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DEVELOPMENT OF THE DODU ADVENTURE MEDIA TO IMPROVE LEARNING OUTCOMES IN STATISTICS FOR FIFTH-GRADE ELEMENTARY SCHOOL STUDENTS

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Abstract

This research aims to develop the Dodu Adventure media to improve learning outcomes in statistics for fifth-grade elementary school students. The objective is motivated by several factors: 1) Students' abilities to understand statistics vary; 2) Statistics is abstract so students require guidance, repetition, and visualization; 3) Teaching generally uses conventional methods, where teachers explain and provide practice problems. These issues lead to a lack of enthusiasm during the learning process and an uneven understanding of statistical material, resulting in generally low learning outcomes. The method used in this research is the Design and Development (D&D) method, developed using the ADDIE model, which includes five stages: analysis, design, development, implementation, and evaluation. The development of the Dodu Adventure media is based on learning outcomes and the scope of the statistics curriculum for fifth-grade students. The first material validation results showed the Dodu Adventure media received a score of 88.9%, categorized as very suitable and considered suitable with revisions. In the second material validation, the media scored 98.1%, considered suitable without revisions by material experts. In media validation, Dodu Adventure received a score of 93.5%, categorized as very suitable and considered suitable with revisions by media experts. Lastly, in learning validation, the learning experts gave a score of 89.5%, considered suitable without revisions. Additionally, based on pre-test and post-test results from 26 students at SDN 053 Cisitu, data showed improvement. The average pre-test score was 52.1, while the post-test score was 72.6. The N-gain result was 0.46, categorized as a moderate improvement.

Keywords: *Developments of Teaching Media; Statistics; Learning Result.*

Abstrak

Penelitian ini memiliki tujuan untuk mengembangkan media Petualangan Dodu guna meningkatkan hasil belajar statistika di kelas V Sekolah Dasar. Tujuan tersebut dilatarbelakangi oleh sifat dasar statistika yang bersifat abstrak namun pembelajaran yang dilaksanakan umumnya masih konvensional, dimana guru hanya menjelaskan dan memberi latihan soal, sehingga memunculkan sikap tidak bergairah dalam mengikuti proses pembelajaran dan munculnya ketidakmerataan pengetahuan serta pemahaman mengenai materi statistika, sehingga hasil belajar yang ditunjukkan pun cenderung rendah. Metode yang digunakan dalam penelitian ini ialah metode *Design and Development* (D&D) yang pengembangannya menggunakan model ADDIE. Berdasarkan hasil validasi materi pertama, media Petualangan Dodu mendapatkan nilai 88.9% yang dikategorikan sangat layak dan dinyatakan layak dengan revisi. Pada validasi materi kedua, media Petualangan Dodu mendapatkan nilai 98.1% yang dinyatakan layak tanpa revisi oleh ahli materi. Selanjutnya, pada validasi media, Petualangan Dodu ini mendapatkan nilai 93.5% yang dikategorikan sangat layak dan dinyatakan layak dengan revisi oleh ahli media. Lalu yang terakhir, pada validasi pembelajaran, ahli pembelajaran memberikan nilai 89.5% pada media Petualangan Dodu yang dinyatakan layak tanpa revisi. Lebih lanjut lagi, berdasarkan hasil *pre-test* serta *post-test* yang dilaksanakan pada 26 peserta didik di SDN 053 Cisitu diperoleh data bahwa terdapat peningkatan antara rata-rata hasil *pre-test* dengan *post-test* peserta didik. Adapun rata-rata hasil *pre-test* dari 26 peserta didik ini ialah 52.1, sedangkan hasil *post-test*nya berada pada nilai 72.6. Adapun hasil *N-gain* yang diperoleh berada pada nilai 0.46 yang dikaterogikan meningkat sedang. Sehingga dari hasil tersebut dapat disimpulkan bahwa media Petualangan Dodu ini dapat meningkatkan hasil belajar statistika di kelas V Sekolah Dasar.

