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Implementation of Math Games to Develop Students' Motivation in Solving Numeracy Problems

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Abstract

The numeracy skills of students in Indonesia are still low. Therefore, researchers implemented mathematics games in mathematics learning to foster students' motivation in solving numeracy problems. The math games implemented include the 3-6-9 game, mission X, mathematical snakes and ladders, and role play. The aim of this research is to find out how to implement mathematical games by referring to the implementation of David C. Korten's model in its application by increasing students' motivation in solving numeracy problems. This research used descriptive qualitative. The subjects were students at SDN Pemurus Dalam 6. Data was collected through interviews, observation, and documentation. The results show that based on the implementation model, this math games program is appropriate, both in terms of the program, program users, and program implementing organization. The implementation of this math games has been successfully implemented and increase students' motivation in solving numeracy problems.

Keywords: math games, numeracy, students' motivation

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INTRODUCTION

The Kurikulum Merdeka, literally means "the curriculum for freedom", as a form of improvement to the 2013 curriculum, is one of the efforts of the Ministry of Education, Culture, Research, and Technology of Republic of Indonesia to overcome the learning crisis after the COVID-19 pandemic (Muhdar, 2023; Nugraha, 2022). In the curriculum, education refers to the essence of learning, where each student has talents and interests that do not have to be the same. The national assessment in the form of the national examination in the 2013 curriculum has changed to become the minimum competency assessment (Andiani et al., 2020; Andika et al., 2013; Hasanah et al., 2021; A. Sari et al., 2020). This assessment measures students' thinking and reasoning competencies in reading literacy and mathematics literacy or numeracy (Andriyani et al., 2024; Ariyanti et al., 2023; Muhdar, 2023; Rohim et al., 2021).

Numeracy ability is the ability to think using concepts, procedures, facts, and mathematical tools. These four things are used to solve contextual problems in various types of appropriate contexts. Numeracy is presented in story problems with three contexts. These contexts are personal, socio-cultural and scientific contexts. Numeracy content is divided into several materials, namely numbers, measurement and geometry, data and uncertainty, and algebra (Kementerian Pendidikan dan Kebudayaan, 2020).

This numeracy ability, which is very important for students to have, is contrary to reality. In reality, the numeracy abilities of students in Indonesia are still low (Ate et al., 2022; Djamilah et al., 2023; Herdiansyah et al., 2024; Napsiyah et al., 2022; Salvia et al.,

2022; Ulfah, 2022; Waluyo, 2022). Based on the results of interviews with SDN Pemurus Dalam 6 teachers, it is known that the numeracy skills of students at that school are not yet adequate. This is due, in part, to students' lack of motivation to learn mathematics (Norhaliza et al., 2022; Nugroho, 2021). In fact, learning motivation influences learning outcomes (Djamilah & Fajriah, 2019; Nur Zaqiyah et al., 2020; Sitti Rahma et al., 2023).

Low learning motivation can be increased by using learning media (Andriyani et al., 2022; Bada & Andriyani, 2022; Khairunnisa et al., 2023; Maharani & Andriyani, 2022). Learning media is important in learning, in process and outcomes (Baihaki, Djamilah, et al., 2022; Djamilah & Puspitorini, 2021; Maulida et al., 2023; Nurmeidina & Djamilah, 2022; S. P. Sari et al., 2022). Learning media that can be applied in schools is in the form of games (Fauzi & Lu'luilmaknun, 2019; Kosasih et al., 2022; Nugraheni, 2017; Rahaju & Hartono, 2017; Rahmadhani et al., 2021; Suliani et al., 2021). Games in learning mathematics (math games) include the 3-6-9 game, mission X, mathematical snakes and ladders, and role play (Afifah & Hartatik, 2019; Albano, 2023; Atmoko et al., 2017; Nawafilah & Masruroh, 2020).

The novelty of this research is that it connects the ability to solve numeracy problems with motivation to learn mathematics, which has not been widely researched before. Therefore, the aim of this research is to find out how to implement mathematical games by referring to the implementation of David C. Korten's model in its application by increasing students' motivation in solving numeracy problems.

RESEARCH METHOD

This research is descriptive qualitative study (Baiduri et al., 2022). The research was conducted from 20 February to 10 June 2023 at SDN Pemurus Dalam 6 Banjarmasin, a public elementary school in the Southern Kalimantan. The data used in this research comes from the implementation of math games in order to increase students' motivation in solving numeracy problems at SDN Pemurus Dalam 6 which was carried out by students of Kampus Mengajar program Batch 5, a flagship social work program by the Indonesian Ministry of Education.

