The impact of self-efficacy and math anxiety on the mathematical communication ability of 7-grade students

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Received: 26 June 2023; Revised: 3 September 2023; Accepted: 12 September 2023

Abstract: The primary aim of this study is to assess the influence of self-efficacy and math anxiety on the proficiency of mathematical communication among Class VII students enrolled in State Junior High Schools within the Depok District. The research methodology employed is quantitative in nature, employing an ex-post facto correlational descriptive approach. The study encompasses the entire population of Class VII students across all State Junior High Schools within the Depok District, with a sample size of 190 students selected through cluster random sampling. Data collection involves employing questionnaires to gauge students' levels of self-efficacy and math anxiety, alongside descriptive tests to evaluate their aptitude in mathematical communication. Preceding the analysis, preliminary tests are conducted to assess linearity and multicollinearity. The data analysis procedure encompasses multiple regression analysis, in addition to t and F tests, to ascertain both individual and collective impacts. The findings reveal the absence of a discernible impact from self-efficacy and math anxiety on the mathematical communication skills of Class VII students in State Junior High Schools located in the Depok District. For subsequent researchers, it is recommended to carefully consider the construction of questionnaire statements to ensure their comprehensibility among students.

Keywords: Math anxiety; Mathematical communication skills; Self-efficacy


INTRODUCTION

In education, mathematics is an important subject (Widana et al., 2018) that not only equips students with essential problem-solving abilities but also lays the groundwork for various practical applications; consequently, mathematical communication skills are also needed to effectively convey and share these insights (Yang et al., 2016). Students who have good mathematics communication skills can be active in learning and analyzing information easily (Syukri et al., 2020). Mathematical concepts are ubiquitous in everyday life, from making informed financial decisions to understanding data trends. The ability to communicate these concepts empowers individuals to apply mathematical thinking to real-world situations, enhancing problem-solving capabilities.

Previous research has shown that students' mathematical communication skills in Indonesia are still low (Harun et al., 2021). Aulia et al., (2021) found that junior high school students had a low level of mathematical communication skills based on their answers to the questions. Hidayat and Arifin (2023) argues that one of the factors causing students' low mathematical communication abilities is their lack of ability to communicate mathematical ideas. The cited studies collectively reveal that students' mathematical communication skills in Indonesia are
notably deficient. Overall, these findings emphasize the prevalent challenge of insufficient mathematical communication skills among students in Indonesia. Consequently, low mathematical communication skills can often lead to reduced student self-efficacy in facing mathematical tasks and challenges.

Self-efficacy is a person's view of his own ability to organize and determine a job (Zhou et al., 2021). It's refers to an individual's perception of their capability to effectively manage and accomplish tasks. Students who have good self-efficacy tend to be more confident and ready to face challenges in mathematics (Riyanto & Mariani, 2019). Students with strong self-efficacy exhibit greater confidence and readiness to tackle mathematical challenges. According to Masitoh & Fitriyani (2018) there are still many students who have low self-efficacy, which is shown by the behavior of giving up and lack of confidence when facing mathematics problems. A considerable number of students exhibit low self-efficacy, characterized by tendencies to give up and lack confidence when confronted with mathematical problems. Students' lack of confidence in learning mathematics can be influenced by mathematics anxiety.

Math anxiety is a psychological state that arises when a person experiences tension, loses self-confidence, and loses self-esteem when facing a mathematical situation (Olaoluwa, 2021). High levels of anxiety can cause low self-efficacy and affect student learning processes (Mamolo, 2022). Math anxiety can erode one's self-confidence in dealing with mathematical tasks and concepts, which in turn can hinder the development of effective communication skills required for discussing and explaining mathematical ideas. Math anxiety also has a negative impact on learning mathematics (Demedts et al., 2022).

In observations and interviews with mathematics teachers at State Junior High Schools throughout Depok District, it was found that several students had low mathematical communication skills. This problem underscores the need for targeted interventions and strategies to enhance students' ability to express mathematical ideas and concepts clearly and confidently. The observation of low mathematical communication skills among students in State Junior High Schools indicates a significant gap in their ability to effectively express mathematical ideas and concepts. They also have a low level of self-confidence and self-esteem, indicated by a nervous attitude, less serious in studies (Puspita et al., 2022), inability to work on math problems independently, and avoid assignments given by the teacher (Kusumaningrum et al., 2020).

The presence of low self-confidence and self-esteem among students highlights a gap in their overall psychological readiness for learning mathematics. The relationships between self-efficacy, math anxiety, and mathematical communication skills among class VII students have not been thoroughly investigated. This presents a gap in the understanding of how these psychological factors impact students' ability to communicate mathematically. Based on the problems described above, the aim of this study is to examine the impact of self-efficacy and math anxiety on the mathematical communication abilities of Class VII students in State Junior High Schools within Depok District, where the objectives are outlined as follows:
1. To determine the effect of self-efficacy on mathematical communication skills;
2. Knowing the effect of math anxiety on mathematical communication skills; and
3. Knowing the effect of self-efficacy and math anxiety on mathematical communication skills.

METHOD

In order to delve into the comprehensive analysis of the interplay between self-efficacy, math anxiety, and mathematical communication skills among seventh-grade students, a meticulous exposition of the chosen research methodology is imperative.

Research Objectives

This study employs a descriptive correlational research design with a quantitative methodology to investigate and establish connections and patterns among self-efficacy, math
anxiety, and mathematical communication proficiency in seventh-grade students. The primary objective of this research approach is to elucidate the degree of association between self-efficacy, math anxiety, and students' mathematical communication skills, while maintaining a non-manipulative stance on variables. The research endeavors to offer a comprehensive insight into the intricate interplay and mutual influence of these factors, thereby enriching the understanding of the dynamics involving self-efficacy, math anxiety, and communication proficiency in the realm of mathematics education.

**Population and Sample**

The research encompassed the entire population of seventh-grade students attending State Junior High Schools within the Depok District. The sampling methodology employed in this study was cluster random sampling. Cluster random sampling is a sampling technique used in research to select participants from a larger population. In this research, cluster random sampling involves dividing the population of seventh-grade students from various State Junior High Schools in the Depok District into clusters, where each cluster represents an entire class. Instead of selecting individual students, the researcher randomly selects entire classes as clusters. Within each chosen class, all students become part of the sample, making the data collection process more feasible.

Within the seventh-grade cohort, students exhibit diverse gradients of self-efficacy, math anxiety, and proficiency in mathematical communication. The utilization of cluster random sampling involves the selection of complete classes as distinct clusters, a technique intended to enhance the comparability of students within each class regarding these attributes. Consequently, the research sample was composed of seventh-grade students, and the total sample size amounted to 190 individuals.

**Variables**

This research comprised three distinct variables: two predictor variables, namely self-efficacy and math anxiety (designated as $X_1$ and $X_2$), and one outcome variable, denoted as mathematical communication ability (represented as $Y$). Self-efficacy refers to an individual's belief in their own capability to successfully perform specific tasks or achieve particular goals (Artino, