The Effect of Curiosity on Mathematical Creativity

Yayan Eryk Setiawan[1], Surahmat[2]
{yayaneryksetiawan@unisma.ac.id[1], surahmatsupangken@gmail.com[2]}

Department of Mathematics Education, Faculty of Teacher Training and Education,
Universitas Islam Malang, Malang, Indonesia

Abstract. One of the important to consider in supporting successful learning is curiosity and creativity. The purpose of this study was to determine the effect of curiosity on mathematical creativity. This type of research is quantitative research. By using a random sampling technique, the sample of this research was 65 students in one semester of the mathematics education study program at the Islamic University of Malang. The data collected in this research is the result of a questionnaire about students' mathematical curiosity and creativity. The questionnaire in this study consisted of a questionnaire about curiosity and a questionnaire about mathematical creativity. The questionnaire used in this study has met the validity and reliability. The results of the questionnaire were analyzed by correlation test and linear regression test with the help of SPSS. The results showed that there was a correlation between curiosity and mathematical creativity. The results also show that curiosity has a positive effect on mathematical creativity by 43%. This influence is due to four things, namely curiosity about new information, alternative solutions, solutions to difficult questions, and errors in solving problems. Thus learning is expected to rise high curiosity, so that mathematical creativity increases.

Keywords: mathematical creativity; curiosity; learning mathematics

1 Introduction

Curiosity is one of the important factors that must be considered in learning mathematics. Because curiosity affects the transformation of students into active individuals [1]. This curiosity is by human development which makes a person learn something, thus gaining new knowledge and skills [2], [3]. This curiosity is also by humans as social beings who make a person need information, thus obtaining new information [4]. The results also show that there is a positive correlation between the level of curiosity and the use of learning strategies [5]. This curiosity allows a person to seek answers, explore problems, observe their environment, and understand events that are taking place in the world [6]. From these various opinions, it can be concluded that the importance of curiosity is that it can benefit students and can make students active in learning, thus gaining new knowledge and skills and obtaining important information for successful learning.The theoretical model of curiosity is divided into two dimensions. The first dimension is the desire to seek new experiences and the second dimension is an appreciation of the complex, new and unknown nature of life [7]. The dimension of curiosity in this research is the desire to seek new experiences in the form of new alternatives in solving mathematical problems.

The importance of this curiosity causes various researchers to be interested in exploring further curiosity. Previous research explored the effect of self-efficacy in creativity and

BIC 2021, October 11-12, Batusangkar, Indonesia

DOI 10.4108/eai.11-10-2021.2319517

curiosity on creative emotions [8]. The results showed that self-efficacy in creativity had an effect of 29.6% on creative emotions and self-efficacy in curiosity had an effect of 17.8% on creative emotions. The previuos study showed a positive relationship between curiosity and motivation [5]. Another study showed that there were significant differences in curiosity based on gender, majors, and monthly expenses [6]. Other studies have shown that perceptions of teaching styles contribute to students' curiosity and motivation to be active in the classroom [9]. Other studies have shown a correlation between problem-solving abilities and the level of curiosity of prospective teachers [10]. The curiosity have an important effect on academic achievement [11]. The curiosity arises from personal which is conducive to the process of developing cultural knowledge [12].

From these various studies, it can be concluded that there has been no research that has investigated the effect of curiosity on students' mathematical creativity. This creativity is important for students to have. This is because creativity is the key to success in the 21st century [13]. Even the results of the study also show that a creative person can find effective ways to solve mathematical problems [14]–[16]and can solve problems with various representations [17]. Meanwhile, students who tend to be uncreative will get stuck in errors in solving math problems [18], [19]. Creativity in this study is defined as an effort to find new alternative solutions in solving mathematical problems [20]–[22]. Thus the purpose of this study was to determine the effect of curiosity on mathematical creativity. The hypotheses of this research are: H_0 = there is no effect of curiosity on mathematical creativity; H_a = there is a significant effect of curiosity on mathematical creativity.

2 Method

This type of research is quantitative research. The sample of this research consisted of 65 students of the mathematics education study program in one semester at the Islamic University of Malang. The sample selection technique in this study was carried out using a random sampling technique. This is because there are no specific criteria in determining the research sample. The predictor variable in this research was curiosity (X), while the dependent variable in this research was mathematical creativity (Y). The measurement of these two variables uses the Likert scale. Where the Likert scale is used to measure a person's attitude or response. Indicators of predictor variables and dependent variables can be seen in Table 1.