The primary data in this research are the results of interviews with 2 teachers, 2 students from every class at SDN Pemurus Dalam 6 which amounts to 12 students, and 5 students of Kampus Mengajar who work at the school, and the results of observations made by researchers regarding the activities carried out and the students' abilities during the activities. The secondary data in this research was obtained from the results of analysis of existing documentation (images and reports) and literature study. Researchers act as key instruments, by conducting observations and interviews and making notes or reports (Yusuf, 2017). Data was collected using interview, observation, and documentation techniques. Interviews were conducted with teachers and students, as well as students who implemented the program. Observations are carried out by researchers being involved in the activity and observing the situation and conditions when the activity takes place.

Meanwhile, documentation is carried out to collect evidence of activities in the form of pictures and reports of activities that have been carried out. Data analysis was carried out by data reduction. then the data is presented in narrative form, so that conclusions can be drawn. The results obtained from this research are a description of the implementation of math games to develop students motivation in solving numeracy problems at SDN Pemurus Dalam 6 based on implementation model by David C. Korten. The suitability model for program implementation according to David C. Korten can be seen in Figure 1 (Noerbella, 2022).

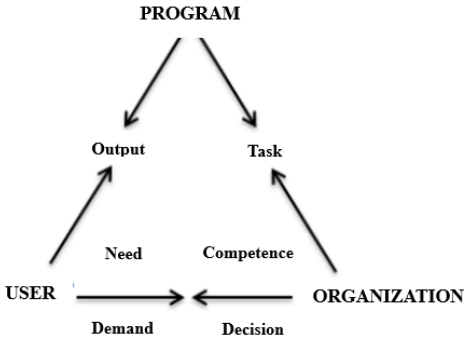

Figure 1. Program implementation suitability model

David C. Korten stated that the success of a program can be seen from the compatibility that exists between the 3 (three) elements of program implementation carried out, namely: (1) compatibility between the program and its users, meaning the compatibility between what is provided by the program and what is needed by the target group (utilizers), (2) compatibility between the program and the implementing organization, namely the compatibility between the tasks envisaged by the program and the capabilities of the implementing organization, and (3) compatibility between the user group and the implementing organization, namely the compatibility between the requirements determined by the organization to obtain program output and its capabilities program targets (Aslur & Tukiman, 2023; Fatonah et al., 2021; Rizal & Susilahati, 2023).

RESULTS AND DISCUSSION

David C. Korten created a program suitability model which consists of three elements, namely the program, program users, and the program implementing organization (Aslur & Tukiman, 2023; Rayyan, 2020; Susanti et al., 2018). In this research, the program is math games in learning mathematics. The math games implemented include the 3-6-9 game, mission X, mathematical snakes and ladders, and role play. The beneficiaries of the program are SDN Pemurus Dalam 6. Meanwhile, the organization implementing the program is the students of Kampus Mengajar batch 5. The success of the program can be seen from the compatibility between these three elements.

The first compatibility that is seen is between the program and program users. The program is said to be successful if the program implemented is in accordance with what is needed by program users. Math games in mathematics learning as a program are seen to be compatible with what is needed by SDN Pemurus Dalam 6 as program users. SDN Pemurus Dalam 6 is one of the schools chosen by the Ministry of Education, Culture, Research, and Technology (Kemendikbudristek) of the Republic of Indonesia as a partner school for the Kampus Mengajar Batch 5. This school is located in South Kalimantan Province, Banjarmasin City, South Banjarmasin District. This school has several problems regarding numeracy, including the low numeracy skills of students, low motivation of students in solving numeracy problems, the absence of fun learning media for learning numeracy, and the lack of teaching staff who can guide students in honing their numeracy skills. Therefore, math games that use fun learning media are implemented by students as additional teaching staff in accordance with the needs of SDN Pemurus Dalam 6 in overcoming problems that occur in order to increase student

motivation in solving numeracy problems (Anisah & Fajriah, 2019; Firdaus & Akib, 2022; Kusumawati & Irwanto, 2016; Nurmeidina et al., 2021).

The second compatibility that is seen is between the program and the program implementing organization. Program implementing organization must have abilities that are appropriate to the tasks assigned by the program. Math games in mathematics learning as a program are seen to be compatible with the abilities of the students of Kampus Mengajar Batch 5 as the program implementing organization. Before serving at school, students of Kampus Mengajar have taken part in a series of training sessions that support their performance at school. In this training, various ways are taught to improve students' numeracy skills. In addition, students who work at SDN Pemurus Dalam 6 come from various different study programs, namely Elementary School Teacher Education, Economic Education, and Pancasila and Citizenship Education. With diverse study program backgrounds, students can exchange ideas to implement programs to improve students' numeracy skills. Students are also supervised by Field Supervisors with expertise in Mathematics Education. Field Supervisor Lecturers, as the name suggests, play a role in guiding students while on duty in the field, namely at school. In this case, the Field Supervisor also plays a role in directing and finalizing the concept of implementing math games in mathematics learning at school. Thus, students of Kampus Mengajar batch 5 as the program implementing organization have the appropriate abilities to implement math games in mathematics learning as a program (Anwar, 2021; Khotimah et al., 2021; Rachman et al., 2021).

