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The Influence of Bullying Experiences on Mathematics Curiosity in Prospective Mathematics Teachers

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Abstract

In the current era, bullying is increasingly happening, especially to students. Bullying is an act of hurting other people that can cause mental and psychological trauma. In this case, students need to minimize bullying in order to instill curiosity when learning mathematics. Mathematical curiosity in mathematics learning is a positive attitude that influences the success of achieving mathematics learning goals. This research aims to determine the effect of bullying experiences on students' mathematical curiosity. This research includes correlational research, collecting data through questionnaires to measure variables of bullying experiences and mathematics curiosity. The research sample was taken using cluster random sampling techniques and obtained two classes of students majoring in mathematics totaling 49 students. Data analysis in this study used a simple Linear Regression Test. The results of the research show that there is a negative and significant relationship between bullying experiences and mathematical curiosity in prospective mathematics teachers. Curiosity towards mathematics is one of the factors that prevents prospective mathematics teachers from experiencing bullying.

Keywords: Mathematics curiosity, Mathematics learning, Bullying experience, Prospective mathematics teacher

1. Introduction

School is a place to study, where there are several important roles in it, both in terms of learning and socializing (Subianto, 2013). In terms of learning, students study and understand the material taught by the teacher (Susilo, Yudi & Khabibah, 2010). The teacher explains and the students listen. After that, questions and answers can be held and discussions between the two regarding the material. Meanwhile, in terms of socializing, a student's character is formed when interacting between friends in the school environment (Kurniawan & Sudrajat, 2020). The interactions that

arise sometimes have positive and negative influences on students. Positive influence can make students have a high social spirit, including students who dare to speak, be open, and care about others (Wicaksana & Rachman, 2018). Meanwhile, negative influences can damage a student's mental health, including talking dirty, being naughty, fighting, and so on (Shaputra, 2023). From these negative influences, students can potentially engage in bullying.

Bullying is an action of people who have the power individually or in groups to hurt someone, so that it can traumatize them mentally and psychologically (Zakiyah, Humaedi, & Santoso, 2017). According to Barbara Coloroso (2003) in Muzdalifah's (2020) research, bullying is a hostile act carried out intentionally with the intention of injuring and hurting, such as intimidation in the form of threats. Chapell, et al (2004) in Ananto's (2019) research stated that there are two dimensions of bullying, including academic bullying and personal bullying. Someone who is exposed to bullying tends to have a lack of self-confidence, anxiety, restlessness, fear and depression (Budhiarti, 2009). This characteristic can have a bad influence on their learning outcomes, especially at school.

One of the compulsory subjects at school is mathematics (Kusumawati & Irwanto, 2016). Mathematics is an abstract science that discusses numbers, space, symbolic and numerical language, logical thinking, pattern relationships, and mathematical forms and structures (Amir & Prasojo, 2016). Mathematics is a science that is studied in schools at primary, secondary and tertiary levels (Rahmah, 2018). In college, mathematics is also called a difficult and scary subject. Apart from the difficult material, mathematics lecturers or teachers are also known for being tough (Broadhurst, 2020). This is what makes students find it In mathematics learning, bullying can be carried out between individuals or groups (Ramadhanti & Hidayat, 2022). Bullying in mathematics learning includes things like when you do a math problem in front but the answer is wrong, then others make fun of you and make the student mentally down; during a discussion in class regarding solving mathematics problems, there are students who have an opinion but other friends doubt and laugh at their opinion; students who are not very clever are shunned by their friends because they don't give the answers they have, students who are too clever are also shunned because they are different from the others, and so on.

Students who are exposed to bullying during the lecture process in class make them no longer willing to try and have an opinion. So the perception arises that if he has an opinion and can do it then his friends will not like him because he is often said to be looking for the lecturer’s attention. This behavior of their friends will affect student’s curiosity and cause them to become inactive every time learning takes place (Arya, 2018). If students are not active during learning, they will be confused when working on questions because many questions will arise in their minds. Olweus (1996) in Ananto's (2019) research explains that bullying is carried out when students repeatedly make sarcastic, arrogant or hurtful comments towards students. Students who receive such treatment will feel unappreciated and afraid to express their opinions. This shows that verbal and social bullying is still often found in classrooms.