Table 1. Indicators of Predictor Variables and Dependent Variables.

Variables	Indicators
Predictor variables: Curiosity	▪ Interested in learning mathematics. ▪ Happy with the assignments given by the lecturer. ▪ Want to know more clearly about his work error. ▪ Always learning even if there is no assignment. ▪ Do the questions in the book, even if there is no assignment. ▪ Keep working on the problem, even if it's difficult.
Dependent variable: Mathematical Creativity	▪ Enjoys finding solutions to problems from various sources. ▪ Have the opinion that there is not only one solution. ▪ Try to solve the problem in another way. ▪ Enjoys solving problems in different ways.

The instrument of this research is a questionnaire to determine students' mathematical curiosity and creativity. This questionnaire consists of 7 statements about curiosity and 4 statements about mathematical creativity developed from the indicators in Table 1.Quantitative data analysis in this research was analyze the regression linear between the two variables with SPSS. The significance level of the regression test results in this study was 5%. Therefore, the test results criteria have H_a accepted if the value of Sig. < 0.05. Thus there is a significant effect of curiosity on students' mathematical creativity.

3 Result and Discussion

3.1Result of The Regression Test

The results of linear regression testing with the help of SPSS in this study can be seen in Table 2. and Table 3.

Table 3. Summary Model of Regression Test Results

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.655[a]	.430	.421	6.501

a. Predictors: (Constant), Creativity

Table 4. Coefficients[a] Value of Regression Test

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	30.007	6.568		4.568	.000
	Creativity	.555	.081	.655	6.888	.000

a. Dependent Variable: Curiosity

From Table 2. it can be seen that the value of the influence of curiosity on mathematical creativity can be seen from the R Square value, which is 0.430. This value means that the effect of curiosity on mathematical creativity is 43% and the other 57% is influenced by other factors not identified in this study. From table 3 it can be seen that the value of Sig. of creativity is 0.000 < 0.05. This means that it can be concluded that H_0 is rejected and H_a is accepted, that is, there is a significant influence of curiosity on mathematical creativity.From Table 3. it can also be seen that the constant value of the Unstandardized Coefficients is 30.007. This means that if there is no curiosity value, then the mathematical creativity value is 30.007. While the regression coefficient is 0.555, which means that for every 1% addition to the level of curiosity, mathematical creativity will increase by 0.555. It can also be said that curiosity has a positive effect on mathematical creativity. Thus the regression equation is $Y = 30.007 + 0.555X$. For example, for someone who has a low value for curiosity (e.g. 50), then the value of creativity is $Y = 30.007 + 0.555(50) = 57.575$. While someone has a high curiosity value (e.g. 95), then the value of creativity is $Y = 30.007 + 0.555(95) = 82.732$. It can be said that the higher a person's curiosity, the higher the value of creativity.

3.2 Discussion

The results of this research contributed to developing the results of previous research on curiosity [1], [4], [8], [10]–[12]by showing that curiosity is correlated with one's mathematical creativity and also curiosity has a positive effect on students' mathematical creativity. The effect of curiosity on students' mathematical creativity is 43%. There are four important things that cause curiosity to affect one's creativity, namely curiosity about new information, curiosity about various alternative problem solving solutions, curiosity about solutions to difficult questions, and curiosity about mistakes made. . Each of these causes is discussed below.

The first is curiosity about new information. The results of previous studies indicate that this curiosity is the beginning of a person's gaining new knowledge [2]. The results of this study extend the results of the study by showing that curiosity about new information causes a person to be happy and try to participate in learning mathematics. This is because every learning in class provides new information. Therefore, as a lecturer or teacher, he should always provide new information in his learning. Because the new information provided will have an impact on fun in learning mathematics and ultimately make someone think creatively.

The second is curiosity about various alternative solutions. The results of previous studies also show that students who can find various alternative solutions are students who have high curiosity [23]. The results also show that this curiosity makes someone interested in knowing different things [24]. The results of this study expand the results of previous studies by showing that curiosity about various alternative solutions affects a person to think creatively mathematically. Therefore, the lecturer or teacher should provide questions consisting of various alternative solutions. Thus, students' mathematical creativity can be improved.

