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Development of a Student Worksheet Based on Creative Thinking Using Maze Chase Wordwall for Natural and Social Sciences

Filaili Desya Luthfitrania✉[1], Choirul Huda[2] & Kartinah[3]

[1,2,3] Elementary School Teacher Education, University of PGRI Semarang, Semarang City, Indonesia

✉ filailidesya12@gmail.com

Abstract. This study is motivated by observations indicating that students exhibit low creative thinking skills in learning natural and social sciences. Additionally, there is a lack of variation in teaching methods, and the use of technology in learning is not optimal, making this a complex issue. To address these problems, the implementation of creative thinking-based student worksheets with maze chase features is expected to enhance students' creative thinking skills, make the learning process more engaging and interactive, and leverage existing technological potential. This research explores the development of a creative thinking-based student worksheet using the Maze Chase Wordwall platform, following the R&D method and the ADDIE research model. Data were collected quantitatively through observations, interviews, questionnaires, and documentation. The study involved a fourth-grade class with a total of 20 students. The results indicate that the Maze Chase Wordwall-based student worksheet provided students with a new and varied learning experience. Furthermore, the integration of technology in natural and social sciences learning increased students' enthusiasm, as they were highly engaged in completing each level of the game. This approach fostered motivation and helped students better understand the evaluation questions presented by educators.

Keywords: Student Worksheet; Wordwall; Natural and Social Sciences; Research and Development; Creative thinking.

1. Introduction

The Japanese government envisions the next societal revolution as "Society 5.0," where advanced technologies and service platforms integrate to empower individuals in a human-centered society (Yamada, 2021). The rapidly growing digitalization occurring in most societies today is shaping a super-smart society (Sá & Serpa, 2022). Society 5.0 is a transformative vision for the future, driven by the integration of digital technologies and human-centered approaches. It converges cyber and physical spaces to create a smart society that addresses megatrends through innovative and collaborative solutions by stakeholders (2023). Additionally, Society 5.0, described as a technological transformation within the societal dimension, is based on the realization of technological integration by fostering harmony and balance between people and technology (Yaraş & Kanatlı Öztürk, 2022).

In 2021, Indonesia was ranked 54th out of 78 countries based on population statistics on education quality (Nuryadi & Widiatmaka, 2023). Given the low quality of education and the low reading index in Indonesia, the education system must equip students with life skills to face the era of Society 5.0 (Shiyamsyah et al., 2024). In the digital era, educators must be able to integrate technology into the learning process. Learners' potential should be directed toward developing the competencies required in the 21st century, which has fully entered the era of digitalization (Özdemir et al., 2020). Optimizing technology in education is essential to creating a meaningful learning experience. This enables students to better understand abstract and complex concepts that are difficult to grasp through reading or listening alone. Education plays a crucial role in various aspects of human life (Arisanty & Riyah, 2019). Effective learning is key to the advancement of the education system (Supiyanti & Iriyadi, 2022). Several researchers have previously investigated this, particularly in relation to digital literacy.

In the 21st century, learner worksheets (student worksheets) have evolved to incorporate web-based educational games. One such game is the maze chase-type Wordwall. Educational

games like Wordwall are designed to enhance learners' creative thinking skills, making learning more engaging and effective. Wordwall can stimulate learners' curiosity, foster creativity, and encourage collaborative learning with peers (Sitompul et al., 2023). The combination of ease of learning, enjoyment, and meaningful knowledge has a positive impact on students' learning attitudes (Lin, 2022).

1.1. Statement of the Problem

The issues identified in this study relate to the learning objectives of natural and social sciences for fourth-grade students at Maranatha Elementary School 01. These include a low ability to think creatively, a lack of variation in teaching methods, and the suboptimal use of technology in learning. Researchers observed the learning system at the school and found that educators at Maranatha Elementary School 01 Semarang have not fully utilized the facilities provided by the school. In reality, adequate and well-maintained learning facilities can significantly enhance the quality of teaching (Haron et al., 2021). Continuously modernizing school facilities is essential for advancing educational equity (Perez, 2024). However, most educators still rely on traditional lecture-based and manual teaching methods. This contributes to students' limited creative thinking abilities in the learning process, ultimately leading to evaluation results that do not align with the expected learning outcomes. To address these challenges, researchers explored ways to make classroom learning more engaging by incorporating Wordwall educational games. As a result, students' interest increased significantly.

Thus, improvements are necessary to enhance students' creative thinking skills and comprehension, which can positively impact their mastery of exact sciences. Educators must adopt effective teaching strategies to overcome these challenges, as such strategies play a crucial role in computational teaching in schools (Månsson, 2023).

