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DEVELOPMENT OF TRADITIONAL GAME-BASED MATHEMATICAL TOOLS FOR ELEMENTARY SCHOOL STUDENTS

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ABSTRACT

This research and development aim to 1) determine the feasibility of developing mathematics learning media using traditional game-based mathematical tools and 2) determine the attractiveness of students' responses to the development of mathematics learning media using Traditional game-based mathematical tools. This research was carried out using the Research and Development (R and D) method using the modified Borg and Gall development procedure, and data collection techniques using a validation questionnaire sheet. The instrument used was a validation questionnaire sheet to determine the feasibility of the module and a questionnaire for student responses to find out the interest. Data analysis techniques used in research and development are quantitative descriptive to process data in the form of scores from the validator's assessment and student response, while qualitative descriptive to describe the data in the form of commentary suggestions for improvement from the validator. Based on the results of the validation of the development of mathematics learning media using the Traditional game-based mathematical tools, an average score was obtained; (1) the feasibility of developing mathematics learning media using traditional game-based mathematical tools results of the validation of material experts obtained an average of 3.73, on linguistic aspects obtained an average of 3.64, on the aspect of feasibility evaluation obtained an average of 3.66, on media experts obtained on average (aspects of media efficiency obtained an average of 3.87, (2) attracting the development of mathematics learning media using the traditional game-based mathematical tools students' responses obtained an average score of 3.61 in the "very interesting" criteria.

1. INTRODUCTION

The field of mathematics is an essential primary field of science that everyone must have to be used for daily life. However, because the characteristics of mathematics are abstract, not everyone can digest it quickly and precisely, making it difficult for many elementary and high school students (Monawati & Elly, 2017). In mathematics learning, what needs to be considered is the readiness of teachers and teacher creativity to determine learning strategies by utilizing the surrounding environment and preparing media or learning facilities that vary from the surrounding environment. This is to overcome saturation in students (Sulistyorini, 2007). The use of the surrounding environment as a medium is one of the solutions that needs to be applied by educators. Using the environment as a contextual learning resource can enrich students' insights as they learn and experience firsthand. Ideally, learning activities that emphasize the process by utilizing the surrounding environment is expected to provide concrete experiences for students; thus, learning becomes meaningful and quality. Learning is of high quality if the teacher presents challenging, fun problems that give opportunities for students to explore, provide successful experiences, develop thinking skills, and utilize learning resources in the form of natural learning resources and design results.

The teachers should be qualified to carry out their duties as professional teachers. There are many efforts by the Government of Indonesia to improve the quality of education nationally, including through the National Education System Law Number 20 of 2003, primarily written in Article 42 concerning the minimum qualifications of teachers. This is followed by Law Number 14 of 2005 concerning Teachers and Lecturers Articles 8 to 25, which regulates the four competencies a professional teacher must have.

Many factors affect the learning process at the elementary level, both in its development and implementation. The questions include learning objectives, materials, facility support, student conditions, and teachers. Many learning activities in elementary schools are oriented toward students and teachers, so this factor significantly affects the success of learning activities in the classroom. In general, the lack of learning success in elementary schools is the lack of attention to students' abilities, let alone individual differences, who have not yet obtained service in learning (Muchtar & Rusmini, 2005). This condition gives birth to learning activities that need to be more qualified and attract optimal student interest. The implication is that the learning process is ineffective. In conditions like this, it is necessary to reflect and improve to produce a learning innovation that can improve the quality of education.

The professional development of teachers is a global concern because teachers have a duty and role not only to provide information on science and technology but also to form attitudes and souls that can survive in the era of hyper-competition (Sukadi, 2006). The task of the teacher is to help students to be able to adapt to the various challenges of life and the urges that develop in them. This empowerment of learners includes aspects of personality, primarily intellectual, social, emotional, and skill. The noble task becomes arduous because teachers must not only prepare the younger generation to enter the century of knowledge but must also prepare themselves to continue as individuals and professionals. The teacher's professionalism will change the role of the teacher who was previously passive to a creative and dynamic teacher.