The third compatibility that is seen is between program users and the program implementing organization. This conformity is said to have been fulfilled if in obtaining program output, program users carry out things in accordance with what is required by the program implementing organization. SDN Pemurus Dalam 6 as a program user is seen to see its suitability in fulfilling what is required by students of Kampus Mengajar batch 5 as program implementers. What is required is that students at SDN Pemurus Dalam 6 participate well in the various math games that are implemented. Based on the results of observations, students at SDN Pemurus Dalam 6 were able to participate well in various math games held by students of Kampus Mengajar batch 5. Thus, SDN Pemurus Dalam 6 as program beneficiaries fulfilled what was required by students of Kampus Mengajar batch 5 as implementers of the program (Prasandha & Utomo, 2022; Rosita & Damayanti, 2021; Shabrina, 2022).

The math games implemented include the 3-6-9 game, mission X, mathematical snakes and ladders, and role play. First, the 3-6-9 game. In this game, students are invited to play and learn to multiply multiples of 3. The way to play is that students take turns saying the number 1, then 2, then when the number is 3, students must clap their hands and cannot say the number 3. This applies to all numbers multiples of 3, namely 3, 6, 9, and so on (Ariyanti, 2020; Handayani & Ariyanti, 2021; Mayada et al., 2023). Students seem more enthusiastic in learning mathematics.

Second, it was Mission X game. In this game, students are invited to play while learning to answer questions about numeration. The way to play is that students look for stars that have been hidden in the school environment. Each star contains numeration questions that have different points. After getting a star, students answer the questions given. Students looked very enthusiastic and showed high motivation (Fauziah & Pawestri, 2022; Lazwardi & Ariyanti, 2019; Melinda & Lazwardi, 2020; Syam et al., 2020; Syamsuddin et al., 2020).

Third, the mathematical snakes and ladders game (See Figure 2). Snakes and ladders are printed in large size and placed on the classroom floor, so that students

experience a new nuance in playing snakes and ladders, namely by standing on the existing boxes.

Figure 2. Mathematical snake and ladder game

The way to play is almost the same as ordinary snakes and ladders, namely students take turns throwing the dice to determine which number box they will stand on. In some box numbers, there are questions that must be answered by students standing in the box. These questions are numeracy questions in the form of number counting operations, including addition, subtraction and multiplication. The students seemed very happy and had high motivation, and even wanted to play continuously without taking turns with other students (Aisyah et al., 2020; Nugroho et al., 2023; Syawahid & Akib, 2023).

Fourth, role play (See Figure 3). The role play is carried out with the aim of making students familiar with currency and buying and selling activities (Andriyani et al., 2023; Baihaki, Maknun, et al., 2022; Hardini et al., 2021; Ilmi et al., 2022; Isnayanti et al., 2023; Khairunnisa et al., 2023; Usman et al., 2022). First, students are introduced to currency values, then students demonstrate the buying and selling process. There are students who act as sellers and there are those who act as buyers. In this role play, students are taught how to make transactions and count. The students seemed enthusiastic in participating in the learning because they were playing together.

Figure 3. Role-play game

The success of the program carried out can be seen from the compatibility between the program, program users, and program implementing organization. The success of the program is assessed based on the perspective of the implementation process and implementation results. Based on a process perspective, the math games program in mathematics learning at SDN Pemurus Dalam 6 has been successful, because the program implemented is in accordance with the work program plan created (Andi et al., 2022). The math games carried out by students are in accordance with the objectives of the Kampus Mengajar foster students' motivation in solving numeracy problems. Math games aims to improve students' motivation in solving the numeracy problems of students at SDN Pemurus Dalam 6 (Ilhamsyah et al., 2021; Saifulloh et al., 2024; Suprotun & Andriyani, 2022). Meanwhile, based on the results perspective, the math games program is also considered successful, because it can provide benefits as expected.

There are five indicators of students motivation observed, namely: (1) passion and desire to succeed, (2) encouragement and need in learning, (3) ideals and hopes in the future, (4) appreciation in learning, and (5) activities that attract attention in learning. Based on the observation sheet, the results are as shown in Figure 4.