1.2. Related Research

Research conducted by Yasa & Trimurtini (2024) analyzed The Role of Wordwall as a technological tool in elementary school learning. The study used a literature review method with a qualitative approach. The findings indicate that the Wordwall application helps deepen students' understanding of the material presented and makes it easier for educators to deliver lessons. This research aims to identify and characterize various learning innovations implemented by teachers.

Furthermore, Imanulhaq & Pratowo (2022) explored Edugame Wordwall: Innovation in Learning Mathematics in Madrasah Ibtidaiyah. This study employed a qualitative descriptive approach. The results concluded that the use of the Wordwall Edugame in second-grade mathematics learning increased students' motivation. The similarity between this study and previous research is that both utilize Wordwall applications to enhance student motivation. However, the difference lies in the subject matter, as this study focuses on mathematics.

Similarly, Agusti & Aslam (2022) examined The Effectiveness of the Wordwall Application on Science Learning Outcomes in Elementary School Students. This study employed a True Experimental Design with a Pretest-Posttest Control Group Design and used simple random sampling. The findings highlight that the integration of e-learning media through the Wordwall application fosters students' interest in completing quizzes, leading to improved learning outcomes.

Although these studies have explored students' understanding of evaluation results when using Wordwall applications, only a few have specifically focused on developing student worksheets based on creative thinking and the Maze Chase Wordwall for natural and social sciences, particularly the topic of the five senses. Therefore, this research emphasizes fostering creative thinking and transforming classroom conditions to make learning more engaging through Wordwall. As a result, students gain a solid understanding of the material and approach evaluation questions more diligently.

1.3. Research Objective

Based on the issues discussed above, this research aims to emphasize the importance of developing creative thinking skills in elementary school students. The primary objective is to

design a Creative Thinking Maze Chase Wordwall-based student worksheet for natural and social sciences subjects. The development of interactive student worksheets using the Maze Chase Wordwall game is expected to enhance students' creative thinking skills, make the learning process more engaging, and maximize the use of technology. The advancement of digital media has significantly impacted education, making its proper utilization essential.

2. Theoretical Framework

2.1. Creative Thinking Ability

Creative thinking ability is defined as an individual's potential to generate original and useful ideas or outcomes in real-world contexts (Stevenson et al., 2021). Additionally, creative thinking can lead to the development of new, more effective concepts while enhancing one's ability to think creatively. Creative thinking involves multiple aspects, including imagination, idea association, mental flexibility, and the ability to view things from different perspectives (Pangestu & Hidayah, 2024). Furthermore, it can be considered a cognitive ability that enables individuals to solve problems by generating new ideas (Casing & Roble, 2021).

According to Brandt et al. (2024), creative thinking is a complex skill that integrates higher-order cognitive abilities with social and emotional traits such as critical thinking, communication, curiosity, collaboration, and persistence. Schools play a crucial role in fostering creative thinking in primary education. Through a well-structured curriculum, schools can provide learning materials that encourage students to think creatively. Learners need to be motivated and independent in deepening their understanding of social sciences and natural sciences (Cohen et al., 2020). In conclusion, creative thinking skills are essential for everyday decision-making, benefiting learners, professionals, and families alike. They facilitate the development of new, more effective, and efficient concepts.

2.2. Creative Thinking Ability Are Carried Out During Learning

Recognizing the importance of creative thinking skills, students should strive to enhance and refine their ability to think creatively, including innovating in learning (Fasha & Ruqoyyah, 2020). Creative thinking is characterized by the ability to create, expand, and apply subjective perspectives by optimizing the right brain (Fajri et al., 2023). With the right learning model, students can develop and strengthen their creative thinking skills.

According to Ibrahim et al. (2024), mathematical creative thinking skills are often a key focus in mathematics education, as they aim to enhance students' creativity in problem-solving. Similarly, Kwangpukieo & Sawangboon (2024) state that mathematics plays a crucial role in shaping human thought, enabling individuals to think creatively, logically, systematically, and analytically.

3. Method

3.1. Research Design

Gustiani (2019) stated that product development in the form of student worksheets and feasibility testing was carried out using the ADDIE research model, which consists of five stages: Analysis, Design, Development, Implementation, and Evaluation. According to Ali (2021), ADDIE was developed alongside other traditional instructional design models to establish a foundation for real-world teaching and development experiences. Each phase plays a critical role in the overall success of the instructional process (DaCosta & Kinsell, 2024). The data collection methods used in this study included observation, interviews, questionnaires, and documentation.

3.2. Respondents

This research was conducted at Maranatha Elementary School 01 Semarang, located in Semarang City, with a total of 103 students divided into six classes. The researchers selected one educator and a group of fourth-grade students, totaling 20 students—14 female and 6

male—aged between 10 and 12 years, as shown in Table 1. The focus of this research is to develop a student worksheet based on Creative Thinking Maze Chase Wordwall for natural and social sciences subjects. The aim is to create a student worksheet that encourages learners to think creatively, flexibly, originally, and innovatively.