Sulistyorini (2007) shows the effect of based learning traditional games on elementary school students' social skills. Research by Kawuryan et al. (2018) shows that based thematic learning model, traditional and game-oriented scientific approaches are proven to have a positive and significant effect on the creative thinking skills of elementary school students. Research by Imswatama and Lukman (2018) shows that teaching materials ethnomathematics-based mathematics proved to be effective in solving problem skills and critical thinking mathematics for junior high school students. In the current 21st century, known as the era of globalization, human activities cannot be separated from technology utilization. The smartphone is one of the uses of technology that is often used, not only by adults but also by

children. Children usually use a smartphone to access the internet and play games. Many kids spend their spare time playing smartphone games in the house, so the opportunity to socialize with friends outside the home is getting lower. A modern game on the smartphone becomes more interesting than a traditional game.

Consequently, the game Traditionally it is rarely played by children. Mathematics learning in school today, there are still many done in class. Sometimes students need to grow creativity by learning math outside of class. One of the learning media that can be used to study mathematics outside the classroom is traditional games.

As well as problems in mathematics learning experienced by grade 3 students at an Integrated Islamic Elementary School (IT) Nurul Islam Paramarta in Seputih Many District in Central Lampung who do not understand mathematics, primarily related to how to describe the standard size for length, weight and time, even though the teacher has tried to use learning aids in the form of clocks from cardboard to describe time measuring instruments, and a ruler to describe the length measure. The initial survey found ten students out of 17 children whose scores for the topic were below mastery learning score (KKM). After exploration and conducting more in-depth interviews about what type of learning the average student preferred showed the result that students were auditive-leaning. The auditive type has the characteristics of being happier to listen to the teacher explain, happy to read aloud and listen, both in conversation and storytelling, like to discuss and talk, liking music and singing, liking to work in groups, and can not for a long time. Based on these trends, there is a need to plan a student learning aid that is well-known to students in their area.

With these problems, researchers develop learning media that can help students understand learning material effectively, be fun, and provide a concrete picture of how to solve math material through games. Based on research and development that has existed before, this research develops learning media with the latest developed in the form of developing mathematics learning media using traditional game-based mathematical tools.

2. METHODS

2.1. Research Model

This research used a research and development model focused on developing learning media. Researchers used Dick and Carey (Dick et al., 2005). Model Instructional Design procedure. The main characteristic steps of the learning system design model proposed by Dick and Carey (2005) are 1) identifying instructional objectives, 2) conducting instructional analysis, 3) analyzing students and context, 4) formulating specific instructional objectives, 5) developing assessment instruments, 6) developing instructional strategies, 7) developing and selecting appropriate instructional materials, 8) designing and conducting formative evaluations, 9) revising learning, and 10) designing and conducting summative evaluations.

2.2. Participants

This research was conducted at SD Nurul Paramarta Lampung. The respondents were grade 3 students in Indonesia. The participants of this study were selected by purposive sampling method. Purposive sampling is a sampling technique that assesses the sample among the selected population (Zulela et al., 2022). The participants in this study consisted of 30 grade 3 elementary school students with experience playing gedrik/angklek (a traditional Indonesian game). They chose research subjects because they were considered students with much experience playing traditional games. The selection of these students also considered the material taught in grade 3, namely multiplication and fractions.

2.3. Data Collection Tools

Observation, questionnaires, interviews, and tests were carried out for data collection. Questionnaires collect data by submitting a list of written questions (Braun et al., 2021). Interviews are a data collection technique through a one-way verbal question-and-answer process (Barrett & Twycross, 2018; Sumilat et al., 2022). The author developed research instruments in the form of observation, questionnaire forms, and interviews. Before using the instrument, validity and reliability tests were carried out to determine its effectiveness of the instrument. Tests were carried out during small-scale trials when giving question cards to students.

Process The questionnaire form was used to find information about suitable learning media to increase students' understanding of multiplication material in 3rd-grade elementary school students. The questionnaire form was used to find information about suitable learning media to increase elementary school grade 3 students' understanding of multiplication material. Research data was obtained by distributing questionnaires to schools in the Jakarta area. Then, to strengthen the results of the questionnaire data, interviews were conducted with several samples during small and large-scale trials.

