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Development of Fishing Games for Innovative and Fun Learning on Elementary School Science Substance Change Material

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Abstract. This study aims to design and implement a fishing game as an interactive learning tool on the material of changes in the form of matter for class 4A at Elementary School 93 Palembang consisting of 30 students. This learning tool was developed using the ADDIE method which includes analysis, design, development, implementation, and evaluation. This fishing game is designed to increase student participation and motivation by presenting interesting and educational activities, so that students can understand the concept of changes in the form of matter in a more real and interactive way. The research methodology used is one group pretest-posttest with observation and assessment of learning outcomes as measuring instruments. The results of the study showed a significant increase in students' understanding of the material of changes in the form of matter after using the fishing game tool. In addition, this tool has proven effective in encouraging students' cognitive development and their ability to apply concepts practically. This study is in line with previous studies which found that fishing games can improve children's cognitive abilities and enthusiasm for learning in elementary education. The application of the ADDIE method in the development of learning tools also supports the creation of organized and effective media according to student needs. Therefore, fishing games as an interactive learning tool are an innovative choice that can enrich the learning process at the elementary level, especially on the material on changes in the form of matter. This study provides an important contribution in the development of fun learning tools and supports the achievement of optimal learning outcomes.

Keywords: Fishing Games; Interactive Learning; Media; Substance Change; Elementary School.

1. INTRODUCTION

Basic education has an important role as a foundation in shaping students' character and knowledge, especially through learning Natural Science subjects (Zhai & Wibowo, 2023; Kang, 2014). Caspari-Gnann & Sevian, (2022) one of the topics commonly taught at the elementary school level is the change in the form of substances, which includes the processes of melting, freezing, evaporation, and condensation (Son et al., 2024; McFeetors & Palfy, 2018). However, this material is often considered difficult to understand by students because it is abstract and difficult to observe directly (Cen et al., 2024). Therefore, a learning method that is more interactive and relevant to everyday life is needed (Liu, 2025), so that students can more easily relate the concepts learned to their own experiences, so that the learning process becomes more effective and enjoyable (Pires et al.,

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2022, Yalçin & Sadik, 2024).

One of the main challenges in learning science at the elementary school level is the low level of student understanding of abstract material, such as changes in the form of substances (Garcia et al., 2024; Goulet et al., 2024). Huang et al., (2024), many students experience obstacles in understanding these concepts because the learning approach emphasizes more on theory and less on practical activities. In addition, learning media that is less varied and less interesting also makes students passive and less motivated (Khan, 2017; Wang et al., 2022). The lack of direct involvement in the learning process results in difficulties in understanding and remembering the material, Lee & Song, (2024), which ultimately has an impact on the weak mastery of science concepts among students.

To overcome these problems one approach that can be used is the application of learning media based on educational games (Al-Jamili et al., 2024). Educational games, such as fishing games, have the potential to be an effective tool in increasing students' learning motivation while helping to clarify abstract concepts (Schouten et al., 2017; Padilla-Zea et al., 2014). Through play activities, students are actively involved in the learning process in a fun way, while observing and directly applying the material that has been learned (Cunningham-Sabo et al., 2023; Park et al., 2016). The use of game-based media is able to create a more real and concrete learning experience, making it easier for students to understand the concept of changes in the form of substances (Daryanes et al., 2023).

A number of previous studies have evaluated the effectiveness of using educational games in the learning process, and the results show that this approach can improve students' understanding of science materials. For example, a study conducted by Susilowati & Widodo (2023) revealed that educational games can encourage increased student motivation and participation in science learning. Meanwhile, Shim, (2023) found that games involving physical activity and cooperation can strengthen the understanding of scientific concepts in elementary school students. However, although the evidence supporting the effectiveness of educational games is quite a lot, the development of game media specifically designed to discuss the topic of changes in the form of substances at the elementary school level is still relatively limited (Kessner & Harris, 2022).