Kata Kunci: Pengembangan Media Ajar; Statistika; Hasil Belajar

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Introduction

Mathematics is a compulsory subject taught at the elementary, secondary, and higher education levels (Nadiyah et al., 2019). Mathematics itself is divided into five content elements: numbers, algebra, measurement, geometry, and data analysis and probability. The data analysis element is part of statistics. This can be seen from the alignment of the learning outcomes in data analysis as outlined by the Ministry of Education and Culture (2022) with the statistical competencies described by Tiro (2018), which include creating graphs, interpreting data, and data visualization and communication.

The competencies in statistics are considered important for students to master, as statistics play a significant role in everyday activities. For example, in measuring height and weight, shoe sizes, exam scores, and even in the quick count results of Indonesia's presidential elections. Additionally, Kusmanto (2017) stated that knowledge of statistics is essential for developing logical, analytical, and systematic thinking. Moreover, considering that statistical material in elementary school serves as the foundation for understanding and learning statistics at higher levels, the success of learning outcomes in elementary school will impact the quality of statistical competencies at higher levels of education (Setiawan, 2021).

In practice, statistical competencies are trained in elementary school starting from phase A and become increasingly complex in subsequent phases. However, explicit introduction to statistics appears in phase C, where according to the learning outcomes in mathematics by the Ministry of Education and Culture (2022), students at this phase are expected to be able to organize, compare, present, and analyze data of many objects and data from measurements in the form of images, pictograms, bar charts, and frequency tables to extract information.

However, the statistical abilities of elementary school students, especially in phase C, are still inadequate. This statement is derived from the low and relatively stable PISA scores in statistical competence over the years (Setiawan, 2021). This is also supported by data from Unaenah et al. (2020), which shows that the average pre-test score on data processing material for 20 students was only 54.95, while the learning mastery threshold was set at 75. Additionally, research conducted by Mas'ulah (2020) found that 15 out of 23 students did not reach the Minimum Mastery Criteria (KKM) in data processing material in fifth grade, indicating that the mastery level in this material only reached 35%.

The low proficiency in statistical material described above may be attributed to the abstract nature of statistics (Widjayanti et al., 2018), causing many students to struggle in understanding statistical concepts. Meliyanti et al. (2018) also revealed that statistics is often considered the most difficult subject by elementary school students, leading to low learning outcomes. Complementing this statement, interviews conducted at a school in Bandung revealed that the teaching of statistics generally takes place using conventional methods, where teachers merely explain and give students practice problems. In this situation, many students who have not fully grasped statistical concepts become confused when given practice problems

by their teacher, widening the gap between students who have and have not understood statistics.

Reflecting on these issues, several factors may contribute to the low statistical competence of elementary school students: 1) students' varying abilities, where some students quickly grasp the material while others need more practice (Chusna, 2016); 2) teachers have not innovated in teaching media, leading to demotivation among students to achieve learning objectives (Mufliva et al., 2023); 3) teachers use conventional teaching methods, so the abstract concepts in statistics are not effectively conveyed to students (Wulandari, 2020); 4) students' fear of asking questions, making it difficult for them to solve challenging problems independently (Yetri et al., 2019).

The aforementioned factors should encourage teachers to innovate in developing and implementing teaching media that can construct students' understanding of abstract concepts in statistics into comprehensive knowledge in a fun and engaging way, motivating students to achieve learning objectives optimally. This aligns with Raesita et al.'s (2019) statement that teaching media will be more effective and efficient if packaged appropriately and presented to the right students. This is in line with the opinion of Hakim & Windayana (2016), who stated that the success of the learning process can be influenced by teaching media that not only captures students' attention to a presentation or object but also forces them to interact with it. Media that promotes interaction is considered interactive media. In line with this, Kurniawati (2018) explained that interactive media can aid the delivery of information and is believed to improve concept mastery, learning achievement, and critical thinking skills.

Based on the above exposition, the researcher was motivated to develop interactive media capable of visualizing abstract statistical concepts and constructing this knowledge so that students can achieve comprehensive statistical competence. This development is carried out in a study titled "Development of the Dodu Adventure Media to Improve Learning Outcomes in Statistics for Fifth-Grade Elementary School Students," which aims to produce validated media that can facilitate the learning process in a fun way in statistics for fifth-grade elementary school students, thus improving their learning outcomes in this material.