2.4. Data Analysis

Before being applied to the research, the research instrument used was tested for validity and reliability using Cronbach's Alpha. Cronbach's alpha is a statistic commonly quoted by authors to demonstrate that tests and scales constructed or adapted for research projects are fit for purpose (Rusmiarti et al., 2022; Taber, 2018). The data result was analyzed using the Miles and Huberman data triangulation model. Activities in data analysis include data reduction, data presentation, data drawing conclusions, and verification (Miles et al., 2018). Miles and Huberman's Interactive Data Analysis Model is shown in Figure 1

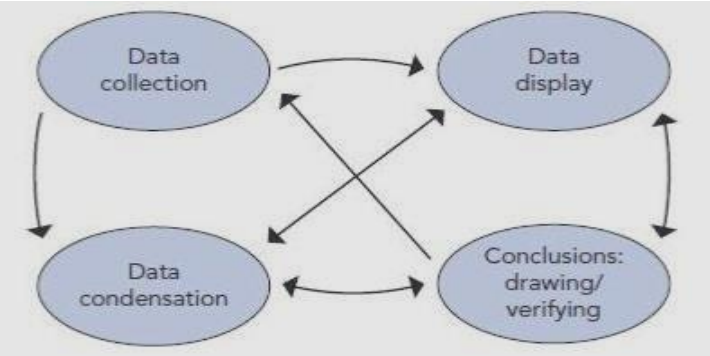


Figure 1 Data Analysis Model Miles and Huberman (Miles et al., 2018)

3. RESULTS AND DISCUSSION

3.1. Preliminary Research

Preliminary research is carried out before the research activities are carried out. At this stage, the researcher conducted a needs analysis and made initial observations. Researchers also distributed questionnaires intending to gather various information needed by students who experienced difficulties. Based on the needs analysis results conducted in the first year of research, an environmental-based mathematics learning tool was designed to solve mathematics learning. The developed math learning aids are combined with traditional games of engklek.

3.2. Development Planning

Learning media development planning activities involve three significant steps: planning, production, and assessment. Meanwhile, in the context of developing learning media, "Gesamsu is an abbreviation of Gedrik Saruk Memang Seru." researchers used the Dick and Carey Model Instructional Design procedure. The steps to be taken are described in Figure 5.

