



Teacher creativity in the use of educational games in distance mathematics learning for junior high school students

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ABSTRACT

Playing is basically a natural activity that children mostly like. It can be used as a means of learning, at least learning about rules and roles. The aim of this research is to study how teacher's creativity influences the use of educational games in distance mathematics learning for eight graders. A number of thirty-five students from a public junior high school in North Sumatra involved in the study by completing a questionnaire regarding their perception on their teacher's creativity and reporting student's learning outcomes on mathematics subject. The authors did not conduct a test of learning outcomes but gathering the data from the school exam. The analysis shows there was contribution of teacher's creativity level into learning outcomes. $Y = 50.030 + 0.424X$ with level of determination as much as 0.277. It can be concluded that it is evident that teacher creativity is an important factor. Although this study fails to show new conclusions, the large amount of determination level could trigger a more elaborated research.

Bermain pada dasarnya merupakan aktivitas alami yang paling disukai anak-anak. Dapat digunakan sebagai sarana pembelajaran, setidaknya pembelajaran tentang aturan dan peran. Penelitian ini bertujuan untuk mempelajari bagaimana kreativitas guru mempengaruhi penggunaan permainan edukatif dalam pembelajaran matematika jarak jauh pada siswa kelas VIII. Sebanyak tiga puluh lima siswa SMP negeri di Sumatera Utara dilibatkan dalam penelitian ini dengan mengisi kuesioner mengenai persepsi mereka terhadap kreativitas guru dan melaporkan hasil belajar siswa pada mata pelajaran matematika. Penulis tidak melakukan tes hasil belajar melainkan mengumpulkan data dari ujian sekolah. Hasil analisis menunjukkan adanya kontribusi tingkat kreativitas guru terhadap hasil belajar. $Y = 50,030 + 0,424X$ dengan taraf determinasi sebesar 0,277. Dapat disimpulkan bahwa kreativitas guru merupakan faktor yang penting. Meskipun penelitian ini gagal menunjukkan kesimpulan baru, besarnya tingkat determinasi dapat memicu penelitian yang lebih mendalam

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INTRODUCTION

Playing is basically a natural activity that children really like and can be used as a means of learning, at least learning about rules and roles. Through play activities, children learn to adapt to their environment and become a means of acquiring new knowledge. Games or games, apart from being used as entertainment, can also be used as a learning medium. This is due to the nature of the game which is fun, stimulates and encourages players to continue to progress so that players will automatically learn a skill and absorb a lot of information. Games aimed at learning activities can be called educational games or educational games (Buscher & Humphrey, 2021). The role of games in learning can be seen from the definition of games as a means or tool (tool) to: (1) increase awareness and increase motivation; (2)

practicing skills; (3) develop knowledge; (4) communication and collaboration; and (5) integrating learning experiences. Usually educational games are designed to convey learning material or strengthen understanding of learning concepts (Sari & Usmeldi, 2019).

Educational games are very useful for reducing and eliminating students' boredom when participating in the learning process because of the fun, motivating and entertaining characteristics of games (Yoda, 2017). Educational games, according to Ismail are educational activities that are fun and useful for improving language and thinking skills, increasing concentration and solving problems (Lubna Naz, Naeem-uz-Zafar, 2020). The explanation of the benefits of educational games is as follows. : (1) Educational games can be useful as learning media to convey information, knowledge or subject matter in an interactive and interesting way for children, (2) Educational games can stimulate children's minds and creativity, (3) Educational games can create a dancing playing environment , safe and fun so that it can improve the quality of children's learning. (3) Educational games improve players' logic and understanding of the information they obtain when using the game. (4) Educational games can make learning more meaningful, so that new information or concepts received can last longer, (5) Educational games can provide information that becomes experience in decision making, so that children make the right decisions and do not repeat the same mistakes . (6) Educational games can be used as a means of evaluating learning outcomes.

Developing students' creativity requires supporting things or conditions, namely creative teachers who include creative learning (creative teaching), creative school principals (creative leadership) and a creative environment (Wisnuardani & Surya Abadi, 2021). Developing creativity in the national context to prepare national citizens to face highly competitive (global) life (Fatchurahman et al., 2022). According to Monawati & Fauzi one of the problems faced in the world of education is fostering teacher creativity (Siagian et al., 2023). Teacher creativity in the teaching and learning process has an important role in motivating students' learning (Eick & Reed, 2002). The aim of developing creativity is to improve the quality of education (Siagian et al., 2023). The development of creativity in education can be driven by three aspects, including; teaching that provides creative and innovative practices, by creating an environment that supports student creativity and by a teacher ethos that maintains an open attitude towards students and reflects (Beijaard, 2019).

