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GAME DEVELOPMENT "*GEMAS* (MODIFIED DIVISION ENGKLEK GAME)" TO IMPROVE UNDERSTANDING OF CONCEPTS IN CLASS II ELEMENTARY SCHOOL STUDENTS

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Abstract
This research aims to develop a game "*GEMAS* (Modified Division Engklek Game)" to improve understanding of concepts for class II elementary school students that meet the criteria of valid, practical and effective. This research uses R&D research with the ASSURE development model. Participants in this research were 16 students. Data collected through questionnaires and tests. The collected data was analyzed through descriptive statistics, paired sample t-test and n-gain test. Based on the research results, it shows that the game *GEMAS* very worthy to use, where the average score from the validation results of media experts is 99% and material experts 77% . The results of the analysis are related to the practicality of the game *GEMAS* very practical, where the teacher response was 99% and student response was 99,4%. Based on the test scores for understanding the concept of division, the average results were obtained *pretest* 62 and *posttest* 85,44 there was an increase of 0,64 in the medium category. As well as the results of the paired sample t-test, the Sig value was obtained. (2-tailed) of 0,000 < 0,05. So, it can be concluded that game media *GEMAS* can be declared effective in increasing students' understanding of the concept of division.
Keywords: Engklek game, ASSURE model, division

INTRODUCTION

Mathematics is a subject taught in elementary schools to equip and develop students' abilities to think logically, critically, systematically and creatively. This ability is needed so that students are able to collect, process and use information in dealing with problems life is increasingly global and competitive (Sosyawati, 2019). Learning mathematics can hone and develop various thinking abilities. Mathematics is composed of concepts that systematic, ranging from simple to complex, systematic and interconnected. The aim of learning mathematics is for students to master the concepts they have learned, to use models as hypotheses to solve problems, to solve internal and external mathematical problems (Syaifar et al., 2022)

Mathematics is often considered a scary subject for elementary school students (Ferryka, 2017). Mathematics is often considered the most difficult subject for students to understand (Harahap et al., 2022). Students experience difficulties in learning mathematics so that students believe that mathematics is very difficult for elementary school students (Kuswidyanarko et al., 2021). One of the materials that students consider difficult is division (Sari et al., 2022). Division is the most

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difficult arithmetic operation to learn among other arithmetic operations that 12 out of 24 students have not reached the target completeness score or 50% of the completeness score, this is because there are no teachers who use a learning approach that suits the students' characteristics and students only memorize it without applying the division procedure correctly (Fauzan et al., 2020). Students experience difficulties in dividing two numbers because students have difficulty moving numbers, so students do not understand and cannot work on the questions given by the teacher (Muthma'innah, 2021). Meanwhile, students experience difficulties in division material because teachers use conventional learning models so students are still confused about how to divide numbers (Sari et al., 2022). Students also experience difficulties with division material because they do not understand the concept of division, are not thorough enough, and only memorize it (Jayadi, 2022).

The research carried out above is in line with the results of observations carried out on October 7 2023 at MI Al-Hidayah GUPPI in mathematics subjects, problems were found, namely a lack of understanding of students' concepts in division material and students' lack of activity in learning mathematics. This is because the methods used by teachers are less varied and there is a lack of learning media. This is also reinforced by the results of the student needs questionnaire which stated that 62,5% of the distribution material was difficult material, 75% of the lecture method was often used by teachers, and 93,75% of students preferred traditional games to digital games. It can be concluded that the majority of class II students at MI Al-Hidayah GUPPI need learning media in the form of traditional games to improve understanding of concepts in division material.

On the other hand, mathematics, especially division material, is very important for students to understand because it is related to everyday life. Therefore, teachers must be able to choose the right learning method for students to encourage their enthusiasm for learning (Fatayan et al., 2022). As well as Teachers should make the learning process as interesting as possible, namely by choosing learning methods that suit students' conditions and can train students to learn actively (Nisa et al., 2023). Apart from that, teachers must be able to create an interesting and inspiring mathematics learning atmosphere. One method that can be used by teachers is through games, games can increase students' understanding of concepts, especially in division material because they can find out the origins of material concepts in a realistic way, thus making the learning atmosphere more lively, and students more enthusiastic (Jayadi, 2022).