Research Methodology

This research on the development of the "Petualangan Dodu" media to improve statistics learning outcomes in fifth-grade elementary school students uses the Design and Development (D&D) method, defined as a structured study consisting of design, development, and evaluation phases aimed at creating new or enhanced products with an empirical foundation. The model used in this research is the ADDIE model (Analysis, Design, Development, Implementation, Evaluation). Participants in this study include experts such as subject matter experts, media experts, and instructional practitioners. Additionally, the participants include 26 fifth-grade students at SDN 053 Cisitu, who serve as the research subjects.

To collect data from the participants, the researcher employed observation sheets, questionnaires, interviews, and tests. More specifically, the observation sheets used in this study were based on the Guttman scale, with the data analysis technique also referring to this scale, which is generally formatted as a checklist with a score interpretation of 1 if a checkmark is present (yes) and 0 if absent (no) (Sugiyono, 2019). After scoring, the total score is converted into a percentage using the following formula:

$$P = \frac{Frequency\ of\ responses\ scored\ 1\ selected}{total\ number\ of\ statements} x100\%$$

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(Sugiyono, 2019)

Next, the data will be averaged and then interpreted according to the following categories:

Table 1.
Percentage Categories

Persentase (%)	Kategori
0-1	None
2-25	A small portion
26-49	Half
0-75	More than half
76-99	The majority
100	All

(Arikunto, 2019)

The questionnaire used in this research employed a Likert scale with 4 levels, with aspects and indicators adapted from BSNP standards in Febriyanti (2020). These include the quality of content and objectives related to the accuracy and appropriateness of the content, alignment with competencies and learning objectives, suitability with the characteristics and needs of the students, and technical quality related to the ease of use of the media, readability of text and media, effectiveness of communication, quality of display, images, and presentation, as well as the quality of media response. The scoring criteria used are as follows:

Table 2.
Questionnaire Data Scores

Score	Category
4	Very Good (SB)
3	Good (B)
2	Not Good (TB)
1	Very Not Good (STB)

(Sugiyono, 2019)

Based on the table, the scores obtained will be calculated as a percentage according to the formula proposed by Arikunto (2019), which is as follows:

$$P = \frac{\sum X \sum Y}{\sum Xi \sum xi} \; x \; 100\%$$

Keterangan:

P = Percentage of validation results

$\sum X \sum x$ = Total score of the responses

$\sum Xi \sum xi$ = Maximum possible score

After calculating the percentage, the researcher will determine the feasibility of the developed media by calculating the average score, which will be interpreted according to the following scoring criteria:

Table 3.

Achievement Levels and Validation Results Qualification

Achievement Level	Qualification	Description
< 20.9%	Not good	Not feasible or needs revision
21- 40.9%	Less good	Less feasible or needs revision
41 – 60.9%	Fairly good	Fairly feasible or needs revision
61 – 80.9%	Good	Feasible or does not need revision
81 – 100%	Very good	Very feasible or does not need revision

(Arikunto, 2019)

data analysis technique used for interview data in this study follows the analysis model proposed by Miles and Huberman, as cited in Harahap & Siswanto (2023), which includes data reduction, data display, and conclusion drawing.

Meanwhile, to determine the extent to which the "Petualangan Dodu" media can improve students' learning outcomes in data processing for fifth-grade elementary students, the researcher used a one-group pretest-posttest design. The analysis carried out is the N-Gain analysis with the following formula:

$$\text{N-Gain} = \frac{\text{posttest score} - \text{pretest score}}{\text{ideal score} - \text{pretest score}}$$

The resulting N-Gain will then be categorized, where the N-Gain score categories used as a reference to determine the conclusion of the improvement in statistics learning outcomes in the fifth grade of elementary school after using the "Petualangan Dodu" media are as follows:

Table 4.
N-Gain Score Interpretation

Gain Factor <g>	Criteria
$0{,}70 \leq g \leq 100$	High
$0{,}30 \leq g < 0{,}70$	Medium
$0{,}00 < g < 0{,}30$	Low
$g = 0{,}00$	No Improvement
$-1{,}00 \leq g < 0{,}00$	Decrease

(Sukarelawan dkk., 2024)

Results and Discussion

The "Petualangan Dodu" media is an interactive learning media. Interactive learning media, as defined by Jafnihirda et al. (2023), is media that allows active interaction between the user and the material being studied through various features such as choices, simulations, exercises, and feedback. Based on this definition, the "Petualangan Dodu" media is equipped with icons and option buttons that students can select, where each icon and option button chosen by the students on each page will direct them to different displays according to the feedback given.