Education or upbringing is the process of changing the attitudes and behavior of a person or group of people in an effort to mature humans through teaching and training efforts, educational processes, methods and actions (Voller, 2019). Education can be obtained formally or non-formally (Mufidah, 2022). Formal education is obtained from structured learning that has been designed by an institution. Meanwhile, non-formal education is knowledge that humans gain in everyday life, either experienced or learned from other people (Zhang et al., 2020). One type of game that is created with the aim of helping the learning process is called educational games. These educational games are usually related to educational games with the aim of educating (Herman et al., 2022). Games or games as a learning medium involve students in the process of experience and at the same time experiencing challenges, getting inspiration, being encouraged to think creatively, and integrating in activities with fellow students in playing games (Drijvers et al., 2021).

Zulfiqar et al. (2019) explained that educational games have four characteristics, namely: (1) The presence of challenges. In educational games, challenges are used to attract players' interest, with the aim of getting players to solve problems that are tested or given. (2) Arouse curiosity. Educational games are designed to arouse players' curiosity, both sensory and cognitive. In line with research conducted by Ibrahim, N; Isharwati, 2017 Producing Android-based mobile learning media for science subjects for junior high school students which is packaged in application package (APK) format (Mehtälä, 2015; Thaba et al., 2021; Yaniawati et al., 2021). (3) The existence of control. Control functions as a determinant of the player's fate. Control is needed to determine the right decisions, which can provide good results for the player. In educational games, control can also be used as learning and experience. (4) There is fantasy. Fantasy includes emotions and thought processes (Gurr et al., 2020). In educational games, fantasy is needed to appeal to the player's emotions, to create a sense of interest and enjoyment (Wibawa et al., 2022). Fantasy develops imagination and thinking processes, so that it can improve learning. Based on the problem formulation that has been expressed above, the aim of this research is to find out how the influence of teacher creativity in the use of educational games in distance mathematics learning through class students?

METHOD

This type of research is quantitative research approach . Sampling techniques are generally random, data collection uses research instruments, quantitative/statistical data analysis with the aim of testing predetermined hypotheses (Rohma et al., 2020). After the questionnaire was distributed and the learning outcome data was obtained, a normality test, linearity test, simple regression analysis and multiple linear regression analysis were carried out, as well as hypothesis testing using the t test (partial test), F test (simultaneous testing) and coefficient of determination test (Sujarwo et al., 2021). The data normality test in this study used Kolmogorov Smirnov test (K-S test) (Budnyk, 2019).

RESULT AND DISCUSSION

Instrument Test Results

Before being used to analyze the required data, the questionnaire/questionnaire statements are first tested to determine the validity and reliability of the questionnaire. The research questionnaire trial was carried out on January 8, 2024, for grade 8 students at Junior high school in North Sumatra (Bahauddin & Setyaningrum, 2019). The results of data analysis for each questionnaire characteristic are as follows:

Validity of the Teacher Creativity Questionnaire in the Use of Educational Games

The validity test was carried out by calculating r using the *Product Moment* correlation formula. If $r_{count} > r_{table}$ at a significance level of 5% with $N=35$ then the instrument is declared valid for measuring teacher creativity in using educational games , but conversely if $r_{count} < r_{table}$ then the instrument is declared invalid and not suitable for use to measure creativity teachers in the use of educational games. The results of the validity test for each item of the teacher creativity instrument in the use of educational games are presented in table 1.