Engklek is a traditional game that can be used as a way to learn mathematics. The engklek game is played by jumping with one foot from one box to another and using a flat surface as the playing surface (Sundari & Siregar, 2023). In the engklek game, students will learn to master, work together, think critically based on the use of media and practice fine motor skills (Aktorida et al., 2022). There are many benefits of traditional engklek games that can be developed by children, namely children who play engklek can train their balance, motor skills, creativity, practice social skills with friends and the community (Sari & Raihana, 2021). Apart from that, the engklek game can increase children's enthusiasm and

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motivation to play and develop their gross motor skills, and add a variety of more innovative learning media (Pratiwi, 2021).

Understanding comes from the basic word, namely understand. Understanding is having extensive knowledge of something, while comprehension is the activity of understanding a problem. A concept is a basic unit of cognition formed from knowledge schemas, connection patterns used to group objects into categories (Radiusman, 2020). Understanding mathematical concepts is the ability to master material and the ability to understand, absorb, master and apply it in mathematics learning (Yuliani et al., 2018).

The division arithmetic operation introduces the concept of division first. If students understand the concept of division it will help them in carrying out these calculations. Division is a process carried out by repeated subtraction (Susanti et al., 2020). Division is the opposite of multiplication. Division is repeated subtraction until it is finished. The prerequisite skills that students must have in learning the concept of division are subtraction and multiplication (Azhari et al., 2023)

Based on previous research, conducted by Widyastuti, Malik & Razak (2020) researched the effectiveness of the traditional engklek game in improving students' mathematics learning outcomes, the results of their research show that the traditional engklek game is effective in improving students' mathematics learning outcomes. Apsari, Atikaningrum, Pramesta & Mariana (2022) researched the implementation of ethnomathematics-based RME material on the characteristics of flat shapes using the engklek game, the results of their research showed that the engklek game could improve mathematics learning outcomes. Mulyasari, Abdussakir & Rosikhoh (2021) researched the effectiveness of ethnomathematics learning using the engklek game on elementary school students' understanding of geometric concepts. The results of their research showed that ethnomathematics learning using the engklek game was effective in increasing students' understanding of geometric concepts.

Murni (2022) researched the application of the traditional dakon edutainment game in an effort to improve students' ability to do simple division, the results of his research showed that the learning method*game* can have a positive effect on student achievement and learning motivation. Handayani & Iswantiningtyas (2020) researched *javanese traditional games as a teaching and learning media to socialize and introduce mathematics since early age*, the results of his research show that traditional Javanese games can be a learning medium for students to practice social skills, introduce mathematics in a fun way and students are more interested in studying mathematics. Authar, Muflihah, Fidyaningrum, Hardiana, Azizah & Ramadhani (2021) researched *improving vocabulary mastery through the traditional game "engklek" for children in kalijaten village, kec. taman, kab. sidoarjo*, the results of the research show that using traditional engklek learning media can facilitate and improve English vocabulary skills and prevent students from getting bored easily.

Islami, Selfiana & Rejeki (2022) researched *application of traditional engklek games to improve mathematics learning outcomes for class III students 001 state private school*, the research results show that the application of the traditional

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game Engklek can improve students' mathematical abilities and learning outcomes. Kamid, Rohati, Rahmalisa, Anggo, Septi, Azzahra & Nawahdani (2021) researched *engklek game" in mathematics: how difference and relationship student attitude towards science process skills*?, the results of the research show that there is student interest in learning and skills in the engklek game in mathematics subjects and there is a relationship between students' interest in learning and students' processing skills in mathematics subjects in elementary schools.

In contrast to previous research, this research focuses on game development "*GEMAS* (Modified Division Engklek Game) to improve understanding of concepts in class II elementary school students. It is hoped that the application of this engklek game can increase understanding of the concept of division. This research aims to produce game development "*GEMAS* (Modified Division Engklek Game)" to improve the understanding of concepts in class II elementary school students that meet the criteria of valid, practical and effective.

METHOD

This research is a type of R&D research (*Research and Development*). R&D is a method or process used to develop or validate a product, whether existing or new, to gain knowledge or answer problems. R&D development aims to develop and produce valid, practical and effective products (Azhari et al., 2023). This development uses the ASSURE model. Development uses the ASSURE development model because it is considered suitable for use in the classroom learning process and is more oriented towards the use of media and method for creating the expected learning process (Emaculata & Winanto, 2022)