Table 1. Information on Learners who Participated in the Study

Class	Number of learners	
	Male	Female
IV	6	14

3.3. Data Collection

The data collection procedure in this study follows the ADDIE research model. First, we conducted a needs analysis, identified problems, and analyzed the assignments to be given to learners. This process began with observing and interviewing fourth-grade teachers. After understanding the actual classroom conditions, we designed and developed student worksheets to address students' difficulties in the natural and social sciences subject on the five senses. Second, we formulated objectives by designing a student worksheet specifically for the five senses topic. We also explored ways to make the worksheet more engaging for students. Third, we developed the student worksheet and validated it to assess its feasibility. Fourth, we implemented the developed student worksheet in a small-scale trial with fourth-grade students at Maranatha Elementary School 01 Semarang. Finally, we conducted an evaluation to determine the validity and appeal of the student worksheet.

3.4. Data Analysis

This research utilizes both qualitative and quantitative data, with each technique applied according to the characteristics of the data obtained during the data collection process. Qualitative data in this study consists of descriptive information gathered from validation results provided by material experts, media experts, and interview responses. This data is derived from feedback, including criticisms and suggestions from various experts, aimed at improving the developed product. The analysis is conducted by categorizing qualitative data, such as expert feedback, as recorded in the questionnaire sheets. Quantitative data includes trial results used to assess the validity of the product and the attractiveness of the Creative Thinking Maze Chase Wordwall student worksheet for natural and social sciences.

3.5. Validity and Reliability

3.5.1. Instrument Validity

Validation data from material validators and media validators were analysed quantitatively and qualitatively as input for the improvement of the developed product. The validation results were calculated as a percentage using the following formula:

$$\%\text{Validity} = \frac{\text{Overall average score}}{\text{Overall Ideal Highest Score}} \text{ X } 100\ \%$$

The suitability of the validation aspects of the student worksheet development can use the criteria in Table 2.

Table 2. Validation Criteria

Number	Achievement Rate (%)	Category
1.	81%-100%	Very Valid
2.	71%-80%	Valid
3.	40%-60%	Less Valid
4.	0-39%	Very Invalid

The research response instrument used a questionnaire with a Guttman scale. The collected data was processed using the formula:

$$\%\text{Validity} = \frac{\text{Overall average score}}{\text{Overall Ideal Highest Score}} \text{ X } 100\ \%$$

The suitability of the response aspects of the student worksheet development can use the criteria in Table 3.

Table 3. Response Criteria

Number.	Achievement Rate (%)	Category
1.	0%-20%	Very unfavourable
2.	21%-40%	Not good
3.	41%-60%	Good enough
4.	61-80%	Good
5.	81%-100%	Very good

3.5.2. Reliability

The reliability of the learning device assessment results is determined based on the level of agreement between validators, which is analyzed using the percentage of agreement (Borich, 1994). A learning device is considered reliable if the percentage of agreement (PA) is ≥ 75%. The formula for calculating the percentage of agreement is as follows:

$$PA = \frac{A - B}{A + B} X\ 100\%$$

Information:

PA : Percentage of agreement
A : Frequency of ratings by experts who gave high scores
B : Frequency of ratings by experts who gave low scores

4. Findings

This chapter outlines the process and results of developing student worksheets based on the Creative Thinking Maze Chase Wordwall for natural and social sciences using the ADDIE research model, which consists of five stages: (1) Analysis, (2) Design, (3) Development, (4) Implementation, and (5) Evaluation. The results obtained in each development phase are described below.

4.1. Analysis

This stage aims to identify problems and needs in the school environment. Researchers developed a student worksheet based on the Creative Thinking Maze Chase Wordwall for natural and social sciences subjects. Additionally, this stage seeks to determine the specific needs of fourth-grade students at Maranatha Elementary School 01 Semarang. The analysis revealed that students struggle to understand evaluation questions, particularly in natural and social sciences. To gather additional data, researchers distributed questionnaires. The results indicated that students often felt bored and had difficulty comprehending the material. Furthermore, educators rarely utilized digital-based student worksheets for evaluations. Researchers also conducted interviews with educators to gain insight into their perspectives. The findings showed that while educators were familiar with Maze Chase Wordwall, they had

never used it in their teaching. They expressed enthusiasm for research related to the development of digital-based student worksheets. As a recommendation, educators suggested that the material in the student worksheet should focus on the five senses. The following is Table 4, which presents the questionnaire results illustrating students' responses.