Table 1 Validity Test Results of Teacher Creativity in The Use of Educational Games

Question Items	r_{count}	r_{table}	Decision	Question Items	r_{count}	r_{table}	Decision
1	0.667	0.334	Valid	11	0.585	0.334	Valid
2	0.446	0.334	Valid	12	0.346	0.334	Valid
3	0.672	0.334	Valid	13	0.398	0.334	Valid
4	0.411	0.334	Valid	14	0.656	0.334	Valid
5	0.422	0.334	Valid	15	0.544	0.334	Valid
6	0.474	0.334	Valid	16	0.604	0.334	Valid
7	0.484	0.334	Valid	17	0.543	0.334	Valid
8	0.559	0.334	Valid	18	0.614	0.334	Valid
9	0.362	0.334	Valid	19	0.383	0.334	Valid
10	0.113	0.334	Invalid	20	0.510	0.334	Valid

Based on the calculations, there was one invalid questionnaire item that was not used to collect data. Therefore, in this study 19 valid questionnaire items were used

Reliability of Teacher Creativity in the Use of Educational Games

A summary of the reliability test of the teacher creativity questionnaire in the use of educational games can be seen from the following table 2 (Umbara et al., 2021).

Table 2. Reability Test Results of Teacher Creativity in The Use of Educational Games

Reliability Statistics	
Cronbach's Alpha	N of Items
0.824	20

it is obtained Alpha cronbach score is 0.824 which means that the questionnaire in this study is reliable.

Research Data Analysis

The research was conducted by grade 8 students of a junior high school on January 15-17 2024. Based on the results of research conducted on 35 students using a research instrument in the form of a closed questionnaire with the scores for each available item filled in by the students themselves (Umbara et al., 2021).

Teacher Creativity in Using Educational Games

The following is a table 3 of descriptive analysis results of teacher creativity in the use of educational games .

Table 3. Statistics Description of Interest in Learning

Statistics	Learning Interest Score
Sample	35
Lowest Score	67
Highest Score	90
Average	79.57143
Standard Deviation	5.694609

From table 3, we then compile a table of categories of data on teacher creativity in the use of educational games and will present it in the form of the following table 4.

Table 4. Categories of Teacher Creativity Data in the Use of Educational Games

Category Limits	Intervals	Frequency	Percentage	Information
$X < (\mu - \sigma)$	$x < 73.88$	6	17%	Low
$(\mu - \sigma) \leq x < (\mu + \sigma)$	$73.88 \leq x < 85.27$	23	66%	medium
$(\mu + \sigma) \leq x$	$85.27 \leq x$	6	17%	High
Total		35	100%	

Based on the subjects of this research overall their teacher's creativity is in the medium category, namely 66%.

Learning Outcomes (Distance mathematics learning)

The following is a table 5 of descriptive analysis results of student learning outcomes data.

Table 5. Statistics Description of Learning Results

Statistics	Learning Outcome Score
Sample	35
Lowest Score	75
Highest Score	92
Average	83.74
Standard Deviation	4.52

From table 5, then compile a table of learning outcomes data categories and will present it in the form of the following table 6.

Table 6. Learning Outcome Data Categories

Category Limits	Intervals	Frequency	Percentage	Information
$x < (\mu - \sigma)$	$x < 79.22$	5	14.0%	Low
$(\mu - \sigma) \leq x < (\mu + \sigma)$	$79.22 \leq x < 88.26$	23	66%	Medium
$(\mu + \sigma) \leq x$	$88.26 \leq x$	7	20%	High
Total		35	100%	

Based on the school data, it can be concluded that the learning outcomes category for students at junior high school for all research subjects is greater in the medium category, namely 66%.

A. Data Analysis Prerequisite Test

a. Data Normality Test

The aim of the normality test in this research is to find out whether the data in this research has a normal distribution or not.

Table 7. Kolmogrov-Smirnov Test Results for Teacher Creativity in the Use of Educational Games

One-Sample Kolmogorov-Smirnov Test		
Teacher Creativity in Using Educational Games		
N		35
Normal Parameters ^{a, b}	Mean	79.57
	Std. Deviation	5.695
Most Extreme Differences	Absolute	.080
	Positive	.080
	Negative	-.077
Statistical Tests		.080
Asymp. Sig. (2-tailed)		.200 ^{c, d}
a. Test distribution is Normal.		
b. Calculated from data.		
c. Lilliefors Significance Correction.		
d. This is a lower bound of the true significance.		

From [table 7](#). above, it can be concluded that the normality test for teacher creativity in the use of educational games is normally distributed with $D_{max}(0.080) < D_{table}(0.224)$ and significance $(0.200) \geq 0.05$.

b. Data Linearity Test

The linearity test is carried out to determine whether the data for each independent variable has a linear relationship with the dependent variable. The guideline used to determine linearity is to look at the analysis results on *the deviation of linearity*. The provisions used for decision making are the significance value in the *deviation of linearity column* > 0.05 , so it is concluded that the relationship between the independent variable and the dependent variable is linear. Conversely, if the significance value is < 0.05 , it is concluded that the relationship between the independent variable and the dependent variable is not linear ([Wijaya et al., 2019](#)).