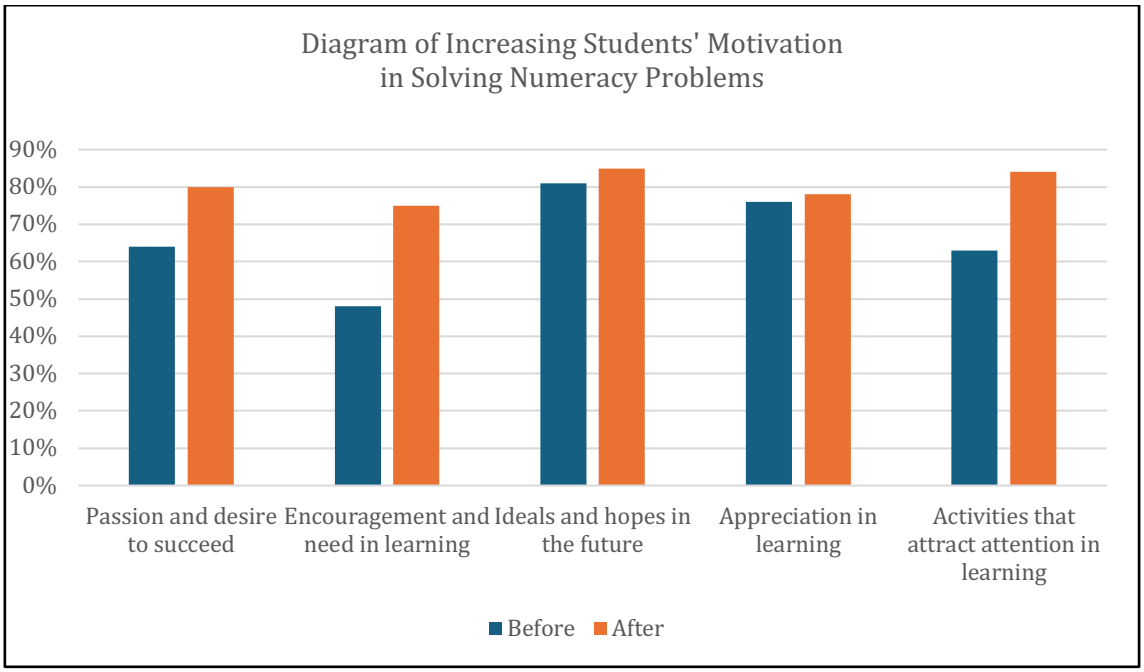

Figure 4. Diagram of increasing students' motivation in seolving numeracy problems

The first indicator is the passion and desire to succeed. The percentage on the observation sheet before the implementation of math games was 64%, increasing to 80%. Students try hard to find solutions to the numeracy problems given through math games, this is because of the students' desire to win the games. This is in line with previous research (Ayunda & Riduan Febriandi, 2023; Juwiantho & Sidarta, 2024; Nurhadiani et al., 2023; Pitanti, 2023) which states the same thing. Then, the second indicator is the encouragement and need in learning, the percentage on the observation sheet before the implementation of math games was 48%, increasing to 75%. Through math games, students' competitive spirit can be fostered so that there is a encourage to

learn. Some previous studies (Divrik & Topal, 2024; Ferdinand Sinuhaji et al., 2024; Fish et al., 2023; Hall et al., 2024) have also found that.

Furthermore, the third indicator is ideals and hopes in the future, the percentage on the observation sheet before the implementation of math games was 81%, increasing to 85%. This can be seen from the increasing number of students who are confident in stating their ideals. Then, the fourth is appreciation in learning. The percentage on the observation sheet before the implementation of math games was 76%, increasing to 78%. This is because students feel happy when they get rewards when they win math games (Divrik & Topal, 2024; Hall et al., 2024).

As for the fifth indicator, namely activities that attract attention in learning, there was an increase from 63% to 84%. Students are interested because math games are rarely used by teachers, and also because in math games, students can be actively involved in learning by interacting with other students. Thus, from the five students' motivation indicators above, the average increase in each indicator is 14%.

CONCLUSION

In order to improve students' motivation in solving numeracy problems of students of SDN Pemurus Dalam 6, students of Kampus Mengajar batch 5 implemented math games. The math games implemented include the 3-6-9 game, mission X, mathematical snakes and ladders, and role play. Based on program implementation model by David C. Korten, this math games program is appropriate, both in terms of the program, the program users, and the program implementing organization. After being studied from a process and results perspective, the implementation of this math games program has been successfully implemented and increase students' motivation in solving numeracy problems. Suggestions for further research are the use of more varied learning media to improve students' numeracy skills.

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DECLARATION

Author Contribution

All authors contribute in the research process, such as collecting the data, analyzing the data, and writing the manuscript. All authors approved the final manuscript.

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This research did not receive any funding.

Conflict of Interest

Both authors declare that they have no competing interests.

Ethics Declaration

We as authors acknowledge that this work has been written based on ethical research that conforms with the regulations of our institutions and that we have obtained the permission from the relevant institutes when collecting data. We support the International Journal on Emerging Mathematics Education (IJEME) in maintaining

high standards of personal conduct, practicing honesty in all our professional practices and endeavors.

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