-test.

Table 3. Small Scale Normality Test

Data	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pretest	.291	6	.124*	.908	6	.423
Posttest	.223	6	.200*	.908	6	.421

The table above explains the results of the Shapiro-Wilk normality test on the pretest and posttest data of fourth-grade students, showing a significance value of 0.423 for the pretest and 0.421 for the posttest. A significance value greater than 0.05 indicates that the pretest and posttest data are normally distributed. Thus, the assumption of normality in the research data has been met, making the data suitable for further analysis using parametric tests such as the Paired Sample T-Test.

Table 4. Large Scale Normality Test

Data	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pretest	.157	20	.200	.943	20	.274
Posttest	.215	20	.016	.933	20	.173

Table 4. shows the results of the Shapiro-Wilk normality test on the students' pretest and posttest data, which indicate significance values greater than 0.05: 0.274 for the pretest and 0.173 for the posttest. Based on these results, the pretest and posttest data can be considered normally distributed. With the assumption of normality met, the data can proceed to be analyzed using parametric tests, such as the paired t-test.

Furthermore, the results of the paired t-test showed a significance value (two-tailed) of less than 0.05, indicating a significant difference between learning outcomes before and after the use of the *Engklek* Smart Quiz learning medium. This suggests that the use of this medium significantly improved students' IPAS learning outcomes.

Table 5. Small Scale T - Test

Table 3. Similar Scale 1 - Test							
Paired Differences				t	df	Sig. (2-tailed)	
Mean	Std. Deviation	Std. Error Mean	95% CI of the Difference				
			Lower	Upper			
-33.333	7.528	3.073	-41.233	-25.433	-10.847	5	<0.000

Based on the results of the paired-samples t-test as shown in Table 5, the significance value (2-tailed) was < 0.000 , which is lower than 0.05. These results indicate a significant improvement in students' scores after participating in learning activities using the *Engklek* Smart Quiz learning media. This finding confirms that the developed learning method is effective in improving the learning outcomes of fourth-grade students in Science and Social Studies (IPAS).

Table 6. Large Scale T - Test

Table 6. Large Scale 1 - Test							
Paired Differences				t		df	Sig. (2-tailed)
Mean	Std. Deviation	Std. Error Mean	95% CI of the Difference				
			Lower	Upper			
-32.250	11.639	2.603	-37.697	-26.803	-12.392	19	<0.000

Table 6 shows that, based on the results of the paired-samples t-test, the significance value (2-tailed) was < 0.000 , which is lower than 0.05. These results indicate a significant improvement in students' scores after participating in learning activities using the *Engklek* Smart Quiz learning media. Therefore, this learning method is effective in improving students' learning outcomes in the Science and Social Studies (IPAS) subject.

Table 7. Small Scale N-Gain

	N	Minimum	Maximum	Mean	Std. Deviation
N-Gain Score	6	0.55	0.60	0.5634	0.02054

Table 7 shows that, based on the N-Gain calculation of 6 fourth-grade students, the N-Gain scores ranged from 0.55 to 0.60, with an average of 0.5634 and a standard deviation of 0.02054. The average N-Gain, which falls into the medium category, indicates that the development of the *Engklek* Smart Quiz learning media was able to moderately improve students' learning outcomes in Science and Social Studies (IPAS), although there were variations in improvement among students.

Table 8. Large Scale N-Gain

	N	Minimum	Maximum	Mean	Std. Deviation
N-Gain Score	20	0.40	0.70	0.6083	0.6253

Based on the N-Gain calculation table above for 20 fourth-grade students, the N-Gain scores ranged from 0.40 to 0.70, with an average of 0.6083 and a standard deviation of 0.06253, which falls into the medium category. These results indicate that the *Engklek* Smart Quiz learning media was able to improve students' learning outcomes on the topic "Forces in Our Surroundings." The comparison of pretest and posttest results in the small group and large group is presented in Figure 8.