1. Linearity Test of Teacher Creativity in the Use of Educational Games on Learning Outcomes (Distance mathematics learning)

The results of the linearity test show in [table 8](#).

Table 8. Test of Linearity of Teacher Creativity in The Use of Educational Games on Learning Outcomes (Distance Mathematics Learning)

ANOVA Table						
		Sum of Squares	df	MSE	F	Sig.
Between Groups (Combined)		534.352	18	29.686	2.634	.029
	Linearity	197.921	1	197.921	17.560	.001
	Deviation from Linearity	336.431	17	19.790	1.756	.133
Within Groups		180.333	16	11.271		
Total		714.686	34			

From [table 8](#). it can be concluded that teacher creativity in using educational games on learning

outcomes is linear with a significance of $(0.113) > 0.05$.

B. Hypothesis test

The analysis technique used to test the first and second hypotheses uses simple regression analysis techniques and the t test, while to test the third hypothesis uses multiple regression analysis techniques and the f test. And for the first, second and third hypotheses, the coefficient of determination for each hypothesis is calculated.

1. Hypothesis testing with simple linear regression, t test, and coefficient of determination

Simple regression is used to predict or test the influence between the independent variable (X) and the dependent variable (Y). In this research, the regression analysis used is simple regression analysis, namely teacher creativity in using educational games, and one dependent variable (Y), namely learning outcomes.

The simple regression equation: $Y' = a + bX$

a. Simple regression test of teacher creativity in the use of educational games on learning outcomes

The following are the results of simple regression analysis test calculations.

Table 9. Simple Regression Test Results for Teacher Creativity in the Use of Educational Games on Learning Outcomes

Coefficients^a						
Model	Unstandardized		Standardized		Q	Sig.
	Coefficients		Coefficients			
	B	Std. Error	Beta			
1 (Constant)	50.030	9.507			5.263	.000
Teacher Creativity	.424	.119	.526		3.555	.001

a. Dependent Variable: Learning Outcomes

Based on [table 9](#) above, it shows that the regression equation model for estimating learning achievement which is influenced by Teacher Creativity in the Use of Educational Games is $Y = 50.030 + 0.424X$.

The constant value (a) of 50.030 is an estimate of the contribution made by factors outside Teacher Creativity in the Use of Educational Games. The regression coefficient value (b) = $0.424 > 0$, meaning that there is a positive influence of Teacher Creativity in the Use of Educational Games (X) on learning outcomes (Y). From the equation above it can be seen that if the value of Teacher Creativity in the Use of Educational Games (X_1) increases by one unit then student learning outcomes (Y) increase by 0.424 units.

b. T Test of Teacher Creativity in the Use of Educational Games on Learning Outcomes

The following are the results of the hypothesis test calculation (t test).

Table 10. T Test Teacher Creativity

Coefficients^a						
Model	Unstandardized Coefficients		Standardized Coefficients		t	Sig.
	B	Std. Error	Beta			
1 (Constant)	50.030	9.507			5.263	.000
Teacher Creativity	.424	.119	.526		3.555	.001

a. Dependent Variable: Learning Outcomes

Based on [table 10](#) above, to determine the magnitude of the influence of the independent variable on the dependent variable is as follows: From the results of the table above it can be seen that $t_{calculates}$ the coefficient for Teacher Creativity in the Use of Educational Games is 3.555. Meanwhile, the t_{table} can be calculated from the t-test table with the formula: $t_{tab} = (\alpha/2; nk-1)$ so we get $t_{tab} = 2.037$.

The variable Teacher Creativity in the Use of Educational Games has a significance level of $0.001 < 0.05$, meaning it is significant. Meanwhile, $t_{count} > t_{table}$ is $3.555 > 2.037$, then H_a is accepted and H_0 is rejected, so it can be concluded that there is a significant influence between Teacher Creativity in the Use of Educational Games on the mathematics learning outcomes of grade 8 students at Junior High School.

Coefficient of Determination of Teacher Creativity in The Use of Educational Games on Learning Outcomes

The following are the results of the coefficient of determination using.