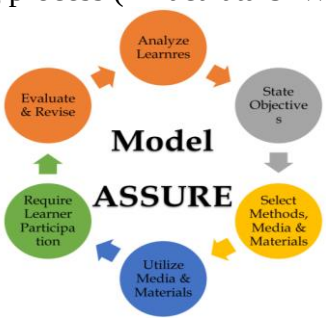

Figure 1 ASSURE MODEL

The ASSURE development model consists of 6 stages, including; (1) *Analyze learners* (student analysis), namely the researcher carried out an analysis of student characteristics through observation, namely that problems were found including a lack of understanding of students' concepts in division material and students' lack of activity in learning mathematics, this was due to the lack of variety in the methods used by teachers and a lack of learning media. This was reinforced by the student needs questionnaire, the results showed that the majority of class II students at MI Al Hidayah GUPPI needed learning methods/media in the form of traditional games to improve understanding of concepts in division material.

These results are an initial reference in game development so that the product is good can be developed in accordance with the characteristics of class II elementary school students, (2) *State objectives* (determining objectives) namely the

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researcher determines standards by looking at KI and KD and learning objectives from indicators sourced from class II thematic books theme 2 playing in my environment sub-theme 3 playing in the school environment author: Yulaika, 2013 curriculum, (3) *Select methods, media, and materials* (choosing methods, media and materials) namely choosing a game method *GEMAS*, demonstrations and discussions. Choose media, namely game media *GEMAS* made of banners, game rules cards *GEMAS*, question cards, answer boards, realistic signs made from sticks with pictures of apples, balls, marbles, matches, ice cream and candy. Selecting material, namely material for dividing whole numbers in class II elementary school (4) *Utilize media and materials* (using media and materials), namely before applying the product, a validation test is carried out first with media and material experts (5) *Require learner participation* (ask for response students) namely the researcher provides teacher and student response questionnaires (6) *Evaluate and revise* (evaluation and revision) namely the researcher gives questions *pretest* and *posttest* to students as evaluation material and analyzing the results of teacher and student response questionnaires as well as if there are suggestions after using the product for the future (Rustandi et al., 2022)

This research was carried out in class II of MI Al-Hidayah GUPPI, Cirebon City, totaling 16 students as the subjects of this research. The data collection techniques used were questionnaires and tests. A questionnaire is a data collection technique that is carried out by providing questions or written statements which will then be answered by the respondent (Sugiyono, 2013). Questionnaires are used to validate media experts, material experts, practitioner experts, teacher responses, and student responses.

Results of expert validation questionnaires on the game "*GEMAS* (Modification Division Engklek Game)" obtained from material experts, media and practitioners which will later be analyzed through calculating the average percentage of each questionnaire. The questionnaire uses a Likert scale with a score of (1-5) (Alhakim & Sumedang, 2018). The following are the percentages and eligibility criteria as follows (Sari, 2023).

Table 1. Eligibility Criteria

Score	Category
81% - 100%	Very worth it
61% - 80%	Worth it
41% - 60%	Decent enough
21% - 40%	Not worth it
0% - 20%	Not Feasible

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Analysis of teacher and student response questionnaires is used to determine the practicality of the game "*GEMAS* (Modified Division Engklek Game) that researchers developed. The questionnaire uses a Likert scale with a score of (1-5) (Alhakim & Sumedang, 2018). Following are the percentages and practical criteria as follows (Aktorida et al., 2022):

Tabel 2. Practicality Criteria

Score	Category
81% - 100%	Very Practical
61% - 80%	Practical
41% - 60%	Quite Practical
21% - 40%	Less Practical
0% - 20%	Impractical

Meanwhile, a test is a method of assessment that is designed and implemented for students at a certain time, place and conditions, as well as on the condition that certain clear requirements are met. Tests are often used to assess and measure student learning outcomes, especially cognitive learning outcomes based on mastery of material in accordance with learning objectives (Sari, 2023). This research uses a test of students' conceptual understanding of the material for dividing whole numbers. The tests given are pretest and posttest. This test is in the form of an essay and consists of 7 questions. These questions have been tested for validity, reliability, distinguishing power and level of difficulty using SPSS version 26 software and have met the valid and reliable criteria. Indicators of conceptual understanding used in this research, according to Minister of Education and Culture Regulation Number 58 of 2014, include: (a) restating the concepts that have been studied, (b) classifying objects based on whether or not the requirements to form the concept are met, (c) identifying the nature -the nature of the operation or concept, (d) applying the concept logically, (e) providing examples or counterexamples, (f) presenting the concept in various forms of mathematical representation (tables, graphs, diagrams, pictures, sketches, mathematical models, or other methods). others), (f) linking various concepts in mathematics and outside mathematics.