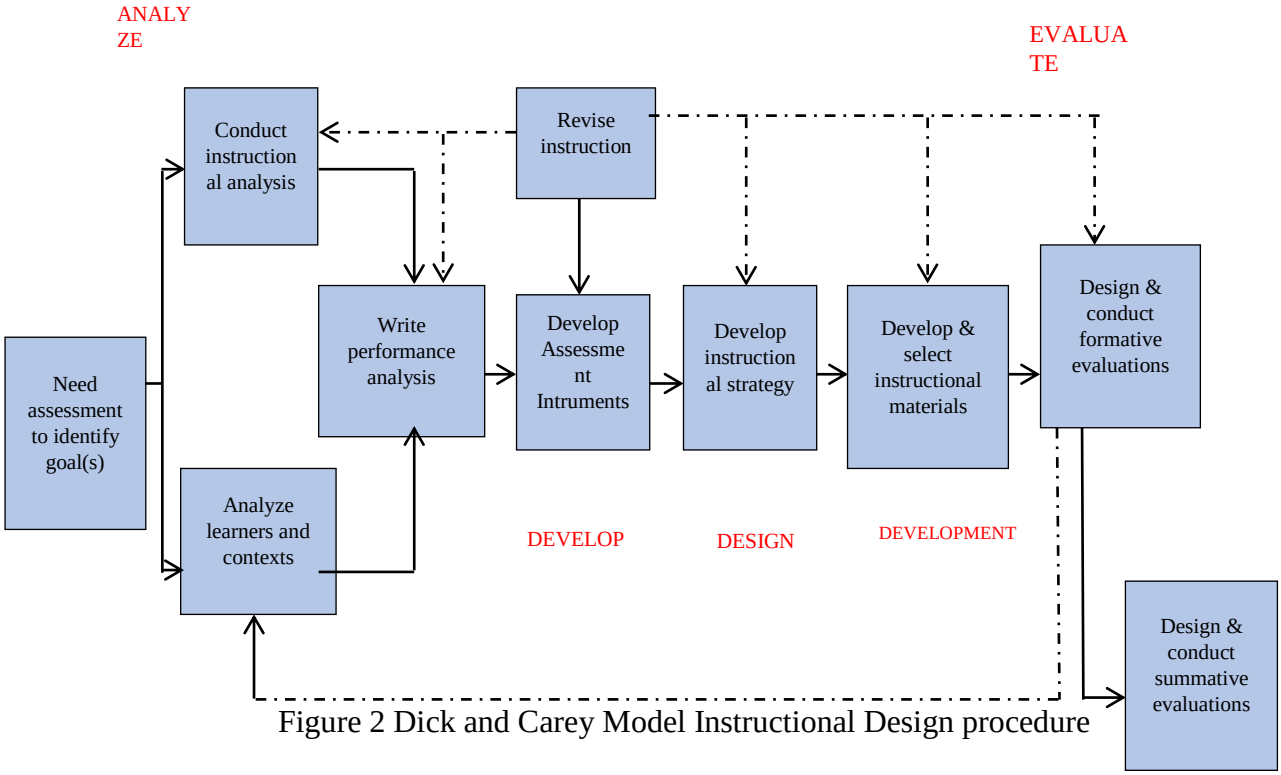


Figure 2 Dick and Carey Model Instructional Design procedure

The mathematics learning tool developed is an innovation in the development of mathematics learning media for learning in elementary schools. In order for the quality of the tool to be better, feasible, and practical, the tool needs to be tested, be it a validity test or a limited trial. In testing environmental-based mathematics learning aids that have been developed, it is necessary to carry out assessment activities by experts. Assessment by experts includes assessment of content aspects, media aspects, and learning design. The validation activity aims to see the suitability of environmental-based mathematics learning aids and the validity of environmental-based mathematics learning aids so they can be used and disseminated. Validation also aims to develop environmental-based mathematics learning aids; this is obtained by making improvements and product improvements based on expert suggestions and input. The validation activity involves three experts; each expert assesses environmental-based mathematics learning aids according to their respective fields of expertise. The following are presented validation results by content, learning design, and media experts.

3.2. Content Validation

Content is a vital part of a product. Content assessment is related to the suitability of the product developed with the material, accuracy, and linkage between the product and the selected material. Assessment of the content includes conformity of the material with essential competencies, the material's accuracy, the material's absoluteness, stimulus, and the language used.

Table 1 Graphic of assessment of the content

No	Validation aspect	Validator			average	Criteria
		1	2	3		
1	Conformity Of The Material With Basic ompetencies	3	4	3	3,67	Valid
2	Accuracy Of The Material	3	4	3	3,67	Valid
3	The Absoluteness Of The Material	4	4	4	4	Valid
4	Stimulus	4	3	4	3,67	Valid
5	The Language Used	4	3	4	3,67	Valid

Based on the content validity analysis results, it can be concluded that the average score obtained for the content aspect of the assessment of environmental-based mathematics learning aids is Valid. Based on the assessment of content aspects, it can be concluded that the environment-based mathematics learning aids developed are very valid criteria. This means that environmental-based mathematics learning aids developed in terms of content are valid, according to experts. The average range based on the results of the assessment of environmental-based mathematics learning aids from the developed equivalence is above the valid criteria. get some suggestions and input from content experts on the environment-based mathematics learning aids developed; the suggestions in question are related to synchronization and the relationship between the content in the question and the question-and-answer technique. Notes and input from content experts will be used as material for improvement to improve the quality of the environment-based mathematics learning aids developed. In an implementation, environmental-based mathematics learning aids are valid in the content aspect and are ready to be continued in the following testing stage.

3.3. Validate Learning Design

Each learning product to be developed needs to be assessed for the suitability of the learning design. Products used in learning activities must pay attention to aspects of conformity with learning objectives, how learning activities are designed, the contribution of products developed to improve student knowledge, learning evaluation, material exploration, student learning activity, and student concentration.

Table 2 Graphic of Assessment of Learning Design

No	validation aspect	Validator			average	Criteria
		1	**2**	**3**		
1	pay attention to aspects of conformity with learning objectives	3	4	4	3,67	Valid
2	how learning activities are designed	4	4	3	3,67	Valid
3	the contribution of products developed to improve student knowledge	3	4	4	3,67	Valid
4	learning evaluation	4	4	4	4	Valid
5	material exploration,	4	4	4	4	Valid
6	student learning activity	4	3	4	3,67	Valid
7	student concentration	4	3	4	3,67	Valid

Based on the validation results of environmental-based mathematics learning aids in learning design aspects. It can be concluded that the environment-based mathematics learning aids developed have been valid in terms of learning design. Product criteria at a very reasonable level indicate that the environment-based mathematics learning aids developed have been tested in content and design to support learning, especially mathematics. The results

of the analysis of the distribution of expansion per item of the validation instrument, environmental-based mathematics learning aids in the learning design aspect are above 0.6. This means that quality-developed environmental-based mathematics learning aids are on very valid criteria. The assessment results are not perfect, so several suggestions and inputs exist on improving the quality of environmental-based mathematics learning aids. Advice and input from learning design experts is the socialization of rules in the game developed on environmental-based mathematics learning aids. Socialization of game rules and procedures will make it easier for students to follow learning patterns and activities using environmental-based mathematics learning aids.