The third is curiosity about the solution to a difficult problem. The results showed that most students easily gave up when solving difficult questions, so they experienced errors in solving math problems [25]–[27]. The results also show that this curiosity causes a person to have the persistence to continue, despite experiencing difficulties [28], [29]. The results of this study extend the results of previous research by showing that curiosity about the solution of a difficult problem causes a person to have mathematical creative thinking by trying to find various sources to solve the problem. Therefore, the lecturer or teacher also gives difficult questions or questions in the form of projects that are used to foster student curiosity.

Fourth is curiosity about the mistakes. Sometimes a student does not want to know the mistakes made when solving problems. Because I'm ashamed of the bad grades. The results show that someone who has a curiosity about his mistakes will be able to modify the wrong alternative solutions so that the correct answer is obtained [14], [15]. The results of this study extend the results of previous studies by showing that curiosity about errors leads to the emergence of mathematical creativity. This is because someone will look for the correct alternative from the mistakes made. Therefore, the teacher or lecturer should convey about the mistakes made by students. So that students can avoid mistakes and can think creatively.

5 Conclusion

Following the purpose of this research, namely to determine the effect of curiosity on students' mathematical creativity. From the results of the research, it can be concluded that this curiosity has a positive effect on students' mathematical creativity by 43%. Four important things cause curiosity to affect students' mathematical creativity. The first is curiosity about

new information, the second is curiosity about various alternative problem-solving solutions, the third is curiosity about solutions to difficult problems, and the fourth is curiosity about mistakes made. Therefore, the recommendation for educators is to carry out learning by increasing student curiosity which results in increasing student mathematical creativity. The recommendation for further research is to conduct in-depth qualitative research on the analysis of students' mathematical creative thinking based on the level of student curiosity.

References

[1] J. Ahmad and N. M. Siew: "Curiosity towards Stem Education: A Questionnaire for Primary School Students," *J. Balt. Sci. Educ.*, vol. 20, no. 2, pp. 289–304, (2021).

[2] S. Ron: "From IQ to IC: A Dispositional View of Intelligence," *Roeper Riview*, vol. 23, no. 3, pp. 1–23, (2001).

[3] Y. E. Setiawan: *Thinking Disposition*. Lumajang: CV. Al-Mukmin Yes, (2020).

[4] N. Aktas and U. D. Ustun, "The Measurement of Curiosity of Teacher Candidates: A Study Based on Breadth and Depth of Interest," *Adv. Educ.*, no. 7, pp. 33–36, 2017.

[5] M. B. Turan and K. Koç: "Examination on the Effect of Learning Strategies on Physical Education and Sports Teacher Candidates and their Motivation of Curiosity and Levels of Exploration," *World J. Educ.*, vol. 9, no. 1, p. 92, (2019).

[6] M. Yıldırım and O. Çoban: "The Analysis of Students ″ Special Curiosity in Sports Based on Some Demographic Variables," *J. Educ. Train. Stud.*, vol. 7, no. 3, pp. 50–57, (2019).

[7] E. M. Cankaya, J. Liew, and C. P. P. de Freitas: "Curiosity and Autonomy as Factors That Promote Personal Growth in the Cross-cultural Transition Process of International Students," *J. Int. Students*, vol. 8, no. 4, pp. 1694–1708, (2018).

[8] W. Daher, F. Gierdien, & A. Anabousy: "Self-efficacy in creativity and curiosity as predicting creative emotions," *JRAMathEdu (Journal Res. Adv. Math. Educ.*, vol. 6, no. 2, pp. 86–99, (2021).

[9] A. Inayat and D. A. Z. Ali: "Influence of Teaching Style on Students' Engagement, Curiosity and Exploration in the Classroom," *J. Educ. Educ. Dev.*, vol. 7, no. 1, p. 87, (2020).

[10] C. A. Karademir: "Pre-Service Teachers' Problem Solving Skills and Curiosity Levels," *Int. J. Educ. Methodol.*, vol. 5, no. 1, pp. 151–164, (2019).

[11] A. Maksum & F. D. Khory, "Effect of Learning Climate, Thinking Pattern, and Curiosity on Academic Performance in Higher Education," *Probl. Educ. 21st Century*, vol. 78, no. 1, pp. 102–113, (2020).

[12] N. S. Mikhaylov: "Curiosity and its Role in Cross-Cultural Knowledge Creation," *Int. J. Emot. Educ.*, vol. 8, no. 1, pp. 95–108, (2016).