The data analysis technique for the test of understanding the concept of division material was analyzed using descriptive statistical analysis, prerequisite test, paired sample t-test, and n-gain. Before carrying out the paired sample t-test, a prerequisite test for the pretest and posttest values, namely the normality test, is carried out. This is done to see whether the pretest and posttest scores are normally distributed or not. All test scores were analyzed using SPSS version 26 software.

RESULTS AND DISCUSSION

The results of the development carried out by this researcher produced learning media, namely the game "*GEMAS* (Modified Division Engklek Game)" to increase the understanding of concepts in class II elementary school students. This

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research and development was carried out using the ASSURE development procedure with 6 development stages (Rustandi et al., 2022). The following *GEMAS* game design was created using the Canva application for editing:

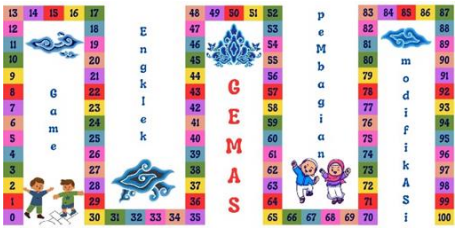

Figure 2. Game design *GEMAS*

Figure 3. Answer Board

Figure 4. Realistic Sign

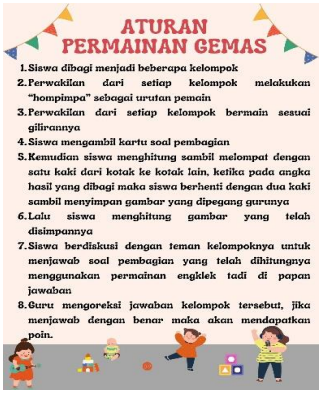

Figure 5. Game Rule *GEMAS*

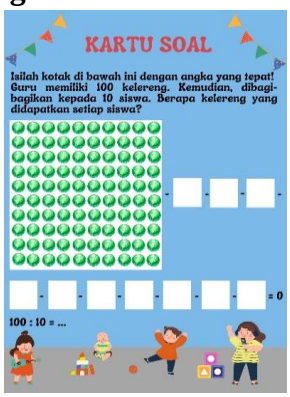

Figure 6. Question Card

Figure7. Answer Key Card

Validation Test Results

The following are the validation results from media experts and material experts:

Table 3. Results of Media Expert Validation Sheet

Aspect	Indicator	Score Indicator (%)	Qualifications
Graphic Quality	Legibility	100%	Very Worth It
	Display quality	95%	Very Worth It
Technical Quality	Usefulness	100%	Very Worth It
	Functionality	100%	Very Worth It
Mean	**4,92**	**99%**	**Very Worth It**

Table 3 shows that the average indicator score is 99% or very worth it to use**.**

Table 4. Results of Material Expert Validation Sheet

Aspect	Indicator	Score Indicator (%)	Qualifications
Content/material aspects	Accuracy	77%	Worth it
	Equipment	73%	Worth it
	Usage	80%	Worth it
Mean	**3,83**	**77%**	**Worth it**

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Table 4 shows that the average indicator score is 77% or worth it to use

Practicality Test Results

The following are the results of the teacher and student response questionnaire:

Table 5. Teacher Response Questionnaire

Aspect	Indicator	Score Indicator (%)	Qualifications
Quality of material/content	Accuracy	100%	Very Practical
	Interest	100%	Very Practical
Instructional quality	Give study help	100%	Very Practical
Technical quality	Media quality	96%	Very Practical
Mean	**4,93**	**99%**	**Very** Practical

Table 5 shows that the average indicator score is 99% or very practical to use.

Table 6. Student response questionnaire

Aspect	Indicator	Score Indicator (%)	Practicality
Quality of material/content	Accuracy	99,6%	Very Practical
	Benefit		Very Practical
	Interest/attention		Very Practical
Quality Instructional	Impactful for student	99%	Very Practical
Technical quality	Legibility	99,6%	Very Practical
	Convenience		Very Practical
	Display design		Very Practical
Mean		**99,4%**	**Very Practical**

Table 6 shows that the average indicator score is 99,4% or very practical to use.

Effectiveness Test Results

To find out the effectiveness, a descriptive analysis was first carried out to draw data collected from the pretest and posttest of students' understanding of mathematical concepts. The pretest and posttest results of students' understanding of mathematical concepts are presented in Table 7.

