



“Peta Numerasi Banyuwangi”: Mathematical Games as Strengthening Proportion Concepts at Middle School Level

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A B S T R A K	A R T I C L E I N F O
<p><i>Numerasi merupakan kemampuan dasar yang perlu dimiliki siswa untuk memahami dan menggunakan konsep matematika dalam kehidupan sehari-hari. Salah satu konsep matematika yang perlu diperkuat pemahamannya adalah perbandingan. Keterampilan siswa untuk membedakan konsep perbandingan senilai dan berbalik nilai dapat dikembangkan melalui permainan matematika yang dipadukan dengan konteks wisata. Banyuwangi adalah salah satu kabupaten yang memiliki banyak tempat wisata di tiap kecamatannya. Penelitian ini bertujuan menghasilkan produk dan mengetahui kualitas hasil pengembangan media permainan matematika berbasis numerasi konsep perbandingan dengan konteks wisata di Banyuwangi. Pengembangan dilakukan dengan model ADDIE (Analysis, Design, Development, Implementation, Evaluation). Produk media permainan dinamakan Peta Numerasi Banyuwangi, yang dikemas dalam bentuk peta, kartu soal, serta pion. Implementasi dilakukan di salah satu SMP di Rogojampi Banyuwangi dengan responden sebanyak 6 orang siswa kelas VII. Hasil penelitian menunjukkan produk media valid, praktis, dan efektif menurut penilaian ahli, tetapi belum praktis dan efektif dalam penilaian pengguna. Kondisi ini menjadi dasar untuk dilakukan implementasi kembali pada responden lain di tingkat yang sama. Selain itu, produk media juga masih memiliki peluang untuk dikembangkan lagi dengan basis konsep matematika lainnya.</i></p>	<p>Article History: <i>Received: 2025-08-16 Revision: 2025-08-16 Accepted: 2026-03-05 Published: 2026-05-01</i></p> <p>Kata Kunci: <i>Konsep Perbandingan Kualitas Produk Media Permainan Peta Numerasi Banyuwangi Pengembangan Media</i></p>
<p>A B S T R A C T</p>	
<p><i>Numeracy is a basic skill needed by students to understand and use mathematical concepts in everyday life. Proportion is one concept that needs to be strengthened. Students’ skills in distinguishing the concepts of equivalent and inverse proportions can be developed through mathematical games integrated with the</i></p>	<p>Keywords: <i>Banyuwangi Numeracy Map Gaming Media Media Development Product Quality Proportion Concept</i></p>

tourism context. Banyuwangi is a regency with many tourist attractions in each sub-district. This study aims to produce and determine the quality of mathematical game based on the concept of proportion numeracy with the tourism context in Banyuwangi. Development was carried out using the ADDIE (Analysis, Design, Development, Implementation, Evaluation) model. The game is called “Peta Numerasi Banyuwangi”, which is packaged in the form of a map, question cards, and pawns. The product was implemented in one of the Junior High Schools in Rogojampi Banyuwangi with 6 grade VII students as respondents. The results indicate that the media is valid, practical, and effective according to expert assessments, but not yet in user assessments. This condition becomes the basis for re-implementation with other respondents at the same level. In addition, the media also still has opportunities to be developed further based on other mathematical concepts.

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1. INTRODUCTION

Numeracy is the ability to understand (Khakima et al., 2021), and apply (Wirawan & Nindiasari, 2024) the concepts of number and mathematical operations in everyday life. Numeracy is also defined as the ability to use quantitative and spatial information to solve everyday problems (Panglipur & Yana, 2023). In addition to understand concepts, numeracy also focuses on the skills and abilities to apply number concepts. Thus, numeracy can be understood as a form of ability that involves a deep understanding of various mathematical facts, concepts, and procedures, as well as their application to solve problems in everyday life.