The development of the "Petualangan Dodu" media is based on the steps in the ADDIE model, which consists of analysis, design, development, implementation, and evaluation. In the analysis phase, the researcher conducted a curriculum analysis, from learning outcomes to learning objectives. After analyzing the curriculum, the researcher conducted an analysis of the availability of supporting facilities owned by both the students and the school. Lastly, the researcher analyzed the needs of the devices that would be used to develop the product, including both the software and hardware. The next step was the design phase, where the

researcher created a flowchart or media flow diagram. The flowchart for the "Petualangan Dodu" media is as follows:

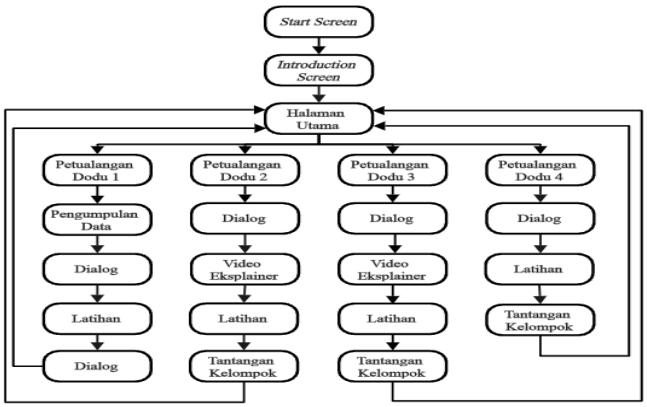

Figure 1. Flowchart of the "Petualangan Dodu" Media

In the next stage, the researcher moved on to the development phase, where each display within "Petualangan Dodu" was developed based on the previously created flowchart. In developing this media, the researcher adapted Dianes' learning theory, which implements mathematics learning through games. According to Dianes, as cited in Yayuk (2019), mathematical games are crucial because they guide and sharpen students' mathematical concepts. In "Petualangan Dodu," this learning theory was further developed into a story-based game containing dialogues with selectable feedback options for students.

The "Petualangan Dodu" media was developed with an imaginative theme set in a forest, featuring imaginative or cartoon-like characters. The choice of an imaginative theme was based on the characteristics of elementary school students, who tend to enjoy cartoons. This aligns with research conducted by Michigan University, as cited in Habib & Soliman (2015), which found that children aged 6-11 spend 28 hours per week watching cartoons. This is further supported by Hamna & Windar's (2022) assertion that elementary school children have a strong instinct to play and watch cartoons. Additionally, the Michigan University study cited in Habib & Soliman (2015) also revealed that children under 12 years old are more attracted to learning content that uses cartoons than traditional academic methods. Well-written scenarios, audio effects, visuals, and colors help children absorb more information than they would in a regular learning environment.

The adventure storyline developed in the "Petualangan Dodu" media is divided into four parts. This division was made based on the consideration of the maximum time span during which students can maintain focus in learning. Students in grade V are generally 11 years old, and at this age, the maximum focus span is around 2-3 hours (Bujuri & Andesta, 2018). Based on this, the researcher concluded that it would not be feasible to combine all content into one media, as this would take an extensive amount of time and prevent students from effectively using the media. Considering these factors, the researcher ultimately decided to divide the media into four parts according to the sub-materials being explained. "Petualangan Dodu 1" covers data collection, which is a prerequisite for learning statistics. "Petualangan Dodu 2" discusses how to create a frequency table. "Petualangan Dodu 3" covers how to create a pictogram, and "Petualangan Dodu 4" explains how to create a bar chart. The following are some examples of the results of this media development:

Figure 2. Start Screen Display

Figure 3. Main Page Display

Figure 4. Dialogue Screen Display

The "Petualangan Dodu" media product then underwent a validation process by subject matter experts, media experts, and educational practitioners to test its feasibility. The results of the validation by subject matter experts are shown in the table below:

Table 6.
Results of Subject Matter Expert Validation

Assessment Aspect	Total Score	Maximum Score	Score (%)	Category
Content Feasibility Aspect	33	40	82.5%	Very Feasible
Presentation Feasibility Aspect	28	32	87.5%	Very Feasible
Language Feasibility Aspect	35	36	97.2%	Very Feasible
Overall Aspect	96	108	88.9%	Very Feasible

Overall, the material validation results in the "Petualangan Dodu" media received a score of 96, which when converted into a percentage is 88.9%. This percentage falls into the "very feasible"

category with revisions. The revisions include adding and completing definitions and examples in several sub-materials.

