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NANA VARNA GAME MEDIA BASED ON A WEBSITE TO IMPROVE COLOR RECOGNITION IN CHILDREN AGED 4-5 YEARS

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Abstract

The research produced an educational game media development product designed to enhance color recognition skills in children aged 4–5 years. The method used is research and development (R&D) with the ADDIE development model. It employs both quantitative and qualitative approaches in the evaluation process. The trial results were conducted at one of the early childhood education institutions, involving 30 children as the main respondents, as well as teachers and parents as supporting respondents. The evaluation was conducted through observation, interviews, and user satisfaction surveys. The research subjects consisted of children in group A at kindergarten institutions in the city of Malang. The analysis results show that the use of the Nana Varna game media significantly improves children's ability to recognize and differentiate basic colors, as evidenced by the increase in test results from pre-research to implementation. This also received positive feedback from expert validation, learning practitioners, and product trials, indicating that the Nana Varna game media can enhance children's learning interest. Thus, Nana Varna media can serve as an innovative and relevant alternative to digital learning media for early childhood education in the digital era. Consequently, Nana Varna has proven to be effective and enjoyable educational media to help young children learn about colors**.**

Keywords: play media, color recognition ability, early childhood, ages 4–5 years.

1. Introduction

Early childhood education is education that begins when a child is born and continues until the age of 6 years. In children aged 0-6 years, it is the golden age, a period that plays a very important role in a child's development because all aspects of development must be achieved by the child to determine the subsequent stages (Adinda & Suhardini, 2022). In line with this, the Minister of Education and Culture Regulation No. 137 of 2014 on national standards for early childhood education explains that the scope of child development according to developmental stages includes aspects of religious and moral values, physical motor skills, cognitive, language, socio-emotional, and arts (Minister of Education and Culture, 2014). One aspect of early childhood development is cognitive development. By enhancing stimulation during this golden age, children can satisfy their curiosity and use practical methods for their cognitive development (Safita & Suryana, 2022). Cognitive development is a very important aspect that influences the stages of subsequent developmental aspects (Ramadhina et al., 2024). Cognitive development becomes one of the very important aspects to be developed for children's thinking abilities, problem-solving, and the development of logical skills in children's future development (Junita & Putrie, 2021). According to Ratna & Watini (2022), the ability to recognize colors is part of cognitive abilities because colors can stimulate the brain and activate the sense of sight. Ideally, the ability to recognize colors in children

aged 4-5 years includes recognizing primary colors, naming and showing three new colors, and mixing 2-3 colors (Ahmad Susanto, 2011).

However, in reality, there are still many children who do not fully understand colors. The research shows a correlation with previous studies that explain that the ability to recognize colors in children aged 4-5 years is still not optimal, such as children not being able to distinguish between yellow and orange (Ni Nyoman, 2021; Lestari, 2024; Hazhari et Sugiyoal., 2021). This can occur due to two inhibiting factors in introducing colors to children. The first is an internal factor related to the child, as explained by Mulyana et al. (2023), who state that a child's motivation to learn and their interests and talents influence their color recognition learning. The second is an external factor, as noted by Hidayati et al. (2020), where a child's ability to recognize colors is often overlooked by parents and teachers, even though color recognition is a crucial aspect of a child's development. Additionally, children may struggle to recognize colors because teachers explain color recognition by showing colors using the lecture method, as mentioned by Maisyarah & Ismawati (2023). Therefore, the lack of color recognition will cause children to have difficulties in developing cognitive skills, memory, imagination, and creative thinking patterns (Fitri, 2021).

Considering the issues in the field and the limitations of previous research, the game tool developed in this study is expected to serve as an effective means of stimulating children's color recognition abilities. This research focuses on producing the Nana Varna game media based on a website. This is supported by the statement that learning about color recognition can be implemented using more engaging, effective, and efficient game- based media, as researched by Junus et al. (2021). In color recognition, using digital game- based media becomes a solution for introducing primary, secondary, and mixed colors. Specifically, this research is directed at how the process of developing the media takes place and how this media is received by teachers and children as users.