Numeracy is crucial for solving everyday mathematical problems (Yunarti & Amanda, 2022), as it can help students develop sensitivity to data presentation, patterns, and number sequences; train reasoning skills for problem-solving (Purwati et al., 2023); and improve students' mathematics learning outcomes by honing critical and analytical thinking skills, particularly in understanding problems involving data presented in tables, graphs, or diagrams (Syawaludin, 2024). However, not all students at various levels have good numeracy skills. Some of the causes of low student numeracy include: the learning process is still teacher-centred, lack of understanding of problems in the form of numeracy questions, students do not fully understand the problems presented in the questions and lack of habit in answering questions that are appropriate to everyday problems/literacy questions, students have difficulty creating mathematical models of problems in everyday life, mathematics curriculum in Indonesia places more emphasis on procedural matters than problem solving (Nasiba, 2022; Nurhayati et al., 2022; Nurwahid & Ashar, 2022; Rahmawati, 2022).

One topic in mathematics that is perceived as not being fully understood within a numeracy framework is proportion. Several previous studies have shown that proportion is still difficult for students. Yonantha et al. (2022) explained that students are less able to differentiate a problem into direct and indirect proportion. Lawuna (2022) also noted that students still struggle with solving direct and indirect proportion problems. Pebrianti and Ambarawati (2024) explained that the concept of proportion is difficult for seventh-grade students to grasp, even though the material is frequently used in everyday life. This conditions indicate the need for developing learning innovations to improve numeracy in the concept of proportion.

The various numeracy fundamentals that students have not yet mastered indicate the need for positive efforts to improve their numeracy skills (Mumpuni et al., 2022). One such effort is optimizing the use of learning media. Learning media are all forms, both physical and technical, used in the learning process to assist teachers in delivering learning materials to students and facilitate the achievement of predetermined learning objectives (Adam & Syastra, 2015). Tafonao (2018) explains that learning media is a teaching aid for teachers in delivering lesson materials, increasing student creativity and attracting students' attention in the learning process so that students will be more motivated to learn, as well as encouraging students' abilities to write, speak and imagine.

The use of media in learning (especially mathematics) can help students reveal various abstract mathematical concepts into reality, thereby fostering motivation and enthusiasm in learning mathematics (Saputra & Permata, 2018); arousing desire, interest, motivation and stimulation of learning activities (Hamalik in Sari, 2018); helping achieve the effectiveness of the learning process and the delivery of messages and content of learning materials (Wulandari et al., 2023). One media that can make learning more enjoyable is games. The use of innovative

and engaging games can improve students' learning outcomes and conceptual understanding (Anisa et al., 2023), and challenge students to win (Handayani & Fathoni, 2024). Therefore, teachers can be creative in developing games as learning media, utilizing various games students are already familiar with or creating new games.

Hayati and Putro (2021) define games as activities controlled and characterized by mutually agreed-upon rules that provide learning experiences for the players. Games also create opportunities for students to interact socially with classmates, improve teamwork, and strengthen interpersonal relationships (Suhendar & Yanto, 2023). These two definitions indicate that games can also be used in learning, including mathematics. Binsasi et al. (2019) explain that math games are one way to build student interest and are a good way to prevent students from getting bored while learning.

Several games have been integrated into mathematics learning as a media to enhance or reinforce students' mathematical concepts. Research by Kurniati et al. (2022) demonstrated that learning using crossword puzzles (TTS) on integer operations was highly practical, motivating, and easy to use. Another study demonstrated that the development of Mahjong Math games on plane and solid shapes in ninth-grade junior high school met the criteria for validity, practicality, and effectiveness based on expert and user assessments (Jannah et al., 2024). The ludo game applied to the topic of lines and angles in grade VII of junior high school is also effective in increasing student activeness in learning (Duarmas et al., 2022). The Zonira Treasure Map games used in grade VIII of junior high school is said to be able to stimulate student creativity in learning and understanding algebra material (Andika & Adityawan, 2018). The results of these studies indicate that no mathematical game has been developed based on a map of a region with a numeracy concept. Therefore, a game based on a map of Banyuwangi Regency was developed by applying the concept of numeracy to the proportion material.