There is still a significant gap in the development of game-based learning media specifically aimed at material on changes in the form of substances at the elementary school level (Møller-Skau & Lindstøl, 2022). Most of the educational games available are still general in nature and have not fully adapted to the characteristics of science materials that tend to be abstract and require concrete visualization. Therefore, this research aims to design and develop learning media that are more focused on the topic of changes in the form of substances, in order to help students understand these concepts more deeply and comprehensively

(Ju et al., 2024).

The uniqueness of this research lies in the creation of an educational game-based learning medium, specifically a fishing game, tailored to the topic of changes in the form of substances. Gómez-León, (2025) unlike conventional educational games that mainly focus on entertainment, this game combines engaging gameplay with instructional content, enabling students to actively engage with and directly observe the processes involved in changes of matter (Sedova et al., 2024). Through the use of this game, students are expected to gain a clearer and more accessible understanding of scientific concepts that were previously perceived as abstract and challenging (Kermavnar et al., 2023).

The primary goal of this study is to develop a fishing game as an interactive learning medium specifically designed for teaching the topic of changes in the form of substances to fourth-grade students at Elementary School 93 Palembang. This research seeks to evaluate the effectiveness of the game in enhancing students' comprehension of the material, while also contributing to the advancement of innovative and enjoyable learning tools at the elementary level. In doing so, the study aims not only to address current educational challenges but also to introduce fresh approaches to science instruction in primary schools.

2. METHOD

This research uses the Research and Development (R&D) method with the ADDIE model (Analysis, Design, Development, Implementation, Evaluation) (Nadiyah & Faaizah 2015). The purpose of this research is to develop interactive learning media based on fishing game that focuses on the material of substance form changes for grade IV students at Elementary School 93 Palembang and to test the feasibility and effectiveness of the media in improving students' understanding of the material taught. The ADDIE model was chosen because it has systematic and structured steps, allowing the creation of valid and effective learning products.

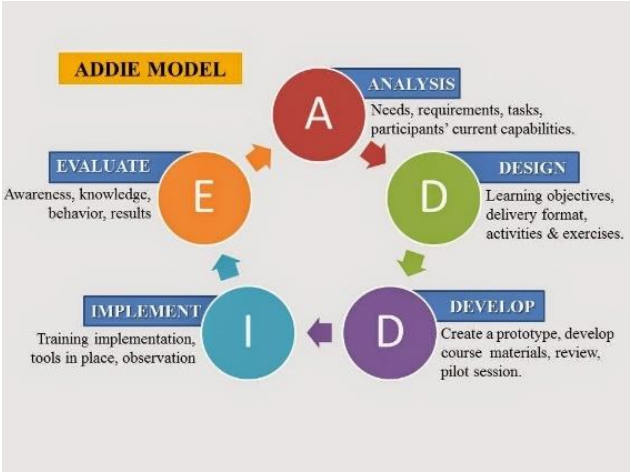

Figure 1. Desain ADDIE

The development procedure used in this study is guided by the steps in the ADDIE model which consists of five interconnected phases, namely: (1) Analyze: This phase is carried out to identify problems, analyze student needs, formulate learning objectives, and assess available resources. In this phase, researchers also observed the existing learning conditions in class IV of Elementary School 93 Palembang to understand the challenges faced in teaching material on changes in the form of substances. (2) Design: In this phase, researchers design learning products, including the selection of teaching methods, the design of media to be used, and appropriate evaluation tools to measure the effectiveness of learning. (3) Develop: In the development phase, the design that has been made will be implemented, including the manufacture of learning products and validation by material experts and media experts. (4) Implement: Products that have been developed are tested on research subjects in class IV Elementary School 93 Palembang. The trial was conducted in several stages to obtain data on the effectiveness and practicality of the media. (5) Evaluate: At this stage, the results of the implementation will be evaluated to assess the effectiveness and efficiency of the media used, as well as to provide feedback for the improvement of learning media (Ghafri, 2013).

