Enhancing fourth-grade fractional learning through Powtoon integrated audiovisual mathematics media

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Article Info	ABSTRACT
	The background of this research highlights the need to integrate technology into education to improve learning experiences and outcomes. The main aim is to develop effective learning media to overcome students' difficulties in understanding grade IV fraction material. This research employed the research and development (R and D) methodology with the Borg and Gall model for designing, validating, and testing media. The validation score was 91.6% from media experts and 89.2% from material experts. Therefore, the product developed was feasible. The research results also show that Powtoon-based learning media significantly increases student motivation and learning outcomes, with an N-gain value of 0.6059 in the small group trial and 0.6331 in the large group trial with the moderate improvement category. The implications show that integrating Powtoon media into mathematics education can create a more exciting and effective learning environment, thus supporting students' academic achievement.

Meningkatkan pembelajaran pecahan kelas iv melalui media pembelajaran matematika audiovisual yang terintegrasi dengan Powtoon

	ABSTRAK
	Latar belakang penelitian ini menyoroti perlunya mengintegrasikan teknologi ke dalam pendidikan untuk meningkatkan pengalaman dan hasil pembelajaran. Tujuan utamanya adalah untuk mengembangkan media pembelajaran yang efektif dalam mengatasi kesulitan yang dihadapi siswa dalam memahami materi pecahan kelas IV. Dengan menggunakan metodologi penelitian dan pengembangan (R and D), penelitian ini mengikuti model Borg dan Gall untuk merancang, memvalidasi, dan menguji media. Skor validasi sebesar 91,6% dari ahli media dan 89,2% dari ahli materi sehingga dinilai sangat layak. Hasil penelitian juga menunjukkan bahwa media pembelajaran berbasis Powtoon meningkatkan motivasi dan hasil belajar siswa secara signifikan, dengan nilai N-gain sebesar 0,6059 pada uji kelompok kecil dan 0,6331 pada uji kelompok besar dengan kategori peningkatan sedang. Implikasinya menunjukkan bahwa pengintegrasian media Powtoon ke dalam pendidikan matematika dapat menciptakan lingkungan belajar yang lebih menarik dan efektif, sehingga mendukung peningkatan prestasi akademik siswa.

1. INTRODUCTION

Education is an essential foundation in the progress of a country. It has a significant role in the fabric of society, which functions as a development of the ability or potential of students in educating the nation's life. Through education, humans are shaped to be independent, capable, have noble character, be creative, and become democratic and responsible citizens. Education requires teachers with pedagogical, personal, professional, and social abilities to carry out the learning process for students to create good learning [1]. In the learning process, the role of teachers has a high potential to hone creativity. Furthermore, the role of educational technology today is also vital in learning [2].

The development of technology brings rapid changes in aspects of life, such as education. The learning process certainly has a negative and positive influence from technology that cannot be avoided. Therefore, teachers and students can benefit from technology in learning activities to improve the quality of education[3]. The rapid change of times requires continuous innovation in the education system, which involves teachers being able to understand and utilize technology wisely so that it is helpful to prepare students to compete globally [4]. Technology in learning can be used as a learning medium and resource that can increase students' insight, motivation, and enthusiasm for learning to improve the quality of education.

Technology supports teaching and learning activities. As teachers, technology can be a learning medium that mediates in delivering learning materials to students [5]. Learning media can create a fun, varied, motivating, and not monotonous learning process to achieve desired learning outcomes [6]. Monotonous learning activities can quickly bore students, make them unfocused and less excited, and lower learning outcomes. Therefore, teachers can use learning media to support the learning process.

Media used in learning activities in elementary schools must be interesting, creative, and effective. Elementary school students like to play around [7]. Therefore, innovative media developed by teachers must consider the characteristics of students who will use the media. Media is expected to be accepted quickly by students so that it can stimulate their thoughts, feelings, and attention and encourage them to become enthusiastic about learning [8].