3.4. Media Validation

The environment-based mathematics learning aids developed are part of the learning media. For this environment-based mathematics learning tool to be valid from the media aspect, media experts also assess this product. Media experts' assessment of the environment-based mathematics learning aids developed includes media relevance, graphics, product display, availability of media use guidelines, and the quality of illustrations found in environmental-based mathematics learning aids. Assessment in terms of media is also related to the readability of the product and clarity of instructions that support the smooth implementation of environmental-based mathematics learning aids.

Table 3 Graphic of Assessment of Media Validation

No	validation aspect	Validator			average	Criteria
		1	2	3		
1	media relevance	3	4	4	3,67	Valid
2	graphics and product display	4	4	3	3,67	Valid
3	availability of media use guidelines	3	4	4	3,67	Valid
4	the quality of illustrations found in environmental-based mathematics learning aids	4	4	4	4	Valid
5	the readability of the product	4	4	4	4	Valid
6	clarity of instructions that support the smooth implementation of environmental-based mathematics learning aids	4	3	4	3,67	Valid

The average validation result of environmental-based mathematics learning aids is valid. This shows that the environmental-based mathematics learning aids developed have been valid in terms of media. Assessments conducted by media experts show that environmental-based mathematics learning aids are feasible teaching aid that can be used in learning activities. The range of scores obtained on each item in the environmental-based mathematics learning assessment instrument in terms of media is above the minimum validity criteria. This means that the overall assessment item of the environment-based math learning aid has been valid with very high validity criteria. Products in the form of environmental-based mathematics learning aids that are developed are not perfect. They need improvement and revision to the quality of the products to be produced and widely used.

Based on the validation results on three aspects: Content, learning design, and media, it can be concluded that the environment-based mathematics learning aids developed is valid and worthy of limited trials. In order to improve the quality of environment-based mathematics learning aids, before environmental-based mathematics learning aids are tested on a small

scale on a one-to-one basis to students, FGD activities are carried out by presenting potential product users.

3.5. Media Development

Gesamsu is an abbreviation of Gedrik Saruk Memang Seru. Gedrik comes from the Javanese language, which means crank, while saruk means kick, so Gedrik Saruk means playing crank by kicking the gaco. Gesamsu is an innovation of the traditional crank game which is used as a tool for teaching mathematics in elementary schools. The gesamsu arena will contextualize learning material on flat shapes, especially squares and rectangles, fractions, addition, subtraction, multiplication, division, angles, and time. Through question cards, students are asked to directly calculate the area or perimeter of flat shapes, especially squares and rectangles, found in the Gesamsu arena. Also, through question cards, students will learn to determine fractions, addition, subtraction, multiplication, division, angles, and the length of time of an event.

3.5.1. *The components of Gesamsu:*

The component of Gesamsu, such as Gesamsu Arena

Figure 3 Gesamsu (Gedrik Saruk Memang Seru) Arena

The Gesamsu Arena is made of a puzzle mat with a length of 240 cm, a width of 120 cm, and a thickness of 1 cm. Then the mat is affixed with stickers in the shape of the Gesamsu arena. The Gesamsu Arena consists of box no. 1, start to box no. 5, or stop. Then the shooting box is followed by the local wisdom box, and the quiz box is the last. Gaco in the Gesamsu game is made of pieces of flip-flops wrapped in paper and then attached with colored stickers.