This type of research is a development study with a descriptive qualitative approach aimed at producing the Nana Varna game media based on a website as a

2. Method

medium to stimulate color recognition skills in children aged 4-5 years. The development of this media was carried out systematically using the ADDIE model (Analyze, Design, Development, Implementation, Evaluation). This model was chosen because it can guide the development process comprehensively, starting from identifying needs to the effectiveness of media evaluation.

2.1. Analyze

At this stage, the researchers conducted observations and interviews at KB & TK Laboratorium UM, TK Negeri Pembina 1, and TK Brawijaya Smart School located in Malang City. Based on the observation results, it was found that there are still children who have a limited understanding of colors among 4-5-year-olds. The observations at these three institutions indicate that children still do not fully recognize colors and color mixing. This is supported by statements from the class teachers at these institutions, who explained that they still use conventional media to teach colors to children. When mixing colors, some children remember that orange is the result of mixing red and yellow only, and they still do not fully understand the mixing of primary colors to form other secondary colors. The explanation can be concluded that the recognition of colors in children is still relatively low, thus requiring an innovation in color recognition for children aged 4-5 years. Therefore, the researchers developed a website-based game media product called Nana Varna that can enhance color recognition skills in children aged 4-5 years.

2.2. Design

At this stage, the researcher determines the theme and plan or outline of the product to be created, visualized in the form of animated images, background text, game rules, and navigation buttons. The researcher determines the theme of the Nana Varna game, which is derived from the Sanskrit language, meaning various colors, by introducing children to colors, mixing colors, and creating colors. In the game, there is also a background sound and voice-over to help children understand the flow of the game.

2.3. Development

In this development stage, it is the production phase of creating the features needed for the web-based game Nana Varna, such as fonts, images, text, audio, and animations. This stage includes various integration processes, namely the designed features, followed by the integrated parts required in various stages, including scene creation, programming, database usage, testing, and expert review.

2.4. Implementation

At this implementation stage, the researcher will conduct trials on the Nana Varna web-based game product that has been developed by the researcher. After validating the product, the researcher will test the product on small and large groups. Next, the trials will be conducted at three institutions, namely KB & TK Laboratorium UM, KB & TK Negeri Pembina 1, and TK Brawijaya Smart School, located in the city of Malang. The small group trial will be conducted with Group A consisting of 10 children, and the large group trial will be conducted with Group A consisting of 15 children in two institutions. In conducting the trial, the researcher used a questionnaire containing developmental aspects when children used the Nana Varna game.

2.5. Evaluation

In the evaluation stage, the researchers evaluate the product with input and suggestions from experts and game users provided by learning practitioners. The data that has been obtained will then be analyzed to further determine whether the created product is feasible and valid for use. Subsequently, the collected data will be analyzed using quantitative descriptive methods.

3. Results and Discussion

3.1 Result

In the development of the Nana Varna media, it has passed the development stage, and the web-based Nana Varna game media has obtained the final product evaluation results from material experts, media experts, and user experts, aiming to determine the feasibility of the web-based Nana Varna game media product. In addition, the data obtained through the observation sheets of small group and large group tests are used to determine the practicality of the Nana Varna web-based game product in the context of learning. There are criteria for the game media to ensure that the media used is truly effective, safe, and meets the children's needs. These aspects include effectiveness, appearance, attractiveness, ease of use, usefulness, and efficiency (Munir, 2017).

3.2 Discussion

The Nana Varna web-based game media, evaluated by subject matter experts from the PGPAUD program and the D4 Animation program at Universitas Negeri Malang, received a score of 91. This result shows that the Nana Varna web-based game media is very suitable for use in stimulating color recognition skills in children aged 4-5 years. This assessment evaluates the effectiveness aspect of the Nana Varna web-based game media. The results of the material expert assessment can be seen in the table below.