Based on the results of interviews with grade IV teachers of SD Negeri Wonosari 01, there are several problems in learning. Students' scores were below the criteria for achieving learning objectives in mathematics subjects. Most students had difficulty understanding fractional material based on the errors in doing and answering questions. From the interview results, the students preferred communicative and interactive media. Students' lack of understanding of the material is caused by teachers who only teach with traditional methods, such as lecturing, discussions, and assignments, so learning media has not been applied optimally. Learning with limited teaching aids and materials tends to provide less than optimal learning results [9]. Thus, learning media must be developed using technology to support school learning facilities. Therefore, teachers need interesting media, one of which is Powtoon.

Powtoon is an audiovisual media that can be accessed at www.powtoon.com. The material can be presented in animated videos that interest students. There are cartoon animation features that can support the material presented and handwriting and transition effects that make the material more interesting[10]. Powtoon can be accessed 24 hours offline via smartphones or gadgets to be studied anywhere and anytime [11]. The Powtoon application can provide more varied material, covering all aspects of the senses, is easily accessible, can be used by teachers and students, can provide motivation, is easy

to apply, and can be used in large groups [12]. Video-based learning media is one of the right alternatives to be used at SDN Wonosari 01 because the facilities in the elementary school can support the use of Powtoon media.

The benefit of Powtoon media in education is that it can make students pay more attention to learning. They focus not only on the media available in school, such as books [13]. According to previous researchers, Powtoon media does not take much time, so the learning atmosphere in the classroom becomes more conducive [14]. Conducive learning can prevent students from boredom and can create learning motivation [15]. The Cognitive Load Theory in learning with multimedia, according to Mayer, uses the dual-channel assumption, visual and audio materials. This theory is divided into three cognitive loads: intrinsic cognitive, Germane, and extraneous loads [16].

The Powtoon media, according to previous research conducted by Juli Asmida, is feasible to use and increase students' understanding of mathematics subjects [17]. The limitations of Powtoon media in previous research were in the time allocation because the video duration was too long, the lack of dancing effects, and students were invited to use applications on laptops and gadgets, ultimately making it less effective [16]. To overcome these limitations, the researchers developed media by utilizing *LCD* so that students only focus on one source, the use of animation, a shorter video duration of approximately 10 minutes, and background sound used as a support to explain the material. Another research on the development of Powtoon media was a contextual learning media based on thermochemical materials [18], video to increase motivation to study chemistry [19], and development of Powtoon learning media [20], [21]. However, there has been no research that examines the development of Powtoon learning media for fractional materials.

Based on the explanation, the researchers wanted to develop Powtoon media in learning activities to be effectively used in learning so that students are motivated, interested, and can understand learning materials, especially in mathematics subjects. Student learning activities need effective and interesting media to produce satisfactory learning results.

Contribution to the literature

This research contributes to:

- Demonstrating the effective use of Powtoon software in audiovisual learning media.
- Expanding the literature on audiovisual-based learning media that can enhance student learning motivation.
- Providing practical recommendations for teachers on integrating technology-based learning media into the curriculum.

2.　METHOD

The research method used was research and development (R&D) to produce a particular product and test its effectiveness [22]. The researchers employed the R&D method to develop Powtoon media for mathematics learning for grade IV students on fractional material.

The researchers implemented the Borg and Gall development model, which is used to develop various kinds of learning strategies, learning models, media, and teaching materials. According to Sugiyono [23], the sequence in the development of the Borg and