Table 4. Percentage of Respondents' Answers Related to Learner Needs Analysis

Number	Question	Answer	
		Yes (%)	No (%)
1.	Do you like learning science?	85	15
2.	Does your teacher present the student worksheet as a learning evaluation process?	80	20
3.	Do you think it is necessary to use digital student worksheets?	60	40
4.	Does the interesting student worksheet help learners to be more enthusiastic about doing the task?	100	0
5.	Has the student worksheet enhanced your creativity so far?	80	20

The results of interviews conducted with educators indicate that they are highly enthusiastic about the development of student worksheets based on the Creative Thinking Maze Chase Wordwall for natural and social sciences, as such resources are not yet available in their teaching. Based on the questionnaire results (see Table 4) and interviews with respondents, researchers concluded that developing student worksheets using the Creative Thinking Maze Chase Wordwall for natural and social sciences is essential to support students in enhancing their creative thinking skills.

4.2. Design

This stage is carried out after gathering data on the school's needs. At this stage, researchers designed student worksheets based on the Creative Thinking Maze Chase Wordwall for natural and social sciences subjects. The design process follows the ADDIE research model (see Figure 1) as a guideline for development, from the initial phase to the final product. Researchers also created work instructions to guide students and facilitate the implementation of activities. Additionally, student worksheet questions were developed within the Maze Chase Wordwall platform, specifically tailored to the material on the five senses.

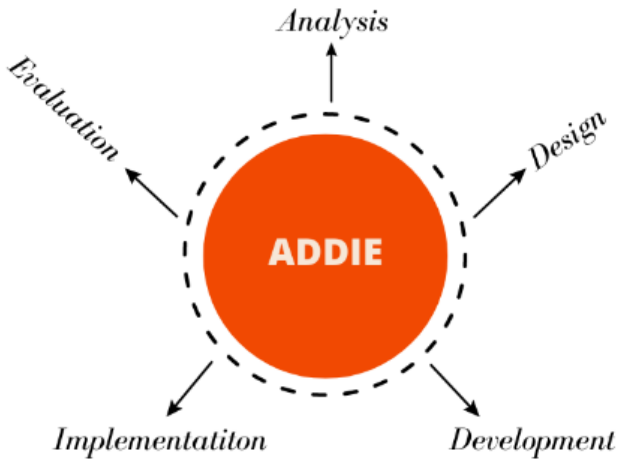


Figure 1. Steps of the ADDIE Research Model

Each learner receives an ordinance using the Maze Chase Wordwall, as well as its usage. As can be seen in Figure 2.

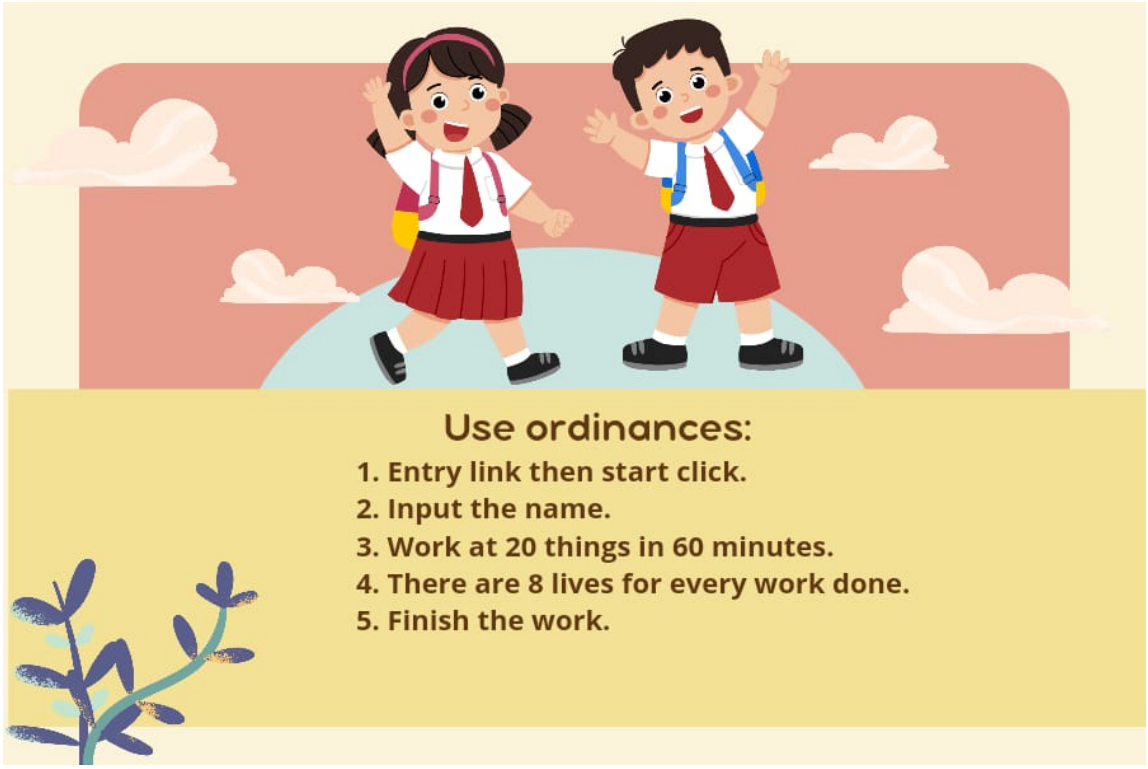
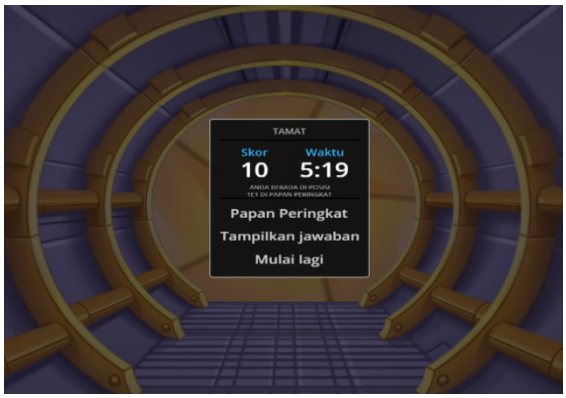