When bullying occurs in class, students will not show interest in learning and gaining new knowledge. So bullying behavior needs to be eliminated so that students can learn and understand learning material in more depth, which will create curiosity in the (Nurvitasari, Sumanik, & Siregar, 2021). Individuals who have the will and desire to learn will have great curiosity about

mathematics, while individuals who do not have the will and desire to learn will be unenthusiastic and bored when studying mathematics (Hadiat & Karyati, 2019).

The relationship between bullying and mathematics curiosity is a complex and multifaceted topic. While there isn't a vast amount of direct research specifically linking these two variables, we can draw some insights from related studies: 1). Impact of Bullying on Academic Performance, bullying can negatively affect a student's overall academic performance, including their interest and curiosity in subjects like mathematics. Students who experience bullying may develop anxiety, low self-esteem, and a lack of motivation, which can hinder their curiosity and engagement in learning (Kamid et al., 2021); 2). Mathematical Curiosity and Motivation, Curiosity in mathematics is often linked to a positive learning environment and supportive relationships with teachers and peers. When students feel safe and supported, they are more likely to explore and engage with mathematical concepts. (Peterson et al., 2019); 3). Affective Aspects in Learning, the affective aspects, such as emotions and attitudes towards learning, play a significant role in students' mathematical curiosity. Negative experiences, including bullying, can diminish a student's positive attitude towards mathematics, thereby reducing their curiosity and willingness to engage with the subject. (Andersson & Wagner, 2017); 4). Indirect Relationships, while direct studies on bullying and mathematics curiosity are limited, research on related areas suggests that creating a positive, bully-free environment can foster better academic outcomes and enhance students' curiosity and interest in subjects like mathematics. (Jaen & Baccay, 2016).

Student's desire and willingness to acquire new knowledge that they have not yet obtained in class is a form of curiosity (Nehru & Irianti, 2020). An effective step to increase curiosity is by asking students critical and complex questions. This method can be used so that he has the curiosity to find the right response to the question (Zetriuslita, 2016). That way, students will feel challenged and will no longer feel afraid during the learning process. So researchers are interested in examining how bullying experiences influence the attitude of curiosity in prospective mathematics teachers.

2. Methods

This research is a regression study to determine the significance of the influence of bullying experiences on a student's mathematical curiosity. This research is quantitative research because to see the influence of these factors on mathematical curiosity, a score instrument is used that has been filled in by students. This research has one independent variable, namely bullying (X) and also one dependent variable, namely bullying (Y).

The relationship between these variables determines the factors that are predictors of mathematics curiosity in students. This research examines the extent to which bullying experiences are a predictor of a student's curious attitudes. Figure 1 below shows the correlation design of bullying experiences with student's curiosity.

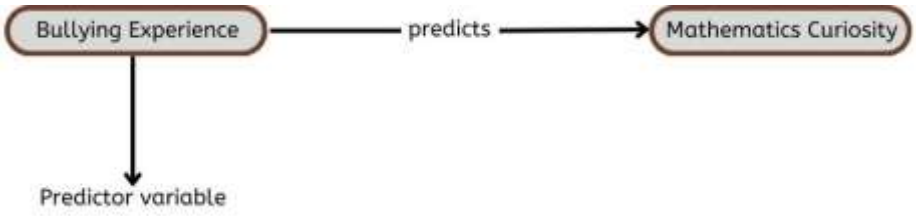

Figure 1 *Relationship between predictors (bullying experience) and outcome (mathematics curiosity)*

The population of this study involved Mathematics Education students aged 18-20 years at one of the universities in Kudus who had experienced bullying, either as victims, perpetrators, or both. From a total of 75 students in 3 classes, researchers randomly selected samples using cluster random sampling techniques. After drawing lots, 2 classes (B and C) were selected with a total of 49 students. Based on calculations using the Isaac and Michael formula quoted from Sugiyono's research by Amin et al. (2023), the minimum sample size required is 43 students. Apart from that, researchers also tested instruments related to bullying experiences on 26 students in class A separately.