The next validation was the media validation, which included one aspect: the graphic feasibility aspect. Based on the questionnaire filled out by the media expert, the total score given by the media expert was 101, which, when converted into a percentage, resulted in a score of 93.5%. Based on this score, the "Petualangan Dodu" media is declared feasible for use with several revisions, including improving the use of words in interactions to be more persuasive and flexible, varying the background music more, increasing the readability of the material, making the sound effects more realistic, standardizing the fonts used, and paying more attention to punctuation and spelling.

Next, the researcher conducted validation with educational practitioners, covering two aspects: content quality and technical quality. The results are shown in the table below:

Table 7.
Results of Educational Practitioner Validation

Assessment Aspect	Total Score	Maximum Score	Score (%)	Category
Content Quality Aspect	11	12	91.7%	Very Feasible
Technical Quality Aspect	57	64	89.1%	Very Feasible
Overall Aspect	68	76	89.5%	Very Feasible

Based on the data above, the validation results for the "Petualangan Dodu" media in terms of learning feasibility are categorized as very feasible, with a total score of 68, which translates to a percentage of 89.5%. The recommendation provided by the validator was to choose supporting software that can be accessed offline.

The next step taken by the researcher was to implement the "Petualangan Dodu" media. This implementation was intended to determine whether the "Petualangan Dodu" media successfully improved students' learning outcomes in the statistics material for fifth-grade elementary school students. In the implementation process of the "Petualangan Dodu" media, the researcher divided the students into small groups of 3-4 people. This division was done to allow students to engage in peer teaching. Peer teaching, or peer tutoring, is a method where students can learn from their peers, which, in the process, makes them feel more comfortable asking questions about material they do not understand (Saleh et al., 2022). The researcher considered using this method important because students often feel reluctant to ask questions to the teacher. This is also supported by Yetri et al. (2019), who stated that students often fear asking questions to the teacher, so when they encounter practice problems with difficult issues, they are unable to solve them.

During the implementation process, the researcher carried out several activities, including administering a pre-test and post-test to measure the improvement in learning outcomes in statistics for fifth grade after using the "Petualangan Dodu" media, conducting observations to see the level of student enthusiasm in using this media, and post-implementation interviews to gather students' responses after learning statistics with the help of the "Petualangan Dodu" media.

The results of the pre-test and post-test were then processed using Microsoft Excel. The calculations showed that the average pre-test score from 26 students was 52.1, with an average post-test score of 72.6. From the average pre-test and post-test results, it can be seen that there was an improvement in learning outcomes in statistics after using the "Petualangan Dodu" media. To determine the category of this improvement, the researcher used the N-gain calculation. The results indicated that the average N-gain score was 0.46, which is categorized as moderate improvement based on the N-gain score interpretation by Sukarelawan et al. (2024). One factor that may have influenced this improvement is that the post-test was conducted together with the lesson on bar diagrams in "Petualangan Dodu 4." As a result, the students were already tired and unfocused during the post-test. Furthermore, during the post-test, the students were not given time to prepare themselves. Ideally, before taking the post-test, students should have been given time to rest and study the material to be tested. This is in line with the points that should be considered when conducting assessments, as stated in the book "Panduan Pembelajaran dan Asesmen Jenjang Pendidikan Dasar dan Menengah" by Asesmen (2021). The book states that when conducting assessments or tests, teachers must communicate this to students so that they can prepare themselves to achieve the best criteria according to their abilities.