[13] Ş. Elaldı and V. Batdı: "The Effects of Different Applications on Creativity Regarding Academic Achievement: A Meta-Analysis," *J. Educ. Train. Stud.*, vol. 4, no. 1, pp. 170–179, (2015).

[14] Y. E. Setiawan: "Student Thinking Process in Correcting Linear Pattern Generalization Errors," *Mosharafa J. Pendidik. Mat.*, vol. 9, no. 3, pp. 371–382, (2020).

[15] Y. E. Setiawan, "The Thinking Process of Students using Trial and Error Strategies in Generalizing Linear Patterns," *Numer. J. Mat. dan Pendidik. Mat.*, vol. 4, no. 1, pp. 1–12, (2020).

[16] Y. E. Setiawan, Purwanto, I. N. Parta, & Sisworo: "Generalization Strategy of Linear Patterns From Field-Dependent Cognitive Style," *J. Math. Educ.*, vol. 11, no. 1, pp. 77–94, (2020).

[17] Y. E. Setiawan: "Prospective teachers representations in problem solving of special angle trigonometry functions based on the level of ability," *Infin. J. Math. Educ.*, vol. 11, no. 1, pp. 55–76, (2022).

[18] Y. E. Setiawan: "Analysis of error in determining the distance between two points in the cartesian plane in the first semester students," *J. Pendidik. Mat. dan IPA*, vol. 13, no. 1, pp. 25–39, (2022).

[19] Y. E. Setiawan & Surahmat: “Error analysis of prospective mathematics teachers in solving of applying radian measurement problem in trigonometry courses,” *Aljabar J. Pendidik. Mat.*, vol. 12, no. 2, pp. 343–357, (2021).
[20] D. F. Shell, M. P. Hazley, L. K. Soh, E. Ingraham, & S. Ramsay: “Associations of Students" Creativity, Motivation, and Self-Regulation with Learning and Achievement in College Computer Science Courses,” *Proc. - Front. Educ. Conf. FIE*, pp. 1637–1643, (2013).
[21] A. Gajda, M. Karwowski, & R. A. Beghetto: “Journal of Educational Psychology Creativity and Academic Achievement: A Meta-Analysis Creativity and Academic Achievement: A Meta-Analysis,” *J. Educ. Psychol.*, vol. 109, no. 2, pp. 1–31, (2016).
[22] W. M. Bart and B. Hikanson: “Exploring the Relation Between High Creativity and High Achievement Among 8th and 11th Graders,” *Int. Online J. Educ. Teach. (IOJET)*, vol. 7, no. 3, pp. 712–720, (2020).
[23] Y. E. Setiawan, Purwanto, I. N. Parta, & Sisworo: “Students' Productive Thinking Disposition in Solving Number Pattern and Geometric Pattern Problems,” Universitas Negeri Malang, (2020).
[24] A. M. S. Atabaki, N. Keshtiaray, and M. H. Yarmohammadian: “Scrutiny of critical thinking concept,” *Int. Educ. Stud.*, vol. 8, no. 3, pp. 93–102, (2015).
[25] Y. E. Setiawan: “Analysis of Student Errors in Assessing the Truth of a Statement,” *J. Didakt. Mat.*, vol. 7, no. 1, pp. 13–31, (2020).
[26] Y. E. Setiawan, “First semester Student Errors in Solving Angular Velocity Problems in Trigonometry Courses,” *Pythagoras J. Pendidik. Mat.*, vol. 16, no. 1, pp. 19–32, 2021.
[27] Y. E. Setiawan, “Analysis of Students' Ability in Proving the Congruence of Two Triangles,” *Al-Khwarizmi J. Pendidik. Mat. dan Ilmu Pengetah. Alam*, vol. 8, no. 1, pp. 23–38, 2020.
[28] D. L. Driscoll, G. Gorzelsky, J. Wells, C. Hayes, E. Jones, and S. Salchak: “Down the Rabbit Hole : Challenges and Methodological Recommendations in Researching Writing-Related Student Dispositions,” *Compos. Forum*, vol. 35, pp. 1–16, (2017).
[29] S. R. Crow and L. Kastello: “The Dispositions of Elementary School Children of Individualistic and Collectivist Cultures Who Are Intrinsically Motivated to Seek Information,” *Res. J. Am. Assoc. Sch. Libr.*, vol. 19, pp. 1–23, (2016).