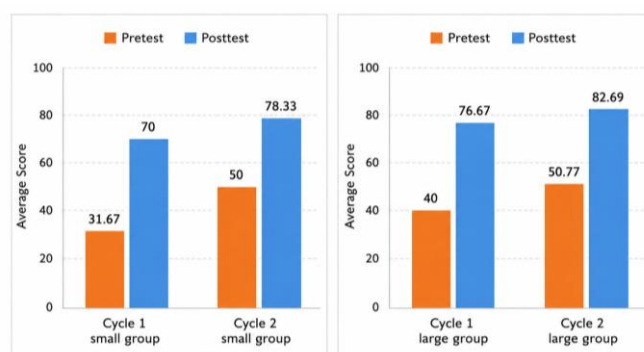


Figure 8. Diagram of the Average Results of the Pretest and Posttest Scores

Figure 8 also shows an increase in pretest and posttest scores for both the small and large groups in each cycle following the use of the *Engklek* Smart Quiz learning medium based on Education Through Art. In the small group, the average posttest score increased from 70.00 in Cycle I to 78.33 in Cycle II, while in the large group, it increased from 76.67 in Cycle I to 82.69 in Cycle II. These results indicate that the developed learning media effectively helps students better understand the material.

In the evaluation phase, the *Engklek* Smart Quiz learning media based on Education Through Art was deemed highly suitable, practical, and effective for use in IPAS instruction. This was evidenced by expert validation scores of 89% for content experts and 96% for media experts, both falling into the “highly suitable” category. Additionally, teacher response rates reached 92.65% and student response rates 94.20%, indicating that the media is highly practical to use. The effectiveness test results also showed an improvement in learning outcomes with an average N-Gain of 0.5634 in the small group and 0.6083 in the large group, both falling into the moderate category. Furthermore, the results of the paired sample t-test showed a significance value (2-tailed) < 0.05 , indicating a significant difference between pretest and posttest scores following the use of the media. These findings are consistent with (Yu et al., 2021), who state that game-based learning media can enhance students’ motivation, engagement, satisfaction, and learning outcomes because the learning process becomes more interactive, engaging, and encourages students’ active participation in learning activities. Furthermore, this medium offers a unique feature: the integration of the traditional game of *Engklek* with the “Education Through Art” concept through movement activities, floor patterns, and ‘do’ and ‘ask’ cards within a single interactive learning medium. However, the implementation of this medium still has limitations, such as the need for a sufficiently spacious area and more complex management of learning time.

Discussion

The development of the *Engklek* Smart Quiz educational media based on Education Through Art is part of a Research and Development (R&D) study aimed at producing innovative educational media to support teaching activities and serve as a learning tool capable of creating a more active, meaningful, and enjoyable learning process for elementary school students. This is supported by research findings indicating that the development of learning media using the ADDIE model can produce valid, practical, and effective products, thereby significantly improving learning outcomes and the quality of the learning process (Dilaines et al., 2024). In the context of IPAS learning, the need for media capable of bridging abstract concepts into concrete experiences is particularly crucial, given that elementary school students are still in the concrete operational stage. Research findings indicate that the use of creative and interactive learning media can increase learning interest and help students understand concepts through more tangible experiences aligned with the context of daily life (Ery et al., 2024). Furthermore, Da Ary & Markamah (2024) explain that the use of learning media tailored to students’ needs can help create a more optimal learning process and effectively support the achievement of learning objectives. Therefore, the development of this medium focuses not only on the product’s feasibility but also on its ability to address various learning challenges encountered in the field, such as low student engagement, the overreliance on lecture-based methods, and the lack of interactive and contextual learning materials. Consequently, this study is oriented not only toward the final product but also toward the learning process facilitated by the use of this medium.

The novelty of the *Engklek* Smart Quiz lies in the integration of the traditional game of *Engklek* with the “Education Through Art” approach, combined with a card-based learning system featuring “do” and “ask” cards. The “do” cards are designed to provide students with instructions on how to practice stylistic concepts through physical activities such as pushing, pulling, jumping, and moving according to floor patterns. Meanwhile, the “ask” cards contain conceptual statements that require students to analyze and provide “yes” or “no” answers accompanied by logical reasoning. The uniqueness of this medium is further enhanced by the inclusion of a hopscotch game mechanism that determines the type of challenge students must perform based on the gaco’s position. Additionally, the use of floor patterns on the hopscotch banner provides clear visual guidance for executing movements, while the music barcode serves as an audio stimulus that enriches students’ learning experience. This combination makes the medium not only educational but also recreational and multisensory, thereby enhancing student engagement more effectively in the learning process. The integration of physical, visual, and auditory activities within a single learning medium demonstrates a holistic learning approach capable of simultaneously accommodating various student learning styles. This media also provides direct learning experiences that enable students to build a deeper conceptual understanding through real interaction with learning activities. Thus, the *Engklek* Smart Quiz not only introduces innovation in the form of media but also in learning strategies that integrate cognitive, psychomotor, and affective aspects in an integrated manner.