The Banyuwangi map became the basis for a mathematical game media because of the many tourist attractions in each district in Banyuwangi, but there are still students who do not understand it. In addition, the game was also developed with the aim of strengthening numeracy skills, especially in the proportion material. This game was developed under the name "*Peta Numerasi Banyuwangi*" (Banyuwangi Numeracy Map), with special characteristics, namely: (1) using a map of Banyuwangi district; (2) applying problems at tourist locations; and (3) applying numeracy, especially the proportion material. This study aims to develop and determining the quality of the results of the development of the "*Peta Numerasi Banyuwangi*" game media.

2. METHOD

This research was conducted to develop and determine the quality of the developed product. A product is considered to be of good quality if it meets the criteria of validity, practicality, and effectiveness based on expert and user assessments (Nievenn in Hobri, 2021). The development was conducted using the ADDIE model, which consists of five stages: analysis, design, development, implementation, and evaluation (Gagne in Mulyasari et al., 2023). Product quality testing was conducted at the development (expert assessment) and implementation (user assessment) stages. The research was conducted based on the following flow.

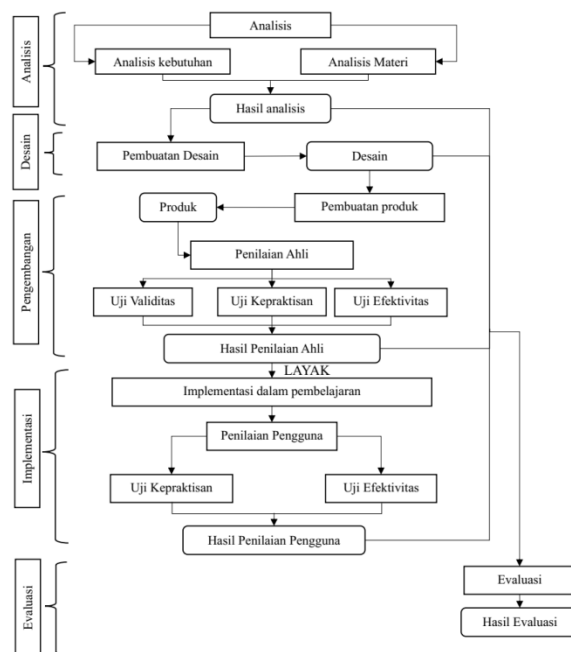


Figure 1. Research Flow

The development was conducted at PGRI Banyuwangi University. The user assessment (product trial) was conducted at a junior high school in Rogojampi, Banyuwangi, which was selected purposively. Initial observations indicate that proportion material had been provided to seventh-grade students. Identification of the six seventh-grade students revealed that three of them were able to solve proportion problems but still had difficulty distinguishing the types of proportions, while the other three students were unable to solve the proportion problems properly. These six students then became respondents in the product trial.

Expert assessment was conducted by one lecturer in the Mathematics Education Study Program and one mathematics teacher who were purposively selected based on their expertise. Experts assessed validity, practicability, and effectiveness based on predetermined criteria using a questionnaire instrument with a Likert scale whose midpoint was removed to eliminate the expert’s choice of a neutral scale so that the results were reliable (Nopembri et al., 2017). The expert assessment indicators are determined as in Table 1 below.