This study involved 30 fourth grade students at Elementary School Negeri 93 Palembang who participated in the trial process of fishing game media in learning about changes in the form of substances. The trial was conducted in three stages: (1) individual trial with three students, (2) small group trial with eight students, and (3) field trial with 19 students. Each stage of the trial was conducted to assess the effectiveness and practicality of the developed media.

In this study, researchers used three types of measuring instruments to collect data. The first measuring instrument is an assessment sheet given to material experts and media experts. This assessment sheet serves to evaluate the feasibility of fishing game learning media. The assessment of the material experts focused on the quality of the content of the material related to changes in the form of substances in science and its suitability for the understanding of grade IV students. The media expert assessment sheet is used to assess aspects of visual design, interactivity, and completeness of content in the game. Each assessment is given a 4-point scale based on Likert (Yang & Yagi, 2024), with the results converted into a percentage of validity to determine the feasibility of the media (Obilor et al., 2024).

The second measurement tool is a response questionnaire given to students and classroom teachers as media users (Hanaysha et al., 2023). This questionnaire aimed to assess the practicality, ease of use, and acceptance of the fishing game media by students and teachers. The scale used was a 4-point Likert scale, and the results were analyzed through the percentage of media practicality collected from user responses. The third measuring instrument is a learning outcome test (posttest) to assess the effectiveness of the media in improving students'

understanding of the material on changes in the form of substances after using the media.

The data collected from the evaluations conducted by material experts and media experts will be analyzed using the following percentage formula:

P=fn×100%P = \frac{f}{n} \times 100\%P=nf×100%

Description:

- P = Percentage of assessment score
- f = The sum of the scores obtained from all assessment items
- n = Maximum score that can be obtained.

The feasibility of the media is evaluated using a rating scale categorized as follows: 81%–100% (very valid), 61%–80% (valid), 41%–60% (fairly valid), 21%–40% (less valid), and ≤20% (invalid). This evaluation is intended to determine the effectiveness and usability of the developed media in the learning process.

3. RESULTS

This study aims to improve the learning outcomes of students in class IV A at State Elementary School 93 Palembang, on the material of substance form changes in science lessons. This media is a fishing game that has been modified to support the teaching and learning process. For this research, data was collected at State Primary School 93 Palembang on grade IV A students. The product presented in this research is the application of fishing game as an interactive learning media on the material of changes in the form of substances related to the material in science lessons. The research and development approach used uses the ADDIE model (*Analysis, design, Development, Implementation, and Evalution*).

The first phase of this study involved a needs analysis. During this stage, researchers conducted preliminary observations in class IV-A of Elementary School 93 Palembang on April 24, 2025, and interviewed both the class teacher and several students. The findings revealed two main issues: low student interest in learning and limited understanding of the topic on changes in the form of substances. These problems were attributed to the lack of innovative learning media used by the teacher. Consequently, there is a need to develop engaging and interactive media to enhance the effectiveness and enjoyment of the learning process (Lin et al., 2024).

In this stage, the researcher examines student characteristics to gain insight into their learning styles and interest in interactive media, while also analyzing the subject matter to identify key concepts related to changes in the form of substances that will be incorporated into the media. The data and insights gathered from this analysis are intended to help formulate clear and measurable learning objectives, thereby supporting the overall development of the learning product.

In the second phase, the researchers initiated the design of the learning

media product. This process involved planning the structure and flow of the fishing game, creating visually engaging designs, and developing evaluation tools such as observation sheets, response questionnaires, and pre-test/post-test questions. All design components were tailored to the findings from the needs analysis and aligned with the learners' characteristics to ensure that the resulting product would be both relevant and effective.

The third phase, development, involves implementing the previously prepared design. During this stage, the interactive fishing game-based learning media is created. The developed product is then evaluated by experts both subject matter and media specialists to gather feedback and assess its feasibility. Based on the input received, necessary revisions are made. Following this, a limited trial is conducted with a small group of students to identify any initial flaws or weaknesses before proceeding to a broader trial phase.