Table 1.1 of Expert Material Validation Data 1

No.	Assessment Aspects	Score
1.	Effectiveness	42
Mean		87,5

Sumber: Munir (2017)

Pada aspek keefektifan terdapat 12 elemen validasi yang telah terindentifikasi. Skor total yang dapat diberikan oleh ahli materi adalah 42 dengan skor yang diharapkan 48. Nilai hasil validasi dihitung menggunakan rumus berikut ini:

$$Vah=\frac{Tse}{Tsh}.100$$

Keterangan:
Vah : Expert Validation
Tse : Total Score Obtained
Tsh : Total Maximum Score
100 : Constant

$$Vah=\frac{Tse}{Tsh}.100$$
$$=\frac{42}{48}.100$$
$$=87,5$$

The feasibility score calculated by material expert 1 reached 87.5, from which it can be concluded that the Nana Varna web-based game product is very suitable for use. Next, the presentation of the score results from material expert 2 can be seen in the following table.

Table 1.2 Expert Validation Data for Material 2

No.	Assessment Aspects	Score
1.	Effectiveness	46
Mean		95

Sumber: Munir (2017)

In the aspect of effectiveness, there are 12 identified validation elements. The total score that can be given by the subject matter expert is 46, with an expected score of 48. The validation result score is calculated using the following formula:

$$Vah=\frac{Tse}{Tsh}.100$$
$$=\frac{46}{48}.100$$
$$=95$$

The feasibility score calculated by the material expert 2 reached a value of 95, which indicates that the Nana Varna game media is very suitable for use.

Next, the scores obtained from both subject matter experts, which are 87 and 95, can be analyzed together to reach a comprehensive final conclusion. The researcher calculated the combined score using the following formula.

$$Sv=\frac{Vah\ 1+Vah\ 2}{2}$$

Information:
Sv = Standard Value
Vah 1 = Final score 1
Vah 2 = Final score 2

ΣVah = Number of values

$$Sv = \frac{\text{Vah 1+Vah 2}}{\Sigma \text{Vah}}$$

$$Sv = \frac{87+95}{2}$$

$$Sv = 91$$

Based on the combined data calculation from both material experts, a score of 91 was obtained. The obtained score can be concluded that the web-based Nana Varna game is very suitable to be used as a learning medium for color recognition to enhance color recognition in children aged 4-5 years. The web-based Nana Varna received a score above 90, indicating that the medium is very suitable for stimulating children's recognition abilities. In line with that statement, creating web-based game media to provide suitable learning at this time is also supported by.

Next, the Nana Varna web-based game media received a score from two media validation experts, the first from the PGPAUD program at Universitas Negeri Malang and the validator from Institut Teknologi Purwokerto, who both scored 96. These results indicate that the Nana Varna web-based game media is very suitable for use in stimulating color recognition skills in children aged 4-5 years. This assessment evaluates the aspects of attractiveness, ease of use, usefulness, effectiveness, and efficiency. The results of the assessment can be seen in the table below.

Table 1.3 Media Expert Validation Data 1

No.	Assessment Aspects	Score
1.	Effectiveness	41
2.	Attractiveness	12
3.	Convenience	22
Mean		93

Sumber: Munir (2017)

Based on the overall score of the 20 identified validation elements. The score given by the media expert is 76, with an expected score of 80. The validation result score is then calculated using the following formula:

$$Vah = \frac{Tse}{Tsh} \text{ x } 100$$

$$= \frac{76}{80} \text{ X } 100$$

$$= 93$$

The feasibility score calculated by media expert 1 reached 95, which indicates that the Nana Varna game media is suitable for use. Next, there is an assessment from two media expert validators from the Purwokerto Institute of Technology who provided their evaluations in the following table.