Gall model consists of ten stages. However, due to time and cost constraints, this research was only carried out until the seventh development stage.
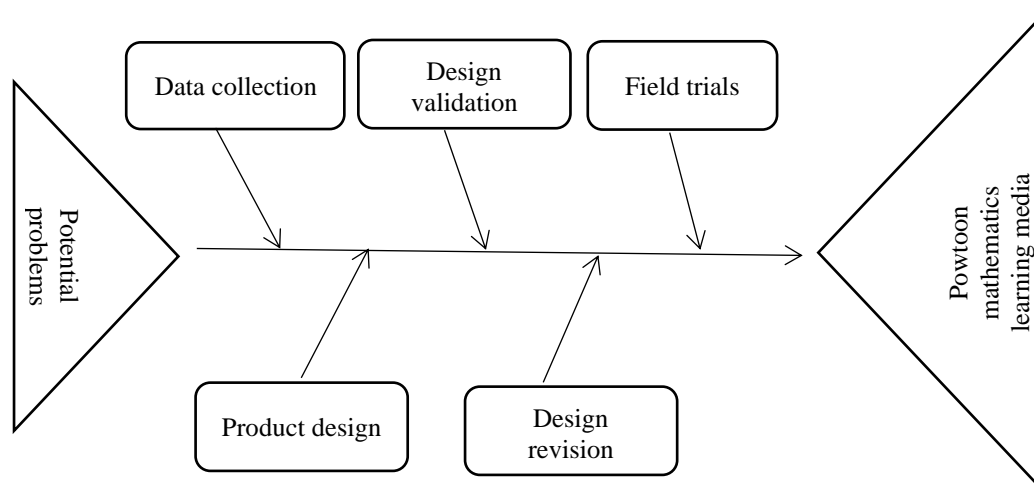

Figure 1. Borg and Gall Model

The subject of the study was the grade IV students, consisting of 26 students in one class as respondents, to find out their responses to the Powtoon learning media. This development consisted of one learning subject, namely mathematics. The other subjects are one learning media validator (a lecturer in art and media from Semarang State University) and one other validator who is a lecturer from Semarang State University who teaches courses related to mathematics and statistics. Data collection techniques were test and non-test techniques. The test techniques were the pretest and posttest, while observation, interviews, documentation data, and questionnaires were the non-test techniques.

The validation sheet regarding product development used the Likert Scale, which contains four criteria that are translated in numbers from 1 to 4, representing (1) poor, (2) low, (3) high, and (4) excellent. The results were then analyzed by calculating each question's percentage of answer item scores. The percentage can be calculated using the following formula.

$$P = \frac{f}{N} \, X \, 100\% \qquad\qquad (1)$$

Information:
P   : Percentage value
F   : Score obtained
N   : The ideal maximum score of the test concerned
The assessment of the converted validation results' Table 1 [24].

Table 1. Feasibility Criteria Percentage

Presentation	Criterion
76% - 100%	Very Feasible
51% - 75%	Feasible
26% -50%	Moderately Feasible
0% - 25%	Less Feasible

3.   RESULTS AND DISCUSSION

This research used the R&D method and Borg and Gall development model adapted by Sugiyono to create Powtoon learning media for grade IV elementary school students on fractional material.

3.1   Potential and Problems

Based on observations and interviews with grade IV teachers, the learning process was conducted using lecturing, causing learning activities to be boring and low in learning enthusiasm. Teachers did not link the material to everyday life, making mathematics less meaningful. The media used was less varied. The teachers only used student books and worksheets available. In addition, learning media training was not optimal, and teachers lacked the knowledge to create learning media.

The Powtoon learning media aligned with the potential problems in grade IV because, according to Piaget's theory, student development emphasizes the development stage and the thinking process to understand the knowledge gained [25]. Media must attract students' attention in the teaching and learning process so that it is easy to stimulate students in learning [26]. Good learning media must meet the requirements of increasing student motivation, stimulating students to remember the material learned, and activating students to respond so that feedback occurs [27].

The researchers identified problems in line with educational needs. Therefore, they developed learning media for mathematics subjects to help students learn mathematics and become motivated, which will produce positive learning outcomes.

3.2   Data Collection

After finding a problem, the researchers analyzed the needs of teachers and students. Teacher and student needs questionnaires were used to assess their references to media that help solve problems [28]. Based on the questionnaire, the students had difficulty learning fractional material. Teachers only used teacher books as learning resources. The learning media were less effective in supporting learning. Teachers used learning media, such as YouTube, but the videos did not match the material presented. Maifit stated that data collection activities involving information and environments are arranged in a planned manner to facilitate students' learning [29] so that students need interesting learning media to support their learning outcomes. It can be concluded that researchers created fractional material Powtoon learning media to increase student understanding of the material.