The implementation of the learning media demonstrated an increase in student engagement, learning motivation, and learning outcomes for the “Forces Around Us” material following the use of the *Engklek* Smart Quiz. This improvement was supported by the results of a paired-sample t-test, which showed a significance level (two-tailed) of <0.05 , indicating a significant difference between pretest and posttest scores after students used the learning media. Additionally, the N-Gain calculations showed an average of 0.5634 for the small group and 0.6083 for the large group, both falling into the moderate category. This indicates that the use of the media was able to enhance students’ conceptual understanding quite effectively. This improvement is evident not only in the cognitive aspect but also in the affective and psychomotor aspects, as students became more active, enthusiastic, and engaged in the learning process. This suggests that learning packaged in the form of games holds great potential for creating more meaningful learning experiences. These findings imply that a learning process that provides students with opportunities to engage directly in learning activities can enhance conceptual understanding more deeply. This is consistent with research by Kristiyawati and Ary (2024) which state that interactive learning media can increase student engagement by providing a more visual, participatory, and enjoyable learning experience. Thus, the interactivity found in the *Engklek* Smart Quiz media is a key factor in improving the quality of learning. Furthermore, Arifah and Ary (2025) explain that learning media based on creative products can boost student motivation because they provide a contextual learning experience closely tied to students’ lives. This further reinforces that the use of traditional games in learning serves not only as entertainment but also as a learning medium with high pedagogical value.

From a cognitive development perspective, elementary school students are in the concrete operational stage, a phase in which learners begin to think logically but still require real objects and direct experiences in the learning process. At this stage, students tend to understand concepts more easily when the material is presented in a form that can be observed, manipulated, and experienced directly, compared to abstract concepts. Therefore, instruction that focuses solely on verbal explanations without being supported by concrete experiences tends to be less effective in helping students develop a deep understanding. This is reinforced by Widianita et al. (2019), who state that students’ conceptual understanding in science learning is still relatively low because the learning process tends to be teacher-centered and is not yet supported by the use of innovative and interactive learning media, resulting in suboptimal student engagement in building conceptual understanding. Direct involvement in the learning process provides students with the opportunity to actively construct knowledge through the processes of observing, experimenting, and reflecting on the experiences gained. Thus, learning becomes more meaningful because students do not merely memorize concepts but also understand how those concepts function in real-life situations. Therefore, learning must be designed in such a way that students can connect the material studied with their daily experiences, making concepts easier to understand and remember in the long term. In line with this, research indicates that students’ low understanding of science concepts remains an issue linked to a lack of meaningful learning activities

(Sholihah et al., 2024). Additionally, teacher-centered instruction also contributes to low student engagement in comprehending scientific concepts (Anwar et al., 2023).

Teaching that remains teacher-centered and fails to provide sufficient opportunities for students to actively participate tends to make students passive, causing them to merely receive information without engaging in deep processing. This situation results in students' limited ability to understand and apply the concepts they have learned. Therefore, there is a need for instructional innovations that can enhance students' active engagement through interactive and participatory activities. The use of interactive learning media is also consistent with the findings of a study by Amiruddin et al. (2023), which states that student-centered learning can improve engagement and learning outcomes because it creates a learning process that is more active, engaging, and meaningful for students. Such an engaging learning environment can boost students' motivation and interest in learning, making them more active in participating in lessons. This is supported by Tampubolon et al. (2023), who state that traditional game-based learning can improve students' conceptual understanding through active, contextual, and meaningful learning activities, enabling students to grasp the material more easily through direct learning experiences. Play activities integrated with learning allow students to learn by doing, making the concepts studied easier to understand and remember. Thus, the use of traditional games as a learning medium is an effective alternative for addressing the issue of students' poor conceptual understanding, particularly regarding abstract topics such as the concept of force.