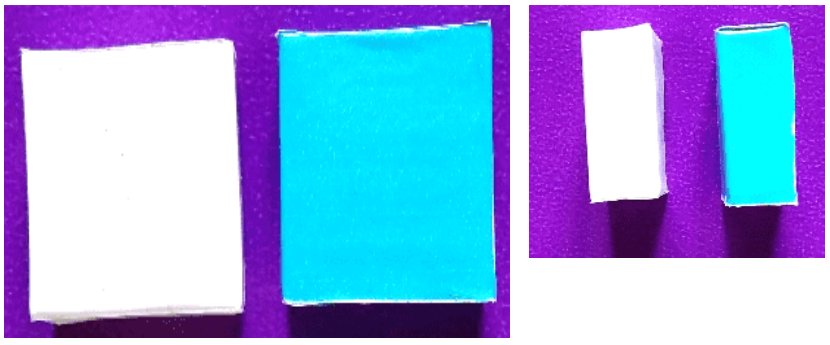


Figure 4 Gaco Gedrik Saruk Memang Seru

The other components are the scoreboards. The scoreboard is made of a styrofoam measuring 40 cm x 60 cm. Push pins are used to attach names and stars to the scoreboard. Question cards are made of BC paper. The size of the question cards is 9.3 cm x 7.5 cm. The

material on the question cards consists of Mathematics subjects. Each question card has a specific star score according to the difficulty level of the question.

Figure 5 Question Card Gedrik Saruk Memang Seru

Kindness card made of BC paper. The size of the question card is 9.3 cm x 7.5 cm. The kindness card contains instructions for growing a Pancasila student profile for elementary school children. Stars are made of BC paper which is used as player rewards.

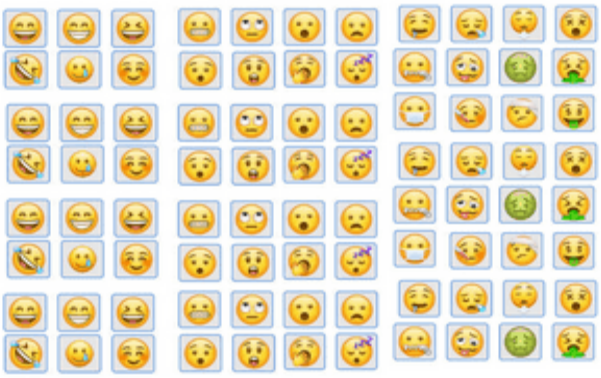
Figure 6 Kindness Card Gedrik Saruk Memang Seru

.

Figure 7 Stars Gedrik Saruk Memang Seru

The emoji sheet is made of A4 size BC paper. Emoji sheets are used to stick to students' feelings after playing Gesamsu. Emoji stickers are made of sticker paper. Emoji stickers are used to find out how students feel after playing Gesamsu.

Picture 8 Emoji Sheets Gedrik Saruk Memang Seru



Picture 9 Emoji Sticker Gedrik Saruk Memang Seru

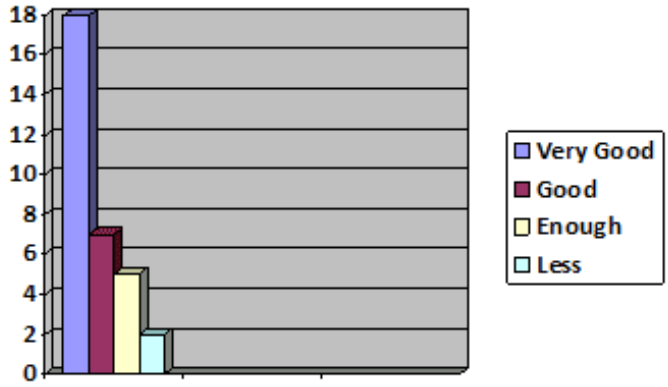
3.6. Focus Group Discussion

FGD is an activity that involves potential users. In the FGD that was carried out, several prospective users were presented, be they teachers or education practitioners. Some of the suggestions and inputs obtained during the FGD include adding problem-based learning activities to improve students' higher-order thinking skills.

3.7. One-to-one

One-to-one is product testing of students on a small scale. Aspects assessed in one-to-one include product clarity and the impact of product use. Product clarity is related to the readability of environmental-based mathematics learning questions and tools, ease of use, and the impact caused by the use of the product. One-to-one limited-scale trials showed that the mathematics learning aids developed were valid and usable by students. Student assessment results were at very high criteria with an average score of very good.