Table 11. Results of The Coefficient of Determination of Teacher Creativity in The Use of Educational Games on Learning Outcomes

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.526 ^a	.277	.255	3.957

a. Predictors: (Constant). Teacher Creativity

The coefficient of determination shows the level of accuracy of the regression line used to find out how much influence one variable has on other variables. Based on the analysis in the table above, it is known that the coefficient of determination is 0.277. This value was then converted into a percentage to become 27.7%, which means that Teacher Creativity in Using Educational Games was able to explain 27.7% of changes in learning outcomes. This shows that there are still 73.3% factors or other variables that influence learning outcomes.

Discussion

Mathematical concepts contain prerequisite material or concepts in the learning process concepts in mathematics require prerequisite material from other concepts. When studying a system of linear equations in two variables, it is necessary to remember the concept of systems of equations in one variable, or even the concept of geometric shapes (Soraya et al., 2022). As well as a teacher who will explain about function material, the teacher must know Do students understand the concept of sets? This connection is necessary trained to students so that they need to be given related material and exercises by connecting concepts in mathematics or other scientific disciplines (Bakhril et al., 2019). The aim of the mathematical connection itself is to enable students to be able to see mathematics as an inseparable science so that students can identify the problem and describe the results using the material mathematics, understand mathematical concepts to understand mathematical concepts will be studied, and use thinking in creating models to solve problems in other scientific disciplines (Lin, 2019). There are many benefits to connection mathematics, as in research when students can relate mathematical ideas then their understanding will be deeper, lasting and students see concepts from a variety of fields. The indicators of connection are according to the National Council of Teachers of Mathematics (Puteri & Riwayati, 2017) includes; (1) Identify connections between ideas mathematics; (2) Mastering how mathematical ideas are linked and developed one with others so that they are completely interconnected; and (3) Explore and using mathematics in contexts outside mathematics (Mazana et al., 2020). Meanwhile, according to Coxford (Guimpayan, 2018) connection capabilities include: (1) Connecting conceptual and process knowledge, (2) Utilizing mathematics in other topics (other curriculum areas), (3) Utilizing mathematics in activities in life everyday life, (4) Viewing mathematics as an integrated science, (5) Using mathematical thinking skills and making models to solve problems in other lessons (6) Knowing the relationship between internal concepts mathematics, and (7) Explore various depictions of the same concept (Annatasya, 2022).

Educational games are one solution offered as an innovative learning media (Mathebekase, 2018). According to educational games are a type of media that can be used for provide information, increase students' knowledge through a unique media and interesting. Educational games are serious games. Meanwhile opinions (Pratama et al., 2020) educational games are one of the learning bases that

combine educational content into an entertainment context to facilitate learning. According to Nikensasi and Hakim (Andini & Yunianta, 2018) educational games can be used in the theme of the game that provides educational value from the game. used in the theme of the game that provides educational value from the game so that games that originally functioned as entertainment media can now be a medium of learning. learning media. An educational game is a breakthrough that will make a difference (Rakoczy et al., 2019).

Based on the results of research by (Asfar & Asfar, 2020) there is an effect of using interactive games on students' mathematical understanding ability students. Learning by using game media will have a positive impact, research from the use of games is effectively used in the learning process and provides a learning experience that attracts students' interest learning process and provides a learning experience that interests students. A good math education game is an educational game that contains material in accordance with the science to be learned, as well as the components in the game, with the science to be learned, and the components in the educational game are consistently connected (Tripolca, 2023). Effective educational games can also affect student learning outcomes in accordance with the objectives to be achieved (Wongwatkit et al., 2020). Therefore, as a learning media that contains educational games, it can help students maximize their learning can help students maximize learning, because with medi will make students feel enjoy or not pressured make students feel enjoy or not pressured in learning (Sukendar, 2018).

CONCLUSION

Based on the results of the analysis and discussion, the following conclusions can be obtained: There is a positive and significant influence on teacher creativity in the use of educational games (X) on student mathematics learning outcomes (Y) in class 8 of junior high school. This is shown by obtaining a coefficient of determination of 0.277 and a value of 3.555 and 2.037. Teacher creativity in using educational games influences the mathematics learning outcomes at least for the subject in this study, grade 8 students at a junior high school in Sumatera.

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