Table 1.4 Media Expert Validation Data 2

No.	Assessment Aspects	Score
1.	Effectiveness	43
2.	Attractiveness	12
3.	Convenience	24
Mean		98

Sumber: Munir (2017)

Based on all aspects, there are 20 validation elements that have been identified. The total score given by the media expert is 79, with an expected score of 80. The validation result can be calculated using the following formula:

$$\text{Vah} = \frac{Tse}{Tsh} x100$$

$$\text{Vah} = \frac{79}{80} x100$$

$$= 98$$

Next, the feasibility test results from both media experts, who each scored 95 and 98, can be analyzed together to obtain a comprehensive final conclusion. The researcher calculated the combined value using the following formula.

$$\text{Sv} = \frac{\text{Vah 1} + \text{Vah 2}}{\Sigma \text{Vah}}$$

$$\text{Sv} = \frac{95+98}{2}$$

$$\text{Sv} = 96$$

Based on the combined data calculations from both media experts, a score of 96 was obtained. Therefore, it can be concluded that the Nana Varna game media is very suitable to be used as a medium to enhance color recognition skills in children aged 4-5 years.

The results show that the Nana Varna web-based game media has already considered aspects of appearance, attractiveness, and ease to stimulate the spirit of learning. This is in line with the indicators of digital games according to media experts, which state that a game is considered interesting if its color composition and animations match the characteristics of children. According to the indicators of digital media that can attract children's attention, it is media equipped with text, audio, colors, and interesting animations that align with children's characteristics. According to Aprilianti et al. (2021), children enjoy using games with an engaging design, supported by cheerful and attractive audio-visuals, and capable of evoking emotional involvement in children. This assessment includes aspects

Assessment was also conducted by learning practitioners to determine whether the Nana Varna game media based on a website can be used during color recognition learning. The assessment was evaluated by three learning practitioners. The validators of the learning practitioners are the class A homeroom teachers from the KB & TK Negeri Pembina 1 Kota Malang institution, the KB & TK Laboratorium UM Kota Malang, and the TK Children Centre Brawijaya Smart School.

Table 1.5 Validation Data of Learning Practitioners 1

No.	Assessment Aspects	Score
1.	Attractiveness	12
2.	Convenience	24
3.	Usefulness	12
4.	Effectiveness	51
5.	Efficiency	8
Mean		99

Sumber: Munir (2017)

Based on all aspects, there are 27 validation elements that have been identified. The total score given by the learning practitioners is 107, with an expected score of 108. The validation result score can be calculated using the following formula:

$$\text{Vah} = \frac{Tse}{Tsh} x100$$

$$\text{Vah} = \frac{107}{108} x100$$

= 99

The feasibility score calculated by Learning Practitioner 1 reached 99, which indicates that the Nana Varna web-based game media is very suitable for use.

Table 1.6 Validation Data of Learning Practitioners 2

No.	Assessment Aspects	Score
1.	Attractiveness	12
2.	Convenience	23
3.	Usefulness	12
4.	Effectiveness	52
5.	Efficiency	8
Mean		107

Sumber: Munir (2017)

Based on all aspects, there are 27 validation elements that have been identified. The total score given by the learning practitioners is 107, with an expected score of 108. The percentage of the validation results can be calculated using the following formula.

$$\text{Vah} = \frac{Tse}{Tsh} x100$$

$$\text{Vah} = \frac{79}{80} x100$$

$$= 98$$

The feasibility score calculated by learning practitioner 2 reached 99, which indicates that the Nana Varna game media is very suitable for use.

Next, the presentation of the validation results of the three learning practitioners can be seen in the table below.

Table 1.7 Validation Data of Learning Practitioners 3

No.	Assessment Aspects	Score
1.	Attractiveness	12
2.	Convenience	24
3.	Usefulness	12
4.	Effectiveness	50
5.	Efficiency	8
Mean		107

Sumber: Munir (2017)

Based on all aspects, there are 27 validation elements that have been identified. The total score given by the learning practitioners is 106, with an expected score of 108. The percentage of the validation score can be calculated using the following formula.

$$\text{Vah} = \frac{Tse}{Tsh} x100$$

$$\text{Vah} = \frac{79}{80} x100$$

$$= 98$$

The feasibility score calculated by learning practitioners 3 reached 98, which indicates that the Nana Varna web-based game media is very suitable for use.