Table 1. Expert Assessment Indicators

Validity Assessment Indicators	Practicality Assessment Indicators	Effectiveness Assessment Indicators
1. Suitability of media products with learning outcomes	Students can solve the questions	Media can increase students’ enthusiasm for learning
2. Suitability of material to students’ cognitive development phases	Images and text are understandable	Media can make mathematics learning more interesting
3. Clarity of writing material and questions in the “Peta Numerasi Banyuwangi” media	Products are easy to use	Media can improve students’ skills in solving proportion problems
4. Suitability of layout on the “Peta Numerasi Banyuwangi”	Instructions are clear	-
5. Use of communicative language on numeration cards	Use of communicative language	-

The data obtained from the expert assessment questionnaire were then analyzed using a formula adapted from Hobri (2021) as follows.

$$I_i = \frac{\sum_{j=1}^n V_{ji}}{n} \tag{1}$$

$$V_a = IP = IE = \frac{\sum_{i=1}^n I_i}{n} \tag{2}$$

where V_{ji} is the value data of the $-j$ against the $-i$ indicator; n is the number of indicators; I_i is the average value of the $-i$ indicator; V_a is the average value of the total validity for all indicators; IP is the average value of the total practicability for all indicators; and IE is the average value of the total effectiveness for all indicators.

The results of the subsequent analysis were adjusted according to the assessment criteria determined by Hobri (2021), as shown in Table 2 below.

Table 2. Expert Assessment Criteria

Interval	Validity Criteria	Practicality Criteria	Effectiveness Criteria
$1 \leq V_a = IP = IE < 2$	Invalid	Very Low	Very Low
$2 \leq V_a = IP = IE < 3$	Less Valid	Low	Low
$3 \leq V_a = IP = IE < 4$	Quite Valid	Curently	Curently
$4 \leq V_a = IP = IE < 5$	Valid	High	High
$V_a = IP = IE = 5$	Very Valid	Very High	Very High

A product is said to have good validity if it at least meets the valid criteria; and has good practicability and effectiveness if it as least meets the high criteria (Hobri, 2021).

The user assessment is carried out to determine the practicability and effectiveness of products. The assessment is carried out in the form of observations assisted by an observation questionnaire sheet which contains two options on the Guttman scale. The assessment indicators are as in Table 3 below.

Table 3. User Assessment Indicators

Practicality Assessment Indicators	Effectiveness Assessment Indicators
1. Players can use media according to game instructions	Players can complete each question within a maximum of 5 minutes
2. Players can understand and correctly solve the given problems	Time taken to complete the game \leq 45 minutes

Note: The timing rules are based on a trial run conducted by perospective mathematics teachers, which average 15 minutes. In accordance with the learning evaluation rules, which require students to spend as least three times the teacher’s, students are expected to complete the game in 45 minutes or less.

The practicality and effectiveness data based on users are analyzed according to the achievement of all indicators in Table 3. So, the “*Peta Numerasi Banyuwangi*” game is said to have good quality if it meets: (1) the average total validity value is $4 \leq V_a \leq 5$; (2) the average total practicality value is $4 \leq IP \leq 5$ and meets the practicality assessment indicators by users; (3) the average total effectiveness value is $4 \leq IE \leq 5$ and meets the effectiveness assessment indicators by users.

3. RESULTS AND DISCUSSION

The research results are described in the following five ADDIE stages:

Analysis

In this stages, needs analysis and materials analysis were conducted. The needs was conducted by reviewing the results of previous research. The results indicated problems in the

mathematics learning process for proportion materials, including a lack of supporting media and students' lack of understanding of how to differentiate between direct and indirect proportion (Lawuna, 2022; Mahmudah et al., 2018; Yonantha et al., 2022).

Based on these issues, a mathematics learning media was developed using *lectora inspire software* for proportion material. The results indicate that the media is suitable for use as a mathematics learning for proportion material, with a percentage of students completing the trial of 74%. The use of software-based media is very interesting and in line with current educational developments that prioritize AI as a support. However, not all schools can implement AI optimally. Therefore, manipulative media is still needed to support student understanding. Furthermore, it is important to highlight local wisdom to increase students' love for their region.

Material analysis was conducted by reviewing the learning outcomes of the 2024 revised edition of the *merdeka* curriculum (Kemendikbudristek, 2024). Based on the results of the analysis, the development of this media was limited to the material of direct and indirect proportions. The curriculum used as development material was the *merdeka* curriculum phase D on the number element with the learning outcome "at the end of phase D students can use prime factorization and the understanding of ratios (scale, proportion, and rate of change) in solving problems". These learning outcomes were developed into two learning objectives, namely students can solve problems related to: (1) direct proportions; and (2) indirect proportions.