In addition to the pre-test and post-test results, observations were also conducted during each session. The results of these observations are shown in the following table:

Tabel 8.
Observation Results

Session	**Average Score**	**Maximum Score**	**Average Percentage (%)**
First	9.7	11	88.2%
Second	10.2	11	92.7%
Third	10	11	90.9%
Fourth	10.3	11	93.6%

To draw a generalized conclusion from the above data, the researcher recalculated the average score percentage from the first to the fourth sessions as follows:

$$P = \frac{40.2}{44} \text{ x } 100\%$$

$$P = 0.9136 \text{ x } 100\%$$

$$P = 91.4\%$$

Based on this percentage, it can be concluded that the majority of students showed a high level of enthusiasm during the Statistics learning process using the "Petualangan Dodu" media.

To further support the observation results, the researcher also conducted post-implementation student interviews with nine randomly selected students. Based on the interview results, students generally enjoyed the learning process and stated that the learning experience was very engaging. One respondent, identified as SM, mentioned, "I feel happy because there's a game." Similarly, another respondent, PSMA, expressed, "Yesterday's lesson was fun because there was an adventure to complete." Additionally, all interviewees stated that the "Petualangan Dodu" media captured their attention and motivated them to learn. They also mentioned that this media helped them understand the Statistics material, specifically in creating frequency tables, pictograms, and bar charts. The average score given by the students for the "Petualangan Dodu" media was 98.3.

However, aside from these statements, the interviews also revealed that 3 out of 9 students felt bored during the learning process, particularly when they struggled with the exercises or group challenges provided in the "Petualangan Dodu" media. Regarding this, a student identified as QS said, "I was confused when working on the bar chart problem because the frequency couldn't be random." Nevertheless, another respondent, FAS, stated, "I didn't find it difficult or boring because I collaborated with my group."

In addition to this, one student, identified as DS, felt confused while following the storyline in the media. DS mentioned, "I was confused when using the media because there was a lot of reading involved." The reading referred to by DS pertains to the dialogues in the "Petualangan Dodu" media. However, contrary to DS's statement, another student, DNA, said, "This media grabbed my attention and motivated me to learn because it involved an adventure, like reading a story."

Furthermore, 2 out of 9 students reported difficulties in using the "Petualangan Dodu" media, which stemmed from their devices not supporting the software used. A student, identified as FAS, stated, "Some buttons were hard to press." However, this complaint was not found in other students' devices.

Based on the interview results above, it can be concluded that the "Petualangan Dodu" media can attract students' interest and foster their enthusiasm for learning, particularly regarding Statistics. The media's storyline design generally makes students want to explore it further. However, in the Exercises and Group Challenges sections, a small number of students felt confused, which sometimes led to boredom. Moreover, the media is still not entirely effective for use anywhere and by anyone, as it requires a good internet connection and suitable devices.

Conclusion

The "Petualangan Dodu" media was deemed appropriate with revisions from the material experts. The suggestions given included enhancing the definitions and examples in several subtopics within this media. Based on the media validation results, "Petualangan Dodu" was considered suitable with revisions. The recommendations included improving the use of language in interactions to be more persuasive and flexible, diversifying the background music, enhancing the readability of the material, making the sound effects more realistic, aligning the fonts, and paying closer attention to punctuation and spelling.

Furthermore, the validation from educational practitioners concluded that the "Petualangan Dodu" media is suitable for use without revisions. However, the educational experts pointed out that the main drawback of this media lies in the supporting platform, which requires internet access. Therefore, for future media development, media developers should choose a platform that allows offline access, with the alternative being the creation of an offline application.

Based on various suggestions from the validators and the revisions made by the researcher, the final product of the "Petualangan Dodu" media can serve as an alternative in teaching statistics, particularly in analyzing and presenting data in the form of frequency tables, pictograms, and bar charts in fifth-grade elementary school classes. Moreover, this media can be used as a model in developing other educational media.

This conclusion is supported by the results of the limited trial implementation, which showed that using the "Petualangan Dodu" media can improve learning outcomes in statistics in fifth-grade elementary school. This was concluded through a comparison of the average pre-

test and post-test results, further reinforced by the N-gain score, which was processed with the help of the Ms. Excel application. The average pre-test score of the 26 students was 52.1, while the post-test score was 72.6. The N-gain score obtained was 0.46, which falls into the category of moderate improvement.

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