Table 7. Pretest and Posttest Results

Statistics	Pretest	Posttest
Mean	62,00	85,44
Std. Deviasi	19,880	10,633
Minimum	37	67
Maksimum	92	100

Table 7 shows that the average pretest score for students' understanding of mathematical concepts is 62,00 with a standard deviation of 19,880, a minimum

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score of 37 and a maximum of 92. Meanwhile, the average posttest score for students' understanding of mathematical concepts is 85,44 with a standard deviation of 10,633. minimum value 57 and maximum value 100.

Then to find out whether there is an increase in students' understanding of mathematical concepts before and after using game media *GEMAS* n-gain test was carried out.

Tabel 8. N-Gain Results

Categorization	F	N-Gain Score	Criteria
Height	6	0,64	Medium
Medium	9		
Low	1		
Amount	**16**		

Based on table 8 above, it shows that the n-gain test results have increased before and after using the game *GEMAS* namely obtaining an n-gain value of 0,64 in the medium category. And there were 6 students who experienced improvement in the high category, 9 people in the medium category, and 1 person in the low category.

To determine the effectiveness of the game "*GEMAS* (Modified Division Engklek Game)" to increase students' understanding of the concept, a Paired Sample T-Test was tested. Before testing the Paired Sample T-test, a prerequisite test must be carried out first, namely the Shapiro-Wilk normality test as in the table below:

Tabel 9. Normalitas Test Results

Tests of Normality

	Shapiro-Wilk		
	Statistic	Df	Sig.
Pretest Matematika	.894	16	.064
Postest Matematika	.929	16	.233

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Based on table 9, the results of the normality test use *Shapiro-Wilk* It is known that the Sig value. The student's mathematics pretest was 0,064 > 0,05, so it can be concluded that the pretest score was normally distributed and the Sig. The student's mathematics posttest was 0,233 > 0,05, so it can be concluded that the posttest scores were normally distributed. Because the data is normally distributed, testing was carried out using the Paired SampleT-test. The results of the Paired Sample T-Test can be seen in table 10.

Tabel 10. Paired Sample T-test Results

Paired Samples Test

	Paired Differences	t	df	Sig. (2-

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					95% Confidence Interval of the Difference				tailed)
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	Pretest Matematika - Postest Matematika	-23.437	14.805	3.701	-31.327	-15.548	-6.332	15	.000

Based on the Paired Sample T-test test results table, the sig value is obtained. (2- tailed) 0,000 < 0,05, this means Ho is rejected or Ha is accepted. So it shows that there is a significant difference between the pretest and posttest. This shows that there is an influence on the differences in treatment given before and after using the game *GEMAS*.

Based on the results of this development research, it is known that the steps for this product development are in accordance with the development stages used, namely referring to the development of ASSURE model learning media which consists of 6 stages, namely student analysis (*analyze learners*), setting goals (*state objectives*), choosing methods, media, and materials (*select methods, media, and material*), using media and materials (*utilize media and material*), asking for student responses (*require leaner participation*), and evaluation (*evaluate*). With this, the researchers designed an engklek game product called the game "*GEMAS* (Modified Division Engklek Game)" to assist in effective learning by using the latest media in the classroom.

The development of this product began with collecting data to obtain problems in mathematics learning, student characteristics, and learning situations. The aim of choosing the engklek game as a research development product is because the engklek game can help and support the learning process. Choosing the engklek game is an alternative solution to make learning more enjoyable for elementary school students, because engklek is a traditional game that can be used as a means of learning mathematics (Sundari & Siregar, 2023). The development of this engklek game media product aims to make it easier for students to be active in learning so they are able to understand the concept of division. This is in line with the opinion expressed by Firdaus and Budiono that traditional games are useful in the physical, emotional and cognitive development process of children, so that the traditional engklek game can be used as a means for the process of learning various knowledge and traditional games are also useful for students to development mathematics ability (Firdaus & Budiyonno, 2021).