3.3   Product Design

The product design stage has several stages: collecting references to support media creation, material selection, media content, and content outlines containing the subject matter to be displayed on Powtoon media about fractional material [30]. After all the materials were ready, the next stage was to produce Powtoon learning media. The characters and images were adjusted to the story idea to support achieving the material's content. To ensure product quality, the design, production, and validation stages were conducted so that the functions and learning competencies applied could be achieved [31].

Powtoon media development planning involved creating learning video scenarios based on learning objectives. These videos contained fractional material related to daily life within 7 to 12 minutes.
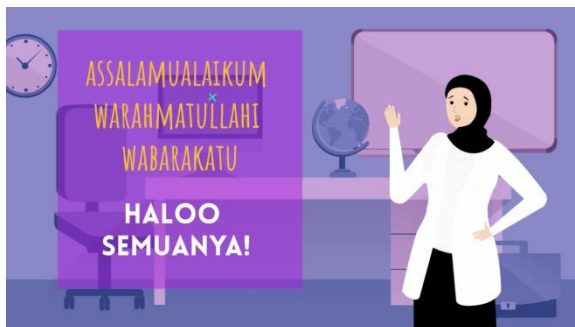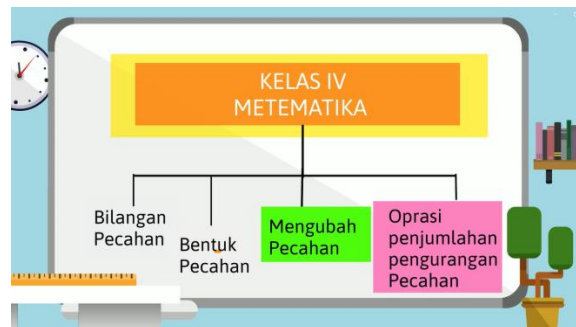
Figure 2. Video Opening
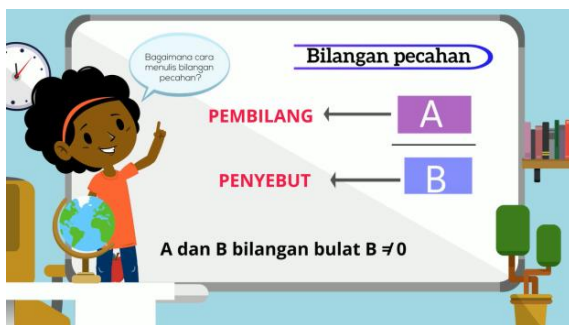

Figure 3. Scope of Material Covered

Figure 4. Core Material

Figure 5. Learning Evaluation

After the product was successfully developed, the final stage was publishing the video through YouTube and Google Drive. Next, the product underwent a media feasibility test through product validation by the media and material expert validators.

3.4 Design Validation

Two validators, one media expert and one material expert, assessed the feasibility of the Powtoon media. Each validation expert provided criticism and suggestions on the validation assessment sheet so researchers could revise it. The media experts used a validation instrument consisting of fourteen indicators stated in four different assessment aspects: learning objectives, the level of development, ease of use, and attractive display design. The validation results were then calculated using the formula [32] presented in Table 2.

Table 2. Media Expert Validation Results

Aspects	Score
Media according to learning objectives	16
According to the level of development of learners	13
Media is easy for students and teachers to use	12
Visually appealing display design	14
Number of scores	55
Percentage	91,6%
Category	Very Feasible

The results of media feasibility validation obtained a score of 55 (91.6%) within a very feasible criterion. The next step was an assessment by a material expert.

The material expert validated content feasibility based on four aspects of assessment: accuracy with learning objectives, students' level of thinking, support for learning content, and suitability of image selection with the material. The results of the expert validation are presented in Table 3.

Table 3. Material Expert Validation Results

Aspects	Score
Accuracy with learning objectives	12
Material according to the level of thinking of students	14
Support for learning content	12
Suitability of the image to the material	13
Number of scores	50
Percentage	89,2%
Category	Very Feasible

The result of the material expert validation is 50 (92%) within the very feasible criteria. Based on the results of assessment validation on each component of learning media by media and material experts, it could be concluded that learning media was suitable for use in the learning process. Some indicators needed to be improved based on the results of assessment validation by both experts. Improvements were made by adding identities and incorrect writing. Empirical studies that support this research were conducted by Ade, which shows that Powtoon learning media is in the very feasible and valid category with a percentage score of 88.87% [33].