In the fourth stage, the refined learning media will be implemented and tested directly in class IV-A of Elementary School 93 Palembang. During this phase, researchers will gather data on the product's effectiveness through classroom observations, student and teacher response questionnaires, and by comparing pre-test and post-test results to assess improvements in students' understanding of the material.

The final phase is the evaluation stage, where all data collected during the implementation phase will be analyzed to determine the product's effectiveness, efficiency, and appeal. The results of this analysis will serve as the basis for concluding whether the product successfully meets the intended learning objectives. Additionally, the findings will offer recommendations for future improvements and potential dissemination of the product to a broader audience.

3.1 Results of Validity and Practicality

The participants in this development research were fourth-grade students from class 4A at Elementary School 93 Palembang in 2025, with data collection conducted between March and April. A total of 30 students from class 4A served as the data source. The trial implementation was carried out in several stages: individual trials involving 3 students, small group trials with 8 students, and field trials with 19 students. The research instruments included a validation questionnaire covering material feasibility and media design aspects, a practicality questionnaire to gather responses from students and teachers, and a learning outcomes test.

In this research, the investigators developed an interactive learning medium based on a fishing game concept to support the teaching of substance form changes. The goal of this product was to enhance students' interest and comprehension of the topic. To collect data, three instruments were employed: validation forms, response questionnaires, and test sheets. The validation form gathered input from subject matter and media experts to assess the validity of the

fishing game-based interactive learning media. Each item on the form used a five-point Likert scale to capture expert evaluations.

The development of the media the implementation of the fishing game as an interactive learning tool for teaching changes in the form of substances was carried out based on the previously designed plan, with a strong emphasis on student engagement to ensure active participation. The components created include: (1) toy fishing rods, (2) fish-shaped pieces containing questions related to the topic of substance form changes, (3) a fishing game box, (4) a 40cm × 60cm display board illustrating the concept of substance form changes, and (5) storage containers for all media components. This product will undergo a validation process conducted by expert validators.

Table 1. Validation Criteria Data Results

No.	Validator	Score Percentage
1	Material Expert	78,25%
2	Media Expert	85,4%
	Average	81,82%
	Criteria	Very Valid

Based on the data presented in Table 1, it can be concluded that the learning media developed for the topic of Changes in the Form of Substances in IPAS lessons is highly valid and appropriate for use, both in terms of content and media design. This conclusion is supported by the average validity score, which reached 81.82%. The percentage was derived from the validation questionnaire completed by expert validators, with one revision suggested by the media expert.

The one-to-one and small group trials were conducted to gather student feedback on the interactive fishing box media developed by the researchers. These assessments were carried out after students had the opportunity to use the media in class IV at Elementary School 93 Palembang, involving 3 students in the one-to-one trial and 8 students in the small group trial. The following section presents a detailed explanation of the questionnaires used in both the one-to-one and small group evaluations.

Table 2. Results of Student Response Questionnaire Data

No	Test	Score	Percentage	Criteria
1	One-to-one	44	83,9%	Very Practical
2	Small Grop	40	70%	Very Practical
Average Percentage			76,95%	
Criteria			Practical	

Referring to Table 2, the learning media on the topic of changes in the form of substances in IPAS material is deemed practical, with a practicality score of 76.95%, based on the results of student response questionnaires.

Table 3. Results of Response Questionnaire Data Teacher

No.	Test	Score	Percentage	Criteria
1	Homeroom Teacher IV- 4	46	88,52%	Very practical
	Average Presentation		88,52%	
	Criteria		Very Practical	

As shown in Table 3, the results of the teacher response questionnaire regarding the material on changes in the form of substances in the natural and social sciences subject indicate a practicality score of 88.52%. This score reflects the evaluation given by the homeroom teacher for grade IV on the practicality of the developed learning media.