The use of traditional games in learning can increase student engagement and support more meaningful and contextual learning (Alotaibi et al., 2024). This is because traditional games are closely related to students' daily lives, so that abstract concepts learned in class can be more easily understood through direct experience. Thus, students not only acquire theoretical knowledge but are also able to relate these concepts to real-life situations they experience. This is highly relevant to the use of the *Engklek* game in the *Engklek Smart Quiz* platform, where playing is not merely recreational but also serves as a means to understand the concept of force through movement and direct interaction. From the perspective of media development, Bestari et al. (2025) state that the ADDIE model is a systematic and effective approach to developing learning media that is valid, practical, and suitable for use. This model allows the development process to be carried out in a targeted and phased manner, starting from needs analysis to product evaluation. Each stage of the ADDIE model also provides an opportunity for revision and refinement so that the resulting educational media can meet the needs of the learners. This reinforces that the development process of the *Engklek Smart Quiz* in this study was conducted scientifically and systematically, resulting in a product with a high level of feasibility. Additionally, Safitri and Marwanto (2025) found that game-based learning can enhance students' critical thinking skills and learning autonomy. Furthermore, research by (Primaestri et al., 2023) indicates that incorporating games into instruction can boost student engagement, motivation, and learning outcomes through more active and meaningful learning experiences. This occurs because students are encouraged to actively engage in the learning process, solve problems, and make decisions based on their understanding. These findings align with the use of game cards in the *Engklek Smart Quiz* medium, designed to train students in analyzing concepts and providing reasons for the answers they choose. Thus, learning emphasizes not only the final outcome but also the thinking process experienced by students. Furthermore, Auranisa and Nuryanto (2025) state that interactive learning media developed using the ADDIE model can improve student learning outcomes because it is designed systematically, engagingly, and in accordance with student characteristics, thereby encouraging active engagement in learning. Media developed through this approach not only presents material but also guides students to actively participate in the learning process. Thus, the combination of a game-based approach, interactivity, and systematic media development is a key factor in improving the quality of learning and student learning outcomes.

Game-based learning approaches are also supported by various recent studies demonstrating their effectiveness in improving the quality of learning. The game-based learning model creates a fun and interactive learning environment, thereby encouraging student engagement in the learning process (Sailer & Homner, 2020). This interactive learning environment enables students to learn through hands-on experiences, group discussions, and independent exploration of concepts. Learning presented in the form of games not only helps students understand the material conceptually but also enhances memory retention by incorporating experiential and emotional aspects into the learning process. Furthermore, a game-based approach offers high flexibility as it can be applied in both in-person learning and under specific conditions, making it relevant across various learning situations. Thus, these findings reinforce

that the use of game-based learning media, such as *Engklek* Smart Quiz, aligns with the principles of active and constructivist learning. This medium not only encourages students to understand concepts theoretically but also provides opportunities to experience them firsthand through physical activities, critical thinking, and social interaction within groups. This makes the learning process more meaningful, contextual, and aligned with the characteristics of elementary school students, who tend to be active, kinesthetic learners and require concrete learning experiences.

The implementation of the *Engklek* Smart Quiz in this study aligns with constructivist learning theory, which emphasizes that knowledge is acquired through direct experience and active student engagement during the learning process. This is supported by research Prasasty et al. (2025), which states that the constructivist approach positions students as active agents in learning by constructing new knowledge based on their prior experiences and existing knowledge, thereby enhancing students' learning outcomes and thinking skills. In practice, students learn through *Engklek* play activities, group discussions, and the completion of "Do" and "Ask" question cards, which encourage students to think critically, move actively, and engage in social interaction. This process demonstrates that learning is not solely teacher-centered but also provides students with opportunities to gain meaningful learning experiences through contextual and multisensory activities. The results of this implementation align with research showing that the use of games in learning can improve students' attention, motivation, and active engagement in the learning process (Tokac et al., 2019). This research indicates that learning activities packaged through games can help students understand concepts in a more concrete and enjoyable way. Furthermore, Suryanti et al. (2020) explain that learning based on local wisdom can improve science literacy among elementary school students because students are more active in exploring the material through contextual and meaningful learning experiences. These research findings are also supported by Nur (2025), who states that traditional games such as *Engklek* can improve learning outcomes, motivation, social interaction, and student engagement in elementary school learning. Traditional games are considered capable of concretizing abstract learning concepts, making it easier for students to understand the material being studied. Meanwhile, according to Fauzi et al. (2024), the implementation of traditional games in learning can increase students' learning motivation and active participation because learning activities become more engaging, interactive, and aligned with the characteristics of elementary school students, who tend to prefer playing and moving around. In line with Irmansyah et al. (2020), traditional games in learning can improve social skills, student engagement, and active participation because the learning process takes place through collaborative and enjoyable activities that align with the characteristics of elementary school children.