This research uses a questionnaire instrument with a Likert scale which contains statements formulated based on indicators of bullying and mathematics curiosity. The dimensions of bullying experience include academic bullying and personal bullying. The bullying experience indicators used are (1) degrading academic abilities, (2) social intimidation, (3) obstruction of academic development, (4) verbal insults, (5) physical violence, (6) acts of exclusion (Ananto, 2019; Coloroso, 2006). Apart from that, the questionnaire indicators used by mathematics curiosity are asking questions about existing information or problems Zetriuslita (2016), studying the material by reading several books related to the subject matter Asmoro and Mukti (2019), willingness to learn, and the willingness to find solutions to existing problems (Latifah & Widjajanti, 2017).

The mathematics curiosity questionnaire instrument uses a questionnaire from Sthephani and Yolanda (2021) which is analyzed qualitatively. Meanwhile, the bullying questionnaire instrument has 24 items representing each indicator. The results of respondent's answers were analyzed and interpreted using alternative answers from a Likert scale which included Strongly Agree (SS), Agree (S), Disagree (TS), and Strongly Disagree (STS). Before the instrument was used, its contents were first validated by 3 mathematics lecturers as experts. To prove whether the instrument meets content validity (seen from the aspects of construction, material and language of the instrument), the validity index proposed by Aiken Retnawati (2017) or what is called the V Aiken index is used with the following formula.

$$V = \frac{\sum s}{n(c-1)}$$

Where V is the index of rater agreement regarding the validity of the item, s is the score determined by the rater minus the lowest score in the category used, n shows the number of raters, and c shows the many categories that the rater can choose. An instrument is said to meet content validity if it has a V Aiken index in the medium range category 0,40 – 0,80 and in the very valid category the V Aiken index > 0,80. The results of proving the content validity by three experts show that the bullying instrument in the construction, material, and language aspects has an average

V Aiken index value of 0,83 which is in the very valid category. This means that each instrument in this research has been proven to have content validity both from the material, construction, and language aspects.

Construct validity for the bullying experience variable is shown by the standard model in Figure 2.

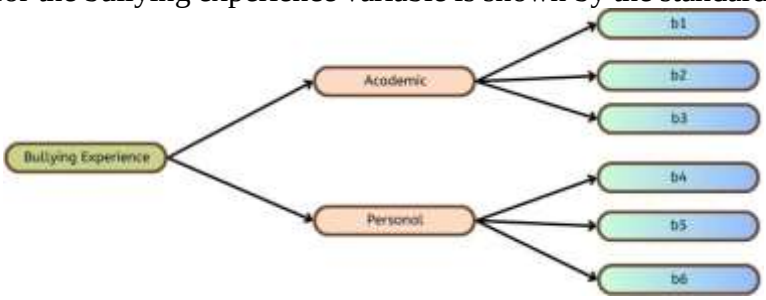

Figure 2. *Theory construct of bullying experience*

Figure 2 shows a standard model with factor loads (path coefficients from latent variables to observable variables) that are moderate to very high ($b1, b2, b3, b4, b5, b6$). This indicates that all observed/observable variables make a significant contribution to measuring the latent variable bullying experience which includes academic and personal bullying. Apart from that, the model in Figure 2 is a suitable model to explain the construction of bullying experience theory because $p_{value} = 0{,}32 > 0{,}05$. This means that the standard bullying experience model is a fit model according to the goodness of fit criteria by (Schermelleh-Engel et al., 2003). This shows that a student's bullying experiences do not only include academic bullying but also personal bullying. Construct reliability for the academic dimension of bullying was obtained at 0,70 and for the personal dimension of bullying at 0,70. These results indicate that each dimension of the bullying experience construct is reliable.

The mathematics curiosity variable is shown in the standard model in Figure 3.