Design

In this stage, the content of the "*Peta Numerasi Banyuwangi*" game was designed. Based on the analysis, the objective of developing the game was to reinforce the concept of direct and indirect proportions. The game was designed as a map board equipped with question cards. The design included images, a grid for the question cards, and game guidelines. The map board was designed to reflect the Banyuwangi Regency, including its sub-districts. The question cards were designed as numeracy-based problems based on the conditions of each tourist destination, with a grid as shown in Table 4 below.

Table 4. Grid of Question Cards for the "*Peta Numerasi Banyuwangi*" Game

Learning Objectives	Indicators
1. Students will be able to solve problems related to direct proportions	Students can solve problems related to direct proportion according to the specified tourist location
2. Students will be able to solve problems related to indirect proportions	Students can solve problems related to indirect proportion according to the specified tourist location

The pawns are prepared in two colors to differentiate the two players.

The "*Peta Numerasi Banyuwangi*" game is designed to be played by two people with the following steps: (1) both players stand facing the game board; (2) both players suit to determine the order of playing steps; (3) the first player chooses a number card at random and does the problem; (4) if the answer is correct, the player can place the pawn on the number on map; (5) conversely, if the answer is wrong, the player may not place the pawn on the number on map and the game moves to the second player who completes the same problem; (6) next, if the answer is wrong, the opposing player can choose a numeracy card at random and work on the problem; (7) the provisions for placing pawns are the same as for the first player; (8) and so on

until the game time is declared over. The winner is the player who can place the most pawns on the map. The time used in the game is ≤ 45 minutes. The design will then be realized into a media in the development stage.

Development

In this stage, the “Peta Numerasi Banyuwangi” board is printed according to the designed image. The materials needed for this development process are 50×33 cm impraboard, art paper, and sticker paper. Furthermore, the question card grid is also developed into question cards, along with a guide to solving them. An example of the results of the question card development is shown in Figure 2.

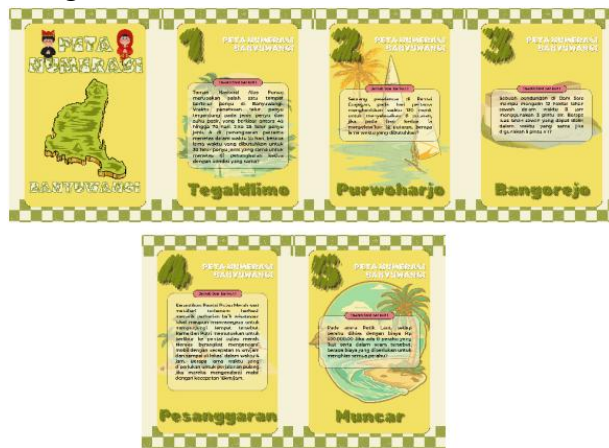


Figure 2. Printed of the “Peta Numerasi Banyuwangi” Game Question Cards

The media quality assessment by experts was conducted by two validators. The first validator (V_1) was a lecturer, and the second validator (V_2) was a mathematics teacher who met the criteria. The expert assessment results were divided into three sections: validity, practicability, and effectiveness. Based on the expert assessment indicators in Table 1, the assessment results can be summarized as in Table 5 below.

Table 5. Expert Assessment Results

Indicator	Assessment Results					
	Validity		Practicality		Effectiveness	
	V_1	V_2	V_1	V_2	V_1	V_2
1	4	4	5	4	4	4
2	5	4	4	5	4	5
3	5	5	4	5	4	4
4	4	5	4	2	-	-
5	4	4	4	4	-	-

The data in Table 5 were then analyzed using formulas (1) and (2) to obtain $V_a = 4,4$, $IP = 4,1$, and $IE = 4,16$. These three results were adjusted to the expert assessment criteria in Table 2 and it can be concluded that the “Peta Numerasi Banyuwangi” game is valid and has a high level of practicability and effectiveness based on expert assessment.