3.5 Design Improvements

At this stage, the researchers improved the design. The learning media must be flexible, practical, and durable, so the design was improved according to input and advice from material and media experts [34]. The material expert provided input to adjust goals to the basic competencies and correct the writing.

3.6 Field Trials

The trials were carried out through two stages: small and large groups. Before the large group trial, a small group trial of 6 students was carried out to determine the effectiveness of the learning media. The pretest scores were obtained before the treatment using Powtoon media. At the same time, the posttest score was obtained after students took part in learning fractional material mathematics using Powtoon media. Results from the small-scale trial were calculated using the N-gain test using SPSS 25. Researchers used the purposive sampling technique for test implementation. The results of the N-gain test before and after learning in the small group trial are presented in Table 4.

Table 4. Small Group Test Results

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
NGain	6	.30	1.00	.6059	.23018
Valid N (listwise)	6				

The results of the N-gain test showed an increase in learning outcomes of 0.6059, which was included in the medium category. The average increase in pretest and posttest results using Powtoon learning media is shown in the following figure.
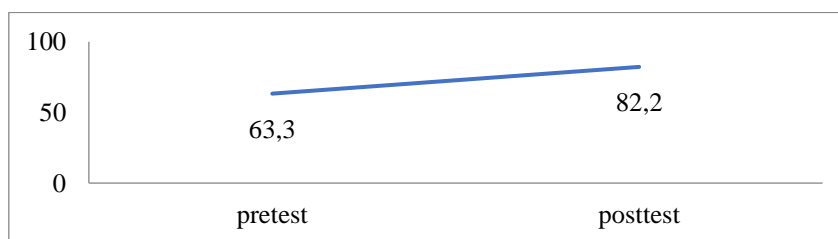
Figure 6. N-Gain Diagram on the Small-Scale Trial

Furthermore, a large group trial was conducted to determine the effect on learning outcomes. The large group trial was conducted with students answering pretest questions, and then teachers and students carried out the learning process using Powtoon learning media. After students received treatment using Powtoon learning media, they answered posttest questions. The learning outcomes are presented in Table 5.

Table 5. Large Group Trial Results

Information	Pretest	Posttest
Number of Students	21	21
Average	59.97	83
Highest value	80	100
Lowest Value	33,3	53.3
Number of Students Complete	2	16

Table 5 shows that the pretest obtained the highest score of 80, while the posttest obtained a score of 100. The lowest score obtained in the pretest was 33.3, while the lowest score of the posttest was 53.3. Only two students completed the pretest, while 16 completed the posttest out of 21.

The results of the data analysis obtained can be tested for normality to be more convincing so that the conclusions do not deviate from the existing truth. The data are said to be normally distributed if Ho is accepted ($t > 0.05$). The results of the pretest and posttest normality tests are displayed in Table 6.

Table 6. Normality Test Results

Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
pretest	.156	21	.200[*]	.963	21	.570
posttest	.181	21	.070	.917	21	.077

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

Based on the Table 6, the sig value in the Shapiro-Wilk column is higher than 0.050 for the pretest (0.570) and posttest (0.077). Based on these data, the pretest and posttest values had a normal distribution. After the values were declared normally distributed, the researchers tested the difference in the average pretest and posttest (t-test) to determine how much influence Powtoon learning media had on student learning outcomes.

The criterion for testing the mean difference is if t-value is lower than $t_{critical}$, Ho is accepted. If $t_{observed}$ is higher than $t_{critical}$, Ha is accepted. If calculated based on significance, Ho is accepted if the sig value is higher than 0.05, and Ha is accepted if the sig value is lower than. Here are the test results to distinguish the average pretest and posttest values using SPSS 25.