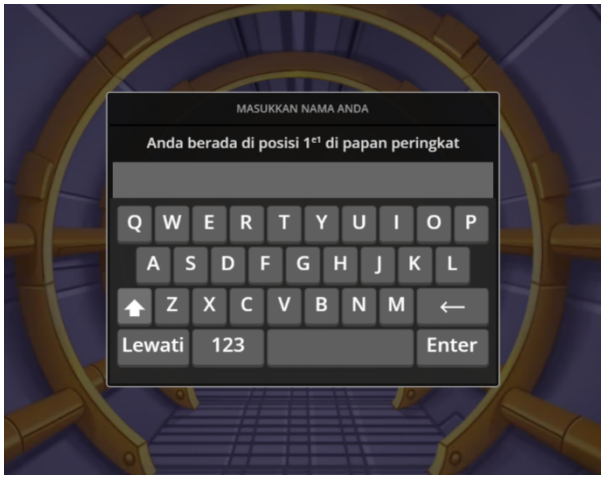
Figure 2. Instructions for using the Question

Each learner is given 20 problems to prepare within the hour, with an example of natural and social sciences. As can be seen in Figure 3.

Figure 3. Student Worksheet

Figure 5. Results of the Development of the Natural and Social Sciences Wordwall Maze Chase Student Worksheet

Balancing Result	Information
	The main display of Wordwall student worksheet question paper.
	Display of questions 20 student worksheet natural and social sciences material Panca Indra.
	Display of Score and Time in working on student worksheet questions.

	The display of typed names has been completed in working on student worksheet questions.
	Student worksheet Leaderboard View.

4.3. Development

At this stage of development, the designed student worksheet is validated by an expert to assess the feasibility of the material and evaluate the Creative Thinking-Based Maze Chase Wordwall media. Additionally, the validator provides written feedback, including suggestions and criticisms, to ensure that the media and materials effectively address the learning challenges at Maranatha Elementary School 01 Semarang.

4.3.1. Validation Stage

The assessment evaluates multimedia design and programming aspects of learning media. Key strengths include clarity in learning objectives, material suitability, and alignment with evaluation questions (see Table 6).

Table 6. Material Expert Validation Sheet

Num.	Indicators		Statement	Assessment Score				Comment
				1	2	3	4	
1.	Design Aspects of Multimedia Displays	1.	Clarity of basic learning competencies				✓	-
		2.	Suitability of material with KD				✓	-
		3.	Learning objectives are clearly written				✓	-

		4. Appropriateness of objectives and materials		✓	-
		5. Suitability of media application with the material		✓	-
		6. Suitability of objectives with evaluation questions	✓		-
		7. Appropriateness of media application with the characteristics of elementary school students		✓	-
		8. Consistency between basic competencies with objectives, materials and evaluation		✓	-
		9. Clarity of target users		✓	-
		10. Clarity of learning media titles	✓		-
		11. Clarity of learning (usage) instructions with the media		✓	-
		12. Media can increase students' motivation to take part in learning		✓	-
2.	Programming Aspects	13. Clarity of material content		✓	-
		14. Orderliness of material content		✓	-
		15. Correctness of material content		✓	-
		16. The material is presented in a coherent manner		✓	-
		17. Ease of material to understand		✓	-
		18. Clarity of examples included to clarify the material		✓	-
		19. Image suitability with material content		✓	-
		20. The attractiveness of the material in motivating users		✓	-

21.	Appropriateness of language to target users	✓	-
22.	Clarity of instructions for working on evaluation questions	✓	-
23.	Correctness of evaluation questions	✓	-
24.	The orderliness of the evaluation questions presented	✓	-
25.	Accuracy of providing *feedback* on user answers	✓	-

Table 6 shows that the media enhances student motivation and engagement. Programming aspects are well-structured, with coherent material presentation, appropriate language, and clear instructions. Overall, the media is effective for elementary school students.