Although the product has been declared to be of good quality by experts, there are several suggestions for improvement that can be accepted and implemented to perfect this product. V_1 suggests that: (1) several questions be improved because they do not match learning outcomes and facts; (2) consider writing the name of the tourist attraction next to the description of each sub-district on the game board to make it more interesting; (3) the game rules are made so that players are free to choose the tourist destination; and (4) consideration is given to conducting limited learning to monitor the correctness of students’ answers. V_2 suggests: (1) modifying the

game board so that it is more practical, foldable, and easy to carry; and (2) clarifying the game steps. After improvements are made according to expert suggestions, the development process continues to the implementation stage.

Implementation

Based on expert advice, the “*Peta Numerasi Banyuwangi*” game board, which was originally without descriptions of tourist attractions, was changed as in Figure 3 below.



Figure 3. (a) Initial Design of the “Peta Numerasi Banyuwangi” Game Board, (b) Improvement Results of the “Peta Numerasi Banyuwangi” Game Board

Implementation was carried out at SMPK Bakti Rogojampi Banyuwangi. Respondents who were product users consisted of 6 students ($S_1, S_2, S_3, S_4, S_5, S_6$) class VII who had previously received proportion material. Some documentation of implementation activities is presented in Figure 4 below.



Figure 4. Documentation of the “Peta Numerasi Banyuwangi” Learning Trial

The implementation process began with an apperception session regarding the direct and indirect proportions. Next, students were given instructions on the procedures and rules of the “*Peta Numerasi Banyuwangi*” game. Students were divided into three groups of two students each. Group 1 consisted of S_1 and S_2 , group 2 consisted of S_3 and S_4 , and group 3 consisted of S_5 and S_6 . The game was played by each group, and the process was observed by an observer.

Observations on the practicality component showed that all six students were able to play the game according to the instructions given, but none of them met the second indicator, which is understanding and solving the problems correctly. This condition is supported by observations on the effectiveness component, summarized in Table 6 below.

Table 6. Product Effectiveness Observation Data

Students	Question Codes	True/False Questions	Question Duration (minutes)	Total Duration for Each Question (minutes)	Total game Duration (minutes)
1. S_1	20	S	4	22	43
	2	B	5		

Students	Question Codes	True/False Questions	Question Duration (minutes)	Total Duration for Each Question (minutes)	Total game Duration (minutes)			
2.	S_2	12	S	4	21			
		21	B	4				
		8	S	5				
		20	B	4				
		13	B	5				
		12	S	4				
3.	S_3	24	B	4	19			
		8	S	4				
		23	S	5				
		24	S	4				
		10	S	5				
		6	S	5				
4.	S_4	23	S	4	22			
		24	S	5				
		3	B	4				
		10	S	5				
		6	S	4				
		16	S	3				
5.	S_5	15	B	3	21			
		19	B	4				
		3	B	4				
		7	B	3				
		23	B	4				
		16	S	4				
6.	S_6	12	B	5	22			
		21	B	4				
		10	B	4				
		14	B	5				
		AVERAGE GAME DURATION					42,33	

Table 6 above shows that a game can be completed in an average time of < 45 minutes. Furthermore, each player is known to be able to complete each problem in ≤ 5 minutes. Both conditions indicate that the media product meets the requirements for effectiveness, according to the indicators in Table 3. However, Table 6 also shows that student work results are not yet optimally accurate. This means that the media product cannot be fully considered practical and effective by users.

The results of the user-based practicality and effectiveness assessments require further investigation to identify any shortcomings. Additional data collection was conducted through interviews with six student users of the product. The interview results are summarized in the following table.