Next, the percentage results from the three learning practitioners, each scoring 99 and 98, can be analyzed together to obtain a comprehensive final conclusion. The researcher calculated the combined percentage using the following formula.

$$Sv = \frac{Vah\ 1 + Vah\ 2 + Vah\ 3}{\Sigma Vah}$$

Information:
Sv = Standar Value
Vah 1 = Final Score
Vah 2 = Final Score 2
Vah 3 = Final Score 3
ΣVah = Number of values

$$Sv = \frac{Vah\ 1 + Vah\ 2 + Vah\ 3}{\Sigma Vah}$$

$$Sv = \frac{99 + 99 + 98}{3}$$

$$Sv = 98$$

Next, the percentage results from the three learning practitioners, each scoring 99 and 98, can be analyzed together to obtain a comprehensive final conclusion. The researcher calculated the combined percentage using the following formula. Based on the combined data calculation of learning practitioners amounting to 98. Therefore, it can be concluded that the Nana Varna game media product is very suitable to be used as a game medium to stimulate color recognition skills in children aged 4-5 years.

Next, group trials were conducted in three institutions, namely a small trial at KB & TK Negeri Pembina 1 Kota Malang consisting of 10 children and a large group trial from two institutions, namely KB & TK Laboratorium UM Kota Malang consisting of 15 children and TK Children Centre Brawijaya Smart School Kota Malang consisting of 15 children. Data shows that the media has a positive influence on the ability to recognize colors in children.

Table 1.7 Small Group Trial Data

No.	Assessment Aspects	Score
1.	Effectiveness	73
2.	Convenience	156
3.	Attractiveness	80
Mean		95

Source: Munir (2017)

Based on the results of the small group trial, the score of 307, while the expected score is 320. To determine the value of the validation criteria result, it can be calculated using the following formula.

$$Vah = \frac{Tse}{Tsh} x100$$

$$Vah = \frac{307}{320} x100$$

$$= 95$$

Based on the results of the small group trial, the score is 307, while the expected score is 320. To determine the value of the validation criteria result, it can be calculated. The results of the small group trial calculations reached 95, indicating that the Nana Varna game media product is very feasible or the media received a positive response and is easy to understand and use. using the following formula.

In the first large group trial on the second day, it was conducted at the KB & TK Laboratory UM in Malang City. The homeroom teacher of group A at the KB & TK Laboratory UM acted as an observer who assessed the participation and responses of the children during the ongoing activities. Here are the results of the trial involving 15 children at the KB & TK Laboratory of UM Kota Malang.

Table 1.8 Large Group Trial 1

No.	Assessment Aspects	Score
1.	Effectiveness	112
2.	Convenience	237
3.	Attractiveness	120
Mean		97

Source: Munir (2017)

Based on the results of the large group trial with an expected score of 480 and the obtained score at the KB & TK Laboratory UM Kota Malang, which is 469. To determine the validation criteria result value, it can be calculated using the following formula:

$$\text{Vah} = \frac{Tse}{Tsh} x100$$

$$\text{Vah} = \frac{469}{480} x100$$

$$= 97$$

The results of the large group trial calculations reached 97, indicating that the Nana Varna game media product is very feasible or the media received a positive response and is easy to understand and use. Next, the third day continued with the assessment of the large group trial in the A group class at TK Children Centre Brawijaya Smart School. The class teacher of group A acted as an observer who assessed the participation and response of the children during the ongoing activities. Here are the results of the trial involving 15 children at TK Children Centre Brawijaya Smart School.