Table 7.Total Score of Material Expert Validation Test

Number	Statement	Score
1.	Design Aspects of Multimedia Displays	46
2.	Programming Aspects	52
	Total	98

Based on the research results from the user validation test, as shown in Table 7, the validity level of the student worksheet is determined as follows:

P value = 98/100×100% = 98%

The usage assessment result of 98% falls into the "very valid" category. With this high percentage, the student worksheet is deemed highly suitable for developing students' creative thinking skills.

The multimedia design is well-structured, with appropriate color selection, font size, and layout, enhancing clarity and attractiveness. Programming aspects ensure easy access, smooth navigation, and responsive buttons (see Table 8).

Table 8. Media Expert Validation Sheet

Num.	Indicators		Statement	Assessment Score				Comment
				1	2	3	4	
1.	Design Aspects of Multimedia Displays	1.	Clarity of multimedia title				✓	-
		2.	Colour selection composition				✓	-
		3.	Appropriateness of *background* and text colour selection				✓	-
		4.	Appropriateness of font selection and size				✓	-

		5. Appropriateness of text placement		✓	-
		6. Proportional display layout		✓	-
		7. Appropriateness of image placement		✓	-
		8. Appropriateness of animation placement		✓	-
		9. Appropriateness of video placement	✓		-
		10. Audio clarity	✓		-
		11. Accuracy of backsound		✓	-
		12. Attractiveness of display		✓	-
2.	Programming Aspects	13. Easy access to the programme		✓	-
		14. Ease of programme operation		✓	-
		15. Accuracy of button function (navigation) with clicks	✓		-
		16. Ease of use of buttons		✓	-
		17. Ease of menu selection	✓		-
		18. Easy access to exit the programme		✓	-
		19. Programme operating system performance		✓	-
		20. Animation running quality		✓	-
		21. Button response speed		✓	-
		22. Completeness of multimedia identity		✓	-
3.	Aspects of Material Delivery Strategy	23. The suitability of the material delivery strategy used in multimedia with students		✓	-
		24. The suitability of the material delivery strategy used in multimedia with the characteristics of the material		✓	-
		25. Material delivery strategies make it easier for students to learn		✓	-

Table 8 shows that the material delivery strategy aligns with students' needs and characteristics, making learning more effective. Overall, the multimedia tool is well-designed, user-friendly, and supports an engaging learning experience. Furthermore, Table 9 presents the Media Expert Validation Test.

Table 9. Total Score of Media Expert Validation Test

Num.	Statement	Score
1.	Design Aspects of Multimedia Displays	46
2.	Programming Aspects	38
3.	Aspects of Material Delivery Strategy	12
	Total	96

Based on the research results from the user validation test, as shown in the Table 9, the validity level of the student worksheet is obtained as follows:

P value = 96/100×100% = 96%

The usage assessment result of 96% falls into the "very valid" category. This high percentage indicates that the student worksheet is highly suitable for developing students' creative thinking skills. Furthermore, Table 10 presents the Results of Learning Device Reliability Test.

Table 10. Validation Results of Learning Device Reliability Test

Learning Tools	Percentage of Agreement (%)	Category
Materials	98	Reliable
Media	96	Reliable

Based on the assessment results shown in Table 10, along with suggestions and comments from material and media validators, the learning tools developed are considered highly valid for use in the learning process. Additionally, the percentage of agreement obtained from the validators indicates that the learning tools are in the reliable category, as they exceed 75%. This aligns with Borich's theory, which states that learning devices are considered effective if they have a practicality coefficient of R = 75% or R ≥ 0.75.

4.4. Implementation

Next, researchers conducted the implementation stage. During this stage, student worksheet trials using the Maze Chase Wordwall for natural and social sciences were first tested on educators. The educator trial was conducted with one fourth-grade educator from Maranatha Elementary School 01 Semarang. After approving the student worksheet product, the educator allowed the worksheet questions on the Maze Chase Wordwall for natural and social sciences to be distributed and tested (see Figure 4). This trial involved 20 fourth-grade students from Maranatha Elementary School 01 Semarang. Following the trial, a questionnaire was distributed to gather opinions from educators and students regarding the developed product. The results showed that the student worksheet, based on creative thinking and the Maze Chase Wordwall, effectively enhances students' creative thinking skills in problem-solving.