Table 7. Additional Interview Results with Students as Product Users

Student	Interview Results
S_1	<ul style="list-style-type: none"> • Students can re-explain the information contained in the problem and determine the corresponding variables in problems 8 and 12 • Students can differentiate between direct and indirect proportions, but cannot define problems related to the concept of indirect proportions

Student	Interview Results
	<ul style="list-style-type: none"> • Students state that the problem error occurred because they were not careful when performing multiplication and division operations
S_2	<ul style="list-style-type: none"> • Students can re-explain the information contained in the problem and determine the corresponding variables in problems 8 and 12 • Students can differentiate and define the concepts of direct and indirect proportions • Students state that errors in solving the problem occurred because they were not careful when performing multiplication and division operations
S_3	<ul style="list-style-type: none"> • Students understand and can differentiate between the types of proportions in questions 23 and 24, but this is not the case for questions 6 and 10 • Students cannot differentiate between the concepts of direct and indirect proportions • Students stated that errors in working on the questions occurred because they did not understand the information in the questions and still had difficulty performing multiplication and division operations
S_4	<ul style="list-style-type: none"> • Students understand and can differentiate the types of proportions in questions 6, 10, and 23, but this is not the case with question 24 • Students cannot define the concept of direct and indirect proportions • Students stated that errors in working on the questions occurred because they did not understand the problem and had difficulty performing multiplication operations
S_5	<ul style="list-style-type: none"> • Students can understand and differentiate between types of proportions in question 16 • Students can differentiate and define the concepts of direct and indirect proportions • Students state that errors in completing the question occurred due to a lack of careful consideration in determining the results of division operations
S_6	<ul style="list-style-type: none"> • Students can understand and differentiate between types of proportions in question 16 • Students can differentiate and define the concepts of direct and indirect proportions • Students state that errors in completing the question occurred due to a lack of careful consideration in determining the results of division operations

The interview results above show that only four out of six students, namely S_1 , S_2 , S_5 , and S_6 , understood the concept of direct and indirect proportions. However, in several problems, students were still less careful and made errors in the calculation process, especially those involving multiplication and division operations. These problems include questions 8, 12, and 16. A different condition was experienced by S_3 and S_4 , who still had difficulty distinguishing the concept of direct and indirect proportions. In addition, both students were also less skilled at performing multiplication and division operations. This condition shows that understanding the concept of arithmetic operations on numbers is a support in solving problems related to other mathematical concepts.

In-depth observations made during the game (via video recording) showed that S_2 was able to play the game according to the game instructions and was able to understand and solve three problems correctly. His opponent, S_1 , was also able to play the game according to the game instructions but was only able to solve two problems correctly. S_3 was able to play the game according to the game instructions but was not able to understand and solve the problems correctly. His opponent, S_4 , understood the game instructions but did not yet understand the questions and could only solve one problem correctly. S_5 and S_6 were able to play the game according to the instructions. Both students understood the questions, but S_5 solved five problems correctly and S_6 solved four.

Evaluation

The evaluation in this study was formative, meaning that evaluations were conducted at the end of each of the four previous stages. This evaluation stage also served as a discussion of the various results obtained in the previous four stages. The analysis stage identified the need to develop media to strengthen students' understanding of proportion material, which they considered to be quite abstract. This is supported by research by Sagita and Kania (2019), which emphasized that learning mathematics with abstract concepts requires the support of media to enable students to grasp the concepts in a concrete way. The materials were developed based on the mathematics learning outcomes of the *merdeka* curriculum (Kemendikbudristek, 2024).

Furthermore, a need to increase understanding and appreciation for local wisdom, particularly tourism in Banyuwangi, was identified. This finding is supported by preliminary research conducted by Zulfah and Insani (2020), which showed that junior high school students in Riau Province were interested in a variety of questions that incorporated the context of local wisdom and Riau's tourist attractions because they resided there. The results of this needs analysis formed the basis for the design of the "*Peta Numerasi Banyuwangi*" game.