Table 7. The Results of t-Test

Paired Samples Test								
	Paired Differences							
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
				Lower	Upper			
Pair 1 pretest - postest	-22.8714	6.1599	1.3442	-25.6754	-20.0675	-17.015	20	.000

Based on the table, the sig value (2-tailed) is 0.000, less than 0.05. It can be concluded that there was a real difference between mathematics learning outcomes in pretest and posttest data. Therefore, Powtoon learning media affected student learning outcomes in grade IV fractional material. After the t-test, the researchers tested the average improvement of students' cognitive outcomes using the N-gain calculation. Table 8 shows the results of the average increase test (Gain) using SPSS 25.

Table 8. N-gain Test

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Ngain	21	.30	1.00	.6331	.23806
Valid N (listwise)	21				

Based on Table 8, the average increase was 0.6331, included in the medium category.

After the learning process, the students filled out a questionnaire on Powtoon learning media. The response questionnaire consisted of 15 indicators of questions. Twenty-one fourth-grade students completed the questionnaire. Table 9 is an analysis of student response assessment data.

Table 9. Percentage of Student Response Results

Assessment Aspect	Percentage	Category
Technical Quality and Presentation of Material	91,6%	Excellent
Presentation of Material Content	89,4%	Excellent
Language and readability of the material	88,6%%	Excellent
Total	89.8%	Excellent

Based on Table 9, the student responses obtained a percentage of 89.8% with an excellent category. Therefore, the Powtoon media can interest students in mathematics subjects in grade IV.

This research has succeeded in developing a Powtoon learning media to improve student learning outcomes in fractional topics. This Powtoon media is innovative because it is more interactive and varied, with diverse animations, so it can motivate students. The development of media is important so that learning continues. Using appropriate learning media can overcome students' bad attitudes and arouse the spirit of learning [35].

Some empirical studies support this research, such as the research conducted by Lativa Qurrotaini with the title The Effectiveness of the Use of Powtoon Video Media in Online Learning [36]. The results of the study show that Powtoon can improve the quality of the teaching and learning process. The material presented using the Powtoon application becomes clearer and more real and students easily understand the material. Norlaili conducted another research. The study results showed a product feasibility value of 4.80 within the feasible category. The Powtoon-based animation video produced fulfilled the main role of learning media as a mediation tool for conveying certain information or messages to students [37]. Other research results also show that Powtoon is effective across various student groups on different subjects, enhancing students' learning outcomes to be more optimal [38].

Learning media is designed with the aim for students to understand the material taught and improve their learning outcomes [17]. The practical implications of this research concern the impact of the research findings on the subsequent learning implementation process. The following are the practical implications of this study: (1) learning using Powtoon learning media creates a fun learning atmosphere and increases

learning effectiveness; (2) providing convenience to students in understanding fractional material for grade IV elementary school; (3) fostering student learning motivation and increasing student enthusiasm; (4) improving student learning outcomes in fractional materials for mathematics subjects in grade IV elementary school; (5) Powtoon learning media can be used as a means of introducing media to students; (6) It makes learning easier in the classroom, help teachers communicate learning content, and creates a fun learning atmosphere [38]. The theoretical implications are research results with supporting theories, such as applying Powtoon learning media can increase student learning motivation [39]. Powtoon media positively impacts learning outcomes, as evidenced by improving students' ability to answer questions after learning using Powtoon media [40].

4. CONCLUSION

The product developed in this study is a Powtoon learning media in the mathematics subject of fractional material. The results of the feasibility evaluation from the media expert was 91.6%, and from the material expert was 89.2%, within the very feasible category. The significant effect of the Powtoon learning media was evidenced by the t-test of 0.000. An average increase of 0.6331 in the medium category was obtained from the N-gain test. The suggestion for the next research is that the Powtoon learning media in the mathematics subject of fractional material can be further researched to determine the interest in learning and the relationship with student motivation. The impact of this research on education is very significant; it utilizes technology to develop learning media to increase student engagement and learning outcomes. This research emphasizes learning technology to make learning materials easier to use and interesting for students.

AUTHOR CONTRIBUTION STATEMENT

NA contributed to making observations and conducting interviews at schools used as research sites to gather information about the problems faced, creating learning media, conducting research, and writing journals using the data obtained. AJ contributed to guiding, directing, and evaluating the authors in journal creation.

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