However, there are several limitations to the implementation of this medium, such as the need for a sufficiently large space, more complex time management, and differences in students' abilities to participate in physical activities and analyze concepts, which affect each student's rate of understanding. The implications of this study can be examined from several perspectives. First, from a pedagogical perspective, the results of this study indicate that the use of game- and art-based learning media can serve as an effective alternative learning strategy to enhance student engagement, motivation, and learning outcomes. Elementary school teachers can adopt a similar approach to create more active, contextual, and student-centered learning experiences. Additionally, from a practical perspective, the *Engklek* Smart Quiz can serve as a reference for developing creative and innovative non-digital learning media, particularly for schools with limited technological resources, ensuring they can still deliver interactive and meaningful learning experiences. Third, from a theoretical perspective, this study contributes to the development of research on traditional game-based learning combined with the Education Through Art approach, thereby enriching the literature on holistic and multisensory learning innovations. Fourth, from an educational policy perspective, the findings of this study can serve as a basis for schools and policymakers to encourage the use of learning media based on local culture as part of the implementation of the Merdeka Curriculum, which emphasizes contextual and learner-centered learning. Thus, this study not only contributes to the development of learning media but also has a broader impact on the implementation of learning in elementary schools. Based on the results of the analysis, discussion, and theoretical support from various previous studies, it can be concluded that the *Engklek* Smart Quiz learning media based on Education Through Art is deemed appropriate and effective for improving elementary school students' IPAS learning outcomes, while also contributing to optimally enhancing students' learning motivation, active engagement, creativity, and critical thinking skills in the learning process.

Conclusion

Based on the research and development that has been conducted, it can be concluded that the *Engklek* Smart Quiz learning media based on Education Through Art was successfully developed as an innovative learning medium that integrates the traditional game of *Engklek* with movement activities, art elements, and the use of Do and Ask question cards in elementary school Science and Social Studies (IPAS) learning. This media is designed to create a learning experience that is more active, interactive, enjoyable, and meaningful, so that students do not merely receive information passively, but are also directly involved through physical activities, discussions, and problem-solving. The integration of movement, visual elements, and social interaction in this media supports learning that is in line with the characteristics of elementary school students.

The feasibility test results show that the *Engklek* Smart Quiz learning media falls into the very feasible category with a percentage range of $81 \leq P \leq 100\%$. The material expert evaluation obtained a score of 89%, categorized as very feasible, while the media expert evaluation obtained a score of 96%, also categorized as very feasible. In addition, the practicality test results indicate that the media is very practical, with teacher response at 92.65% and student response at 94.20%. These results show that the media meets the aspects of content suitability, design, language, ease of use, and can be effectively implemented in the IPAS learning process in elementary schools.

The effectiveness test results show that the *Engklek* Smart Quiz media based on Education Through Art is able to improve students' learning outcomes. The Shapiro-Wilk normality test indicated that both pretest and posttest data were normally distributed, as the significance values were greater than 0.05, namely 0.423 and 0.421 in the small group, and 0.274 and 0.173 in the large group. Furthermore, the paired-sample t-test results showed a significance value (2-tailed) of less than 0.05, indicating a significant difference between students' learning outcomes before and after using the learning media. The N-Gain results also showed an improvement in learning outcomes, with an average of 0.5634 in the small group and 0.6083 in the large group, both in the medium category. Based on these results, the *Engklek* Smart Quiz media based on Education Through Art is considered feasible, practical, and effective for use in IPAS learning, as it is able to improve learning outcomes, active engagement, learning motivation, creativity, and critical thinking skills of elementary school students.

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