Table 4 Information about assessment results students



Noted:

Score	Information
76-100	Very Good
51-75	Good
26-50	Enough
1-25	Less

Based on Table 4, it can be illustrated that in the one-on-one test in the form of test measurement results on the development of Gesamsu media (Gedrik Saruk Memang Seru) there were 18 students who scored (76-100) in the very good category, seven students who scored (51- 75) Good category, five students who scored (26-50) in the adequate category, one student who scored (1-25) in the poor category. Obtained evaluation after using Gesamsu media. It is good with average ones obtained of mastery learning. Active learning of students during teaching and learning activities become livelier and easier understood by students. Participant students begin to dare to do the exercises questions in front of or on the blackboard after practicing with the Gesamsu game. So media mathematics learning, Gesamsu media (Gedrik Saruk Memang Seru) is said to be effectively used in mathematics learning.

4. CONCLUSION

This study's results show that Gesamsu is an abbreviation of Gedrik Saruk. Indeed, it is fun not only as entertainment for children but also in this game; there is an educational value that can shape children's character. The benefits that can be drawn from this game are that it can train children's physique and balance, concentration, intelligence, obeying rules, sportsmanship, honesty, and creativity. Besides being beneficial for children, this dengklaq game can be used as a medium for learning mathematics because the game contains many elements of mathematics. Gesamsu is an innovation of the traditional crank game, which is used to teach mathematics in elementary schools. The gesamsu arena will contextualize learning material on flat shapes, especially squares and rectangles, fractions, addition, subtraction, multiplication, division, angles, and time. Through question cards, students are asked to directly calculate the area or perimeter of flat shapes, especially squares and rectangles found in the Gesamsu arena. Also, through question cards, students will learn to determine fractions, addition, subtraction, multiplication, division, angles, and the length of time of an event.

REFERENCES

Barrett, D., & Twycross, A. (2018). Data collection in qualitative research. *Evidence-Based Nursing*, *21*(3), 63–64.

Braun, V., Clarke, V., Boulton, E., Davey, L., & McEvoy, C. (2021). The online survey as a qualitative research tool. *International Journal of Social Research Methodology*, *24*(6), 641–654.

Dick, W., Carey, L., & Carey, J. O. (2005). *The systematic design of instruction*.

Imswatama, A., & Lukman, H. S. (2018). The effectiveness of mathematics teaching material based on ethnomathematics. *International Journal of Trends in Mathematics Education Research*, *1*(1), 35–38.

Kawuryan, S. P., Hastuti, W. S., & Supartinah, S. (2018). The influence of traditional games-based and scientific approach-oriented thematic learning model toward creative thinking ability. *Cakrawala Pendidikan*, *1*, 237921.

Miles, M. B., Huberman, A. M., & Saldaña, J. (2018). *Qualitative data analysis: A methods sourcebook*. Sage publications.

Monawati, M., & Elly, R. E. (2017). Korelasi persepsi siswa terhadap pembelajaran matematika dengan hasil belajarnya di kelas v sd negeri i pagar air aceh besarkorelasi persepsi siswa terhadap pembelajaran matematika dengan hasil belajarnya di kelas v SD Negeri i pagar air aceh besar. *Jurnal Ilmiah Mahasiswa Pendidikan Guru Sekolah Dasar*, *2*(1).

Mukhtar dan Rusmini. (2005). Pengajaran Remedial: Teori dan Penerapannya dalam Pembelajaran. *Jakarta: PT Nimas Multima*

Rusmiarti, R., Hermansyah, H., & Selegi, S. F. (2022). The Effectiveness of Online Learning Using Information Search Methods on Learning Outcomes of 5th Grade Science Subjects at Kemala Bhayangkari Elementary School. *Buana Pendidikan: Jurnal Fakultas Keguruan Dan Ilmu Pendidikan Unipa Surabaya*, *18*(1), 18–25.

Sukadi, G. P. (2006). *Guru Masa Depan*.

Sulistyorini, S. (2007). Model pembelajaran IPA sekolah dasar dan penerapannya dalam KTSP. *Yogyakarta: Tiara Wacana*.

Sumilat, J. M., Tuerah, R. M., & Setiawan, B. (2022). The Utilization of Online Media in Calculation Operations Mathematics Learning in Elementary School Students. *Journal of Educational and Social Research*, *12*(3), 90–90.

Taber, K. S. (2018). The use of Cronbach's alpha when developing and reporting research instruments in science education. *Research in Science Education*, *48*(6), 1273–1296.

Zulela, M., Neolaka, A., Iasha, V., & Setiawan, B. (2022). How is the Education Character Implemented? The Case Study in Indonesian Elementary School. *Journal of Educational and Social Research*, *12*(1), 371–371.