Based on the research results above, the results of the validator assessment stated that the product being developed meets the valid criteria or is suitable for use. This is because the engklek game that was developed is a game *GEMAS* can make students active in learning, make students not easily bored, objects used in games *GEMAS* This is concrete, and uses banners that contain attractive images and colors*full colour* which can attract the attention of elementary school students, this feasibility is based on the advantages of the engklek game product stated by Desmariani, Kusuma & Yanti (2021) Based on the research results above, the

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results of the validator assessment stated that the product being developed meets the valid criteria or is suitable for use. This is because the engklek game that was developed is a game *GEMAS* can make students active in learning, make students not easily bored, objects used in games *GEMAS* This is concrete, and uses banners that contain attractive images and colors *full colour* which can attract the attention of elementary school students, this feasibility is based on the advantages of the engklek game product stated by (Zuhra et al., 2022). This is in line with research conducted by Nurhasanah & Sarivah (2020) that the engklek game received a validation score in the appropriate category because the engklek game can be used as a learning medium. Also, research conducted by Utami, Holisin & Mursyidah (2018) shows that the engklek game can increase student activity in learning mathematics.

Based on the results of teacher and student questionnaires, it is a game media product *GEMAS* developed meets the criteria of being very practical. This is because the game *"GEMAS* (Modified Division Engklek Game)" can help students improve their ability to understand the concept of division so that students have high enthusiasm in using the game *GEMAS*. This engklek game is designed in such a way and there are colorful boxes and there are concrete objects as realistic signs made of cardboard, skewers which are then attached to pictures of apples, ice cream, marbles, balls, candy which attract students' attention. This is reinforced by Desmariani, Kusuma & Yanti (2021) namely that the development of engklek games is generally made directly by the players, using objects around them, then processed into a fun game. Besides that, using engklek learning media can increase students' activeness and interest in learning mathematics, and can make teachers more innovative in developing learning media (Utami, Kurnia, et al., 2018). This is in line with research conducted by Apsari, Atikaningrum, Pramesta & Mariana (2022) that using the engklek game in the learning process can increase students' understanding without memorizing because students feel enthusiastic and show an active response in learning. Also, research conducted by Mulyasari, Abdussakir & Rosikhoh (2021) shows that learning using an ethnomathematics approach can help students understand mathematical concepts.

Based on the results of research and product application in class II MI Al Hidayah Guppi, game media " *GEMAS* (Modified Division Engklek Game)" is effectively used by students. This can be seen from the increase in the average pretest and posttest results. Before using the product the average test was 62 and after using the product the average test increased to 85,44. The N-Gain results also experienced a moderate increase in students' mastery of concepts, namely 0,64. And the results of the Paired Sample T-test obtained a Sig value. (2-tailed) 0,000 which means game media *GEMAS* can increase students' understanding of the concept of division. It can be concluded that the game product *GEMAS* (Modified Division Engklek Game)" can be said to be effectively used to increase students' understanding of the concept of division. This is because the base used as a foothold usually uses chalk to draw the footing. In this study, banners with pictures and numbers were used as a foothold for the engklek game, which previously used broken roof tiles and was replaced with realistic markers made of cardboard and

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sticks. The satay is then affixed with a printed image, which is usually played individually and replaced in groups, as well as the rules of the game. This effectiveness is based on the characteristics of the engklek game stated by Sosyawati (2019) that the engklek game is a game that uses counting, objects, and there is an agreement on the rules of the game. The engklek game is also inseparable from the child's ability to recognize shapes and numbers as well as the importance of cooperation and internal discipline game. The engklek game can be used by elementary school teachers as a learning resource for the cognitive development of mathematics. Also, the opinion expressed by Mulyasari, Abdussakir & Rosikhoh (2021) is that ethnomathematics learning using "engklek games" is effective in increasing students' understanding of concepts. Apart from that, concrete objects were chosen because based on Piaget's theory, grade II elementary school students are still at the concrete operational stage (Andini, 2020). This is in line with research conducted by Widyastuti, Malik & Razak (2020) that learning using the traditional engklek game is effective in improving students' mathematics learning outcomes. As well as research conducted by Islami, Selfiana & Rejeki (2022) that the application of the traditional engklek game can improve students' mathematical abilities and learning outcomes.

CONCLUSION

Based on the results and discussion it can be concluded that game media " *GEMAS* (Modified Division Engklek Game)" to improve students' understanding of concepts that meet the criteria of valid, practical, effective. This is because the expert validation results are very feasible or valid, the results of the teacher and student response questionnaires are very practical, and effective as seen from the results of descriptive statistics, there is an increase in the average pretest result and posttest. The N-Gain results also experienced an increase in students' conceptual understanding, in the medium category. As well as the results of the paired sample t-test, the Sig value was obtained. (2-tailed) 0,000 which means game media *GEMAS* can improve students' understanding of concepts. Hence, the gaming medium *GEMAS* can be an alternative for elementary school teachers to deliver material about division.

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