3.2 Learning Media Effectiveness Results

The effectiveness of learning aids is assessed by the learning achievements achieved by students after participating in learning about changes in the form of substances in science sources by using the Fishing game for material on changes in the form of substances for class IV -A students consisting of 19 people. Of these, 17 students successfully achieved graduation and 2 students did not achieve graduation as a result of the learning that had been given to them. The percentage of these results can be seen in the diagram below:

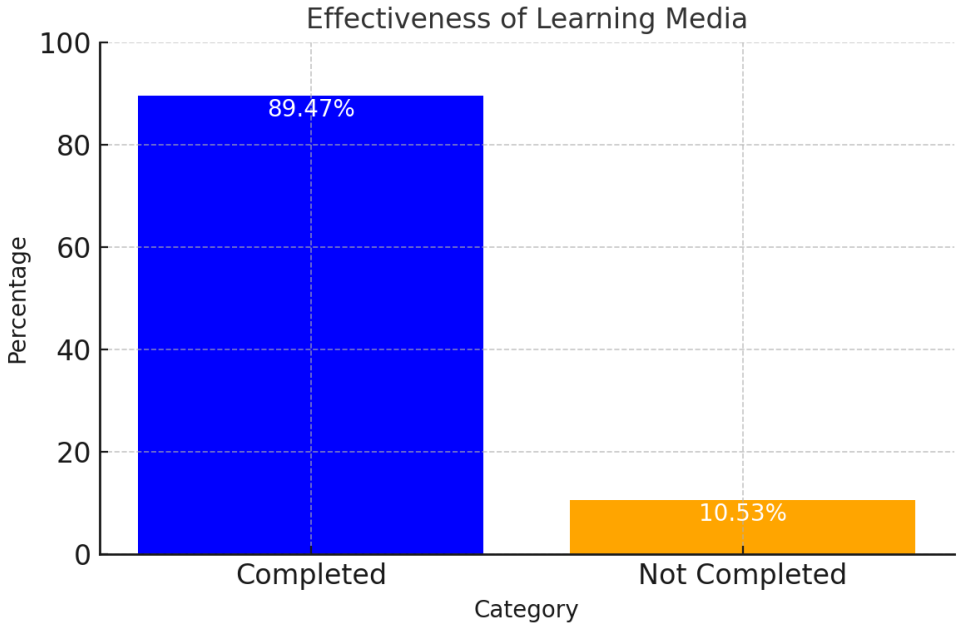

Figure 2. Diagram of Percentage of Classical Completion

The classical completeness rate of 89.47% indicated a highly satisfactory achievement, leading to the implementation of interactive learning tools using fishing game-based media in the learning process of class IV A at Elementary School 93 Palembang.

4. DISCUSSION

This study aims to develop and evaluate the effectiveness of a fishing game as an interactive learning medium for teaching the topic of changes in the form of substances to fourth-grade students at Elementary Schools 93 Palembang. The findings demonstrate that this media effectively enhances students' comprehension of the topic. Assessment results indicate that students showed increased engagement and motivation when using the fishing game compared to conventional teaching methods. For instance, in a field trial involving 19 students, over 85% met the Minimum Mastery Criteria, reflecting a notable improvement in their understanding. These outcomes align with research by Li, (2025), which found that educational games can boost student motivation and comprehension in science learning, particularly when the media supports active learning. Su & Zhao, (2024), this supports the notion that interactive approaches are especially valuable for teaching abstract concepts like changes in substance form.

A key factor contributing to the success of the fishing game is its ability to integrate gaming elements with active learning strategies. Educational games are crafted not merely for entertainment, but also to present scientific concepts in an engaging and practical manner (Sharma et al., 2024). Through this medium, students can interact directly with the content, enabling them to observe and experience changes in the form of substances firsthand within the game. This supports Tseng, (2025) findings, which highlight the importance of using instructional media that can concretely represent scientific concepts, making it easier for students to grasp and retain the material. Game-based learning media offers experiences that closely relate to students' everyday lives, thereby enhancing their comprehension of topics often perceived as challenging (Câmara Olim et al., 2024; Rico-Juan et al., 2024).