Table 1.9 Large Group Trial 2

No.	Assessment Aspects	Score
1.	Effectiveness	106
2.	Convenience	235
3.	Attractiveness	120
Mean		96

Source: Munir (2017)

Next, the results of the large group trial at TK Children Centre Brawijaya Smart School Kota Malang are 461. To determine the validation criteria value, it can be calculated using the following formula.

$$\text{Vah} = \frac{Tse}{Tsh} x100$$

$$\text{Vah} = \frac{461}{480} x100$$

$$= 96$$

Thus, the results of the two large group trials, which each obtained scores of 97 and 96, were subjected to a combined data analysis to obtain a comprehensive final conclusion. The researcher calculated the combined results using the following formula:

$$\text{Sv} = \frac{\text{Vah 1} + \text{Vah 2}}{\Sigma \text{Vah}}$$

Information:
Sv = Expert Validation
Vah 1 = Validation 1
Vah 2 = Validation 2

$$\text{Sv} = \frac{\text{Vah 1} + \text{Vah 2}}{\Sigma \text{Vah}}$$

$$\text{Sv} = \frac{97+96}{2}$$

$$\text{Sv} = 96$$

Based on the results of the combined data calculations from the large group trials, a score of 96.5 was obtained, which leads to the conclusion that the Nana Varna web-based game media product is very suitable for use as a medium to stimulate color recognition skills in children aged 4-5 years.

Gambar 3.1 Penerapan Media Permainan *Nana Varna*

Based on the results of the combined data calculations from the large group trials, a score of 96.5 was obtained, which leads to the conclusion that the Nana Varna web-based game media product is very suitable for use as a medium to stimulate color recognition skills in children aged 4-5 years. The convenience of the Nana Varna web-based game media is applied during learning, as the Nana Varna web-based game media can be accessed through laptops or gadgets anytime and anywhere as long as there is an internet connection. The Nana Varna web-based game media is also equipped with instructions and usage steps that make it easier for teachers and parents to assist children. This is supported by the statements of learning practitioners that, from all aspects of the indicators of web-based game media, the Nana Varna web-based game media has met the aspects of attractiveness, ease, usefulness, effectiveness, and efficiency. The explanation is as follows: First, in terms of attractiveness, the Nana Varna web-based game media is designed to capture children's attention so they do not quickly get bored. In line with this, children's interest and enthusiasm in using the media will affect their emotions, so the presence of visualizations in the form of images can help children understand the material more easily (Fransisca et al., 2022).

4. Conclusion

Based on the results of the combined data calculations from the large group trials, a score of 96.5 was obtained, which leads to the conclusion that the Nana Varna web-based game media product is very suitable for use as a medium to stimulate color recognition skills in children aged 4-5 years. The convenience of the Nana Varna web-based game media is applied during learning, as the Nana Varna web-based game media can be accessed through laptops or gadgets anytime and anywhere as long as there is an internet connection. The Nana Varna web-based game media is also equipped with instructions and usage steps that make it easier for teachers and parents to assist children. This is supported by the statements of learning practitioners that, from all aspects of the indicators of web-based game media, the Nana Varna web-based game media has met the aspects of attractiveness, ease, usefulness, effectiveness, and efficiency. The explanation is as follows: First, in terms of attractiveness, the Nana Varna web-based game media is designed to capture children's attention so they do not quickly get bored. In line with this, children's interest and enthusiasm in using the media will affect their emotions, so the presence of visualizations in the form of images can help children understand the material more easily (Fransisca et al., 2022).

Field implementation trials also show that the media is very effective for use in teaching color recognition to young children. The development of innovative and effective play media tailored to children's needs is crucial for supporting the development of color

recognition skills in children. The media developed by the researchers will be one of the effective alternatives in introducing colors to children.

It is concluded that the Nana Varna web-based game media is an effective, engaging, and highly suitable medium for the fine motor skills stimulation process in early childhood. This media becomes a new alternative in the world of early childhood education, combining elements of play, learning, and creativity into a cohesive, enjoyable, and educational experience.

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