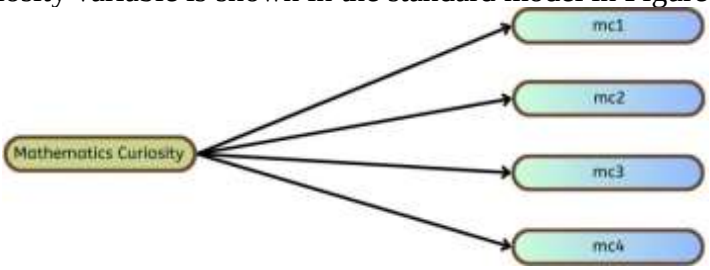

Figure 3. *Theory construct of mathematics curiosity*

Figure 3 shows a standard model with factor loads (path coefficients from latent variables to observable variables) that are moderate to very high ($mc1, mc2, mc3, mc4$). This indicates that all observed/observable variables make a significant contribution to measuring the latent variable mathematics curiosity.

Data obtained from bullying experience questionnaire scores, and mathematical curiosity were tested for significant simultaneous relationships using simple linear regression (F test). Meanwhile, to see the partial relationship between the independent variable and the dependent variable, the partial t test is used. Before carrying out a significance test, the data is confirmed to be normal,

homogeneous, linear and autocorrelation. After fulfilling several prerequisites, a simple linear regression test was carried out with the help of SPSS 26. Several hypotheses formulated in this research were that there was a significant negative relationship between student's experiences of bullying and their curiosity about mathematics (H_1).

After showing the significance of the relationship between the independent variable and the dependent variable, the coefficient of determination R^2 between the independent variable and the dependent variable is determined either partially or simultaneously. The coefficient of determination or value is defined as the percentage of variation in the dependent variable that is explained by the independent variable. The independent variable has a very strong contribution to the attachment variable if $R^2 \geq 0{,}65$, has a strong contribution when $0{,}40 \leq R^2 < 0{,}65$, and has a weak contribution for $R^2 < 0{,}20$ (Berman & Wang, 2017). The partial determinant coefficient, also called effective contribution, is a value (in percent) to see the magnitude of the relationship contribution made by each independent variable (bullying experience) to the dependent variable (mathematics curiosity).

The relationship between variables can also be expressed using an equation y $= a + bx$ where is the dependent variable, is the independent variable, is the constant (intercept), and is the regression coefficient for each independent variable. This equation model is said to be a fit model if the results of the F test show that there is a significant simultaneous relationship between the experience of bullying and mathematics curiosity.

3. Result and Discussion

In this research, prerequisite tests were carried out before carrying out the simple linear regression test, namely the normality test, linearity test, heteroscedasticity test, and autocorrelation test. This normality test uses the Kolmogorov Smirnov test assisted by SPSS 26. Based on the results of the normality test, a p_{value} of $0{,}20 \geq 0{,}05$ was obtained so that the data on students' experiences regarding bullying and mathematics curiosity had a significantly normal distribution. In the linearity test, the bullying and mathematics curiosity variables obtained a value of $0{,}28 \geq 0{,}05$, so it can be seen that the two variables have a linear relationship.

Furthermore, the autocorrelation test obtained a variable value of $1.92 > 0{,}05$. So, in this study there was no autocorrelation between the variables bullying and mathematics curiosity. The final step is to carry out a heteroscedasticity test. From this test the bullying variable obtained a value of $0{,}90 > 0{,}05$. So it is known that in this study there were no symptoms of heteroscedasticity. Thus, all prerequisite tests for this research data have been fulfilled.

The results of the t test on the simple linear regression test between X and Y can be seen in Table 1.

Table 1.
Partial T-Test Between Independent Variables and Dependent Variable

Model	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	T	Sig.

1	(Constant)	126.32	7.84		16.11	0.00
	Bullying experience	-0.37	0.17	-0.29	-2.10	0.04

a. Dependent Variable: mathematics curiosity

Table 1 shows that the significance value of the independent variable (bullying) has a $p_{value} < 0{,}05$ and the coefficient of the independent variable is negative. This means that bullying has a statistically significant negative relationship with mathematics curiosity. Based on Table 1, the simple linear regression equation model between bullying and mathematics curiosity can be expressed as:

$$y = 126.32 - 0{,}37X$$

Based on the y-intercept equation, it is known that if there is no bullying then mathematics curiosity is worth 126,32. Based on this equation, it can also be seen that for every 1% increase in curiosity about mathematics, the experience of bullying will decrease by 0,37.