This research also revealed that using the fishing game not only enhanced students' comprehension of the concept of changes in the form of substances but also positively influenced their social skills and collaborative abilities. Working in small groups during gameplay encouraged students to engage in discussion and cooperate in solving problems presented in the game. These findings are consistent with Y.-I. Lee & Yu, (2025), who emphasized that games promoting student collaboration can foster social development and deepen the understanding of scientific concepts. Therefore, beyond supporting conceptual understanding, the fishing game also plays a vital role in nurturing students' social interaction and teamwork, de Leng et al., (2024), which are essential components of an active and collaborative learning environment.

Despite the high level of effectiveness demonstrated by this medium, some students still faced difficulties in grasping certain concepts related to changes in the state of substances, particularly during the initial stages of implementation. This indicates that while the fishing game helped make the material more

approachable, challenges remain in ensuring that all students can fully comprehend and apply the scientific concepts. These findings align with the study by Chen et al., (2024), which emphasized that the effectiveness of game-based learning also relies on how well the media accommodates diverse learning styles be they visual, kinesthetic, or auditory. Therefore, although the fishing game has been shown to significantly improve student understanding, further adaptations are necessary to ensure inclusivity and effectiveness for learners with varying preferences and needs (Holden, 2008; Sailer et al., 2024).

From a practicality standpoint, the evaluation results indicated that the fishing game media was positively received by both students and teachers. Feedback from the questionnaires revealed that the media was highly practical, with a practicality score exceeding 80%. This suggests that the fishing game is not only effective in enhancing students' understanding but also user-friendly and suitable for classroom implementation. These findings align with the study by Kwak et al., (2024), which emphasized that game-based learning tools must be easily accessible and well-accepted by users to deliver optimal benefits in the teaching and learning process. This aspect of practicality is particularly crucial, given the time and resource constraints often faced by elementary school teachers in designing engaging learning experiences (Retno et al., 2025). As such, the fishing game presents an efficient and practical solution for improving the quality of science instruction at the primary school level (Wyles et al., 2019).

The results of this study have significant implications for the future development of learning media. With its demonstrated effectiveness and practicality, the fishing game presents an innovative solution to address the challenges of teaching abstract concepts in elementary education, particularly in science subjects. The findings reveal that a game-based approach not only enhances students' cognitive understanding but also fosters social interaction and collaboration. Therefore, advancing the development of fishing games and integrating other educational game strategies should become a priority in the elementary school curriculum. This aligns with the conclusions of Gabrielsson et al., (2025), who emphasized that innovation in instructional media can positively influence the creation of more engaging and effective learning environments. Moreover, incorporating game-based learning innovations can contribute to more active, meaningful, and enjoyable classroom experiences, ultimately supporting improved learning outcomes in primary education (Escala et al., 2024).

In conclusion, the findings of this study offer valuable insights into the potential of educational game-based learning media as an effective strategy for enhancing students' comprehension of complex and abstract concepts. The success of the fishing game in both improving students' understanding of changes in the form of substances and fostering their social skills highlights the significant promise of using game-based media in primary education. Consequently, this research contributes not only to the advancement of instructional media but also

to the implementation of innovative, enjoyable, and effective learning approaches in the classroom.

5. CONCLUSION

The development of educational games, particularly the fishing game, has been shown to effectively enhance fourth-grade students' understanding of the topic of changes in the form of substances. By employing an engaging and interactive learning approach, students became more active, motivated, and better able to connect abstract scientific concepts with real-life experiences. The findings revealed that over 85.7% of students achieved scores above the Minimum Mastery Criteria and responded positively to the use of game-based learning media. Beyond improving cognitive outcomes, educational games also contribute to strengthening the Pancasila Student Profile values, such as collaboration, independence, and critical thinking. Therefore, educational games are a promising and innovative alternative for teaching IPAS in elementary schools and hold potential for broader application across various topics to foster an active, meaningful, and enjoyable learning experience.

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