Figure 4. Students' Working Process

The following is presented Table 11 which is the result of students' responses to learning using the Maze Chase Wordwall.

Table 11. Learner Response Questionnaire

Num.	Statement	Answer	
		Yes	Not
1.	Do the instructions on the wordwall maze chase worksheet help you learn?	✓	
2.	Are the pictures on the wordwall maze chase worksheet clear?	✓	
3.	Is the animation on the wordwall chase maze worksheet clear?	✓	
4.	Is the video on the wordwall maze chase worksheet clear?	✓	
5.	Are the buttons on this wordwall maze chase worksheet easy to understand?	✓	
6.	Is the language used in the wordwall maze chase worksheet easy to understand?	✓	
7.	Is the maze chase wordwall worksheet attractive?		✓

8.	Is the font used in the wordwall maze chase worksheet easy to read?	✓	
9.	Is the music on the wordwall maze chase worksheet clearly audible?	✓	
10.	Do the various colours, images, animations, sounds and videos on the wordwall maze chase worksheet keep you from getting bored of learning?	✓	
11.	Is the material on the wordwall maze chase worksheet easy to understand?		✓
12.	Are the exercise questions on the wordwall maze chase worksheet easy to understand?	✓	

Based on the students' response questionnaire, as shown on the Table 11, it proves that there is feasibility in the product that has been developed. The survey results indicate that students find the Wordwall Maze Chase worksheet helpful for learning, with clear images, animations, videos, and easy-to-use buttons. The language and font are easy to understand, and the music is clearly audible. urthermore, Table 12 presents the score results from the questionnaire.

Tabel 12. Learner Response Questionnaire Score

Number	Score
1.	20
2.	20
3.	18
4.	17
5.	19
6.	20
7.	20
8.	20
9.	20
10.	20
11.	20
12.	20
Total	234

Based on Table 12, the results of the learner response questionnaire indicate that the maximum average score is 240. According to the analyzed data, the obtained score is 234, which demonstrates that the product aligns with the learners' needs.

4.5. Evaluation

At the evaluation stage, validation data from media experts, material experts, and class IV teacher questionnaires were analyzed. Additionally, an evaluation of the product's attractiveness was conducted. This stage aimed to determine whether the student worksheet is valid, feasible, and engaging for learning about the five senses at Maranatha Elementary School 01 Semarang. Before implementation, the student worksheet product was revised based on feedback and suggestions from validators to ensure its validity and feasibility for the trial at Maranatha Elementary School 01. Table 13 below presents the evaluation of the media's attractiveness.

Table 13. Assessment of Media Attractiveness

Num.	Statement	Answer	
		Yes	Not
1.	Is the maze chase wordwall worksheet attractive?	✓	
2.	Is the content in the wordwall maze chase worksheet clear and appropriate to the material?	✓	
3.	Is the maze chase wordwall worksheet material in line with the curriculum?	✓	
4.	Is the explanation of building space material on the maze chase wordwall worksheet clearly displayed?	✓	
5.	Is the maze chase wordwall worksheet material appropriate for students' needs?	✓	
6.	Does the wordwall maze chase worksheet use language that is easy to understand?	✓	
7.	Can the maze chase wordwall worksheet help students in learning the material of building space?	✓	
8.	With the maze chase wordwall worksheet, can students draw conclusions from the material learnt?	✓	
9.	Does the wordwall maze chase worksheet use a clear text layout?	✓	
10.	Does the wordwall chase maze worksheet have good image, video and audio quality?		✓
11.	Can the wordwall maze chase worksheet encourage students to improve mathematical disposition?	✓	
12.	Can the wordwall maze chase worksheet encourage students to improve their mathematical reasoning skills?	✓	

Based on the Table 13, the assessment of media attractiveness can be categorised as very valid, because educators have assessed the product according to their needs.

4. Discussion

The results of this study indicate that the development of a student worksheet based on creative thinking using the Maze Chase Wordwall for natural and social sciences enhances students' creative thinking skills. This is because the learning process places students at the center of problem-solving, allowing them to take an active role in their education. As a result, students gain a deeper understanding of lessons and develop the ability to solve problems effectively and appropriately. In line with research by Puchongprawet & Chantraukrit (2022), creative problem-solving ability consists of four key actions: 1) clarifying (understanding the problem), 2) identifying (generating various problem-solving approaches), 3) developing (assessing and selecting the best approaches), and 4) implementing (surveying and identifying necessary resources).