Meanwhile, the results of the significance test of the relationship between the independent variables simultaneously and the dependent variable are shown in Table 2.

Table 2.

F-Test for Simultaneous Relationship Between Bullying Experiences with Mathematics Curiosity

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	544.75	1	544.75	4.40	0.04[a]
	Residual	5825.78	47	123.95		
	Total	6370.53	48			

a. Predictors: (Constant), bullying experience

b. Dependent Variable: mathematics curiosity

Table 2 shows that $p_{value} < 0{,}05$ so that bullying experience has a statistically significant simultaneous relationship with mathematics curiosity. In other words, the equation model y = 126,32 – 0,37 is a suitable model to explain mathematics curiosity based on bullying experience simultaneously.

Meanwhile, the strength of the simultaneous relationship between bullying experience with mathematics curiosity can be seen in Table 3.

Tabel 3.

Model Summary for Predictor and Outcome Relationship

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.292[a]	0.09	-.07	11.13

a. Predictors: (Constant), bullying experience

The experience of bullying with mathematical curiosity has a weak simultaneous contribution because it has an R Square value of 0,09 or 9 % (See Table 3) which is in the interval $R^2 < 0{,}20$.

Meanwhile, the partially effective contribution of bullying experiences to mathematical curiosity can be calculated by utilizing the correlation coefficient of the independent variable with the dependent variable in Table 4.

Table 4.
Correlation Test Result

		Bullying Experience	Mathematical Curiosty
Pearson Correlation	Bullying	1	-0.29
	Mathematical Curiosity		0.04
Sig. (1-tailed)	Bullying	.	.00
	Mathematical Curiosity	.00	.

In Table 1 and Table 4 it is known that the relationship between bullying experiences and mathematics curiosity has a negative correlation of 0,29. These results indicate that the experience of bullying makes a smaller contribution to the mathematics curiosity of prospective mathematics teachers. However, in Table 4 it can be seen that the experience of bullying with mathematics curiosity has a low level of correlation.

The experience of bullying has a statistically significant negative relationship with mathematics curiosity. These results show that the lower the bullying experience of prospective mathematics teachers, the higher the chance that they will have mathematics curiosity. Vice versa, the higher the experience of bullying, the lower the possibility of having mathematics curiosity. This factor also has a weak correlation with the mathematics curiosity experienced by students. This means that the resilience of a student's curiosity is to a small extent influenced by the collective experience of bullying. This means that the experience of bullying can influence students majoring in mathematics on their curiosity when learning. Prospective mathematics teachers who minimize their experiences of bullying will be able to raise their curiosity and be able to solve mathematics problems in class. When a classmate couldn't learn, he would help them. As stated by Batubara (2018), helping someone in difficulty will make it easier to seek knowledge (study).

Bullying is defined as a specific type of aggression that involves an imbalance of power and repeated, intentionally harmful behavior directed at another person. It is not surprising that the experience of bullying has a negative correlation with mathematics curiosity. This is because if someone has the experience of bullying while studying mathematics, then he will not dare to ask questions or do the questions in front of him. In accordance with the opinion of Wahani et al. (2022), bullying that occurs will have an influence on a person's curiosity.

These results highlight important preventive factors against bullying and that mathematical curiosity must be integrated into mathematics learning activities. In this case, we must bury or take the positive side of the bullying experience so that we can apply curiosity to ourselves when learning mathematics. In addition, future research can investigate external factors that influence mathematics curiosity and other internal factors such as self-concept. Future research could also involve more respondents and investigate the impact of bullying on mathematics teacher's

perspectives. So we can investigate whether it is true that the mathematics teacher is fierce and scary because of the bullying he experienced during lectures?

4. Conclusion

The experience of bullying has a negative relationship with mathematics curiosity in prospective mathematics teachers. Prospective mathematics teachers who have high levels of bullying experience are less likely to have mathematical curiosity. This factor is the reason why prospective mathematics teachers are reluctant to ask questions or have curiosity during learning. Further research can be carried out by increasing the research sample and relating the impact of mathematics teachers' bullying experiences on their image when teaching in class. External factors such as self-concept are also important to explore regarding the influence of bullying experienced by students.

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