The "*Peta Numerasi Banyuwangi*" game media design was created with the aim of strengthening the concept of proportion, specifically to help students distinguish between problems involving direct and indirect proportions. The concept of proportion is integrated into various problems contextualized to tourist attractions in Banyuwangi. The design is made to engage students in learning while playing with it. This is supported by Agustira and Rahmi (2022), who stated that engaging, easy-to-understand, and tailored learning media can help improve student concentration. The design is presented in the form of images and question card grids to facilitate checking the writing and content.

The "*Peta Numerasi Banyuwangi*" game was developed according to the design and resulted in a board game complete with question cards. The product was then assessed for feasibility by experts and users. Expert assessments indicated that the product was valid, feasible for testing (practical), and potentially effective in strengthening the concepts of direct and direct proportion. The results of the expert assessment indicate that the media is in accordance with the competencies that students need to achieve and fulfills the characteristics of learning media. This is in accordance with the requirements for media development as stated by Asyhari and Silvia (2016), that the media must fulfill the following factors: (1) educational, that the learning media is in accordance with the objectives or competencies that have been determined and must be achieved by students in the applicable curriculum; (2) manufacturing techniques, that the media in accordance with scientific concepts, and fulfilling the requirements for the condition of the material and form of the media (strong, durable, and not easily changed); and (3) beauty, that the media has artistic form, appropriate size, accurate and attractive color combinations, so that it is able to attract attention and increase students' interest in using it.

The results of expert assessments serve as the basis for implementing media in learning. This aligns with the opinion of Suarsini et al. (2020) who explained that expert feasibility testing is necessary before a product is used by students. Implementation is carried out as a product trial process to determine its practicability and effectiveness by users. The users were selected as ninth-grade students at SMPK Bakti Rogojampi who had already learned the

concept of proportion in their learning but were still not optimal in distinguishing the concepts of direct and indirect proportion.

The results of user assessments indicate that the product is not yet fully practical and effective because many users still make errors in solving the questions in the game. This condition became the basis for further investigation in the form of student interviews. These interviews are as additional data collection technique used to determine the causes of student errors. This finding is supported by Raharjanti et al. (2016), who stated that investigating the causes of student errors in solving problems can be done through additional interviews. The results of the interview investigation showed that 2 out of 6 students still had difficulty distinguishing between the concepts of direct and indirect proportions. Furthermore, students who had no difficulty distinguishing between the concepts of proportions actually had difficulty performing multiplication and division. This is an interesting finding, indicating that arithmetic operations are a basic concept needed in solving problems in mathematics. This is supported by Singh's opinion (in Raharjanti et al., 2016) that a sufficient understanding of the concepts of multiplication and division is necessary so that students can see their relevance in the problem-solving process.

The results of this implementation cannot be used as a definitive assessment of the practicality and effectiveness of the “*Peta Numerasi Banyuwangi*” game. Further research on other users at the same level is needed to truly understand the feasibility and impact of using this game. As a new product, this game has been registered and copyrighted by the Ministry of Law and Human Rights under creation number EC002025108748 (Hidayat et al., 2025). This means that the “*Peta Numerasi Banyuwangi*” game has been recognized as a new product, which can be used or developed by others with the creator's permission.

4. CONCLUSION

The research aims to develop a “*Peta Numerasi Banyuwangi*” game media based on proportion material. Specifically, this media is expected to be used by students in grade VII of junior high school. The results of the study indicate that the media meets the requirements of validity, practicability, and effectiveness based on expert assessment, but does not meet the requirements of practicability and effectiveness based on user assessment. Four out of six users were unable to solve the questions in the game correctly due to an inadequate understanding of the concept of proportion, as well as a lack of skill in performing multiplication and division operations. Therefore, the “*Peta Numerasi Banyuwangi*” game media cannot be said to be of good quality. The quality of this product needs to be further explored with other users at the same level. The media can also be developed with other material bases.

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