Engaging learning experiences help students study in a comfortable and enjoyable environment, preventing boredom and increasing their interest in learning. This aligns with findings from Miller et al. that demonstrate the significance of engaging learning environments affecting students' emotional, cognitive, and social engagement in mathematics, indicating that engagement can mitigate boredom and enhance interest in learning (Miller et al., 2020). This, in turn, enhances their ability to grasp concepts. Ramzan et al. further emphasize that a positive learning atmosphere, characterized by enjoyment, significantly influences students' attitudes toward learning, which indirectly suggests improvements in their grasp of concepts (Ramzan et al., 2023). By incorporating interactive and enjoyable activities, students' motivation and participation improve, leading to better conceptual understanding. Hidayat et al. (2024) provide evidence that interactive activities significantly increase student motivation and engagement, which contribute to improved conceptual understanding of the

subject matter. A pressure-free learning atmosphere positively impacts students' ability to comprehend and apply concepts effectively.

The implications of this research are highly significant in the context of primary school education, particularly in developing student worksheets that foster creative thinking. Integrating educational games such as Wordwall into learning can enhance the quality of education by providing valuable insights into students' learning activities, supporting educators, and helping to monitor and improve the overall learning experience.

This study underscores the importance of problem-based learning approaches in enhancing students' understanding and creative thinking skills. It suggests that learning strategies promoting the development of creative-thinking-based student worksheets should be continuously refined to help learners navigate complex challenges. Creative thinking plays a crucial role in assessing creativity potential, which has been a major research focus for many years (Yörük, 2024). By recognizing the significance of creative thinking, educators can design more effective and efficient teaching strategies to foster its development, ultimately improving the quality of teaching and learning in primary education.

This research was conducted on Natural and Social Sciences subjects for fourth-grade students, as these subjects are essential for helping students navigate their daily lives. In the 21st century, creative thinking skills are crucial due to the increasing complexity of real-world problems. In Natural and Social Sciences, students are also expected to analyze various real-life problems. By using student worksheets based on creative thinking, deeper learning can be achieved in students' everyday experiences.

The strength of this study lies in its structured findings, such as creative problem-solving ability and the assessment of creativity potential. The data were collected directly from learners as the primary subjects of the Maze Chase Wordwall Natural and Social Sciences student worksheet research. There is evidence that students demonstrated high enthusiasm from the beginning to the end of the worksheet activities. However, the study's weakness lies in the lack of facilities for implementing student worksheets based on creative thinking using Maze Chase Wordwall in Natural and Social Sciences. The researchers hope that this study will encourage further research on developing creative-thinking-based student worksheets, ultimately contributing to the advancement of quality education in Indonesia.

6. Conclusion

Based on the research results, the utilisation of the Maze Chase Wordwall application has been effective in assessing Natural and Social Sciences learning outcomes in fourth-grade students at Maranatha Elementary School 01 Semarang. This research holds significant importance for students' daily lives. The study concludes that the implementation of the Maze Chase Wordwall application, as conducted by the researchers, involved balancing student worksheets, designing questions, and ensuring a smooth execution of the application. One of the key advantages of this approach is that it allows for a more efficient and structured assessment of learning outcomes compared to traditional written tests or paper-based worksheets. Additionally, it simplifies the process for educators to determine students' scores during assessments. Based on the validation results from material experts, the creative-thinking-based student worksheet using Maze Chase Wordwall for Natural and Social Sciences achieved a validation percentage of 98%. Similarly, media experts validated the same worksheet with a percentage of 96%. Furthermore, the reliability results of the learning tools indicate a percentage of agreement that exceeds 75%, confirming their reliability.

Limitations

This study has several limitations. Firstly, there is limited discussion on the Wordwall educational game. Secondly, the research focuses only on one school, one class, and one subject—Natural and Social Sciences. Thirdly, time constraints posed a challenge, as the material delivered by educators continued to follow the semester's learning schedule.

Recommendation

After developing a student worksheet based on creative thinking using the Maze Chase Wordwall for Natural and Social Sciences, researchers provided the following recommendations to support further research:

1. For schools and teachers – It is essential to continuously update learning media to ensure it remains relevant and aligns with students' needs.
2. For students – The development of this worksheet aims to encourage students to self-reflect, think creatively, and enhance their learning outcomes. Additionally, it can expand their knowledge of educational games.
3. For researchers – Future research should build upon this study, expanding its scope and incorporating new variations of educational games in updated applications. This will help maintain students' interest and foster their creativity.

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Conflict of Interests

The authors have no conflict of interest in conducting research and article publication.

Declaration of Generative AI-assisted Technologies

This manuscirpt was prepared without the assistance of Generative AI. All intellectual contributions, critical analyses, and final revisions were conducted by the authors. The authors take full responsibility for the accuracy, originality, and integrity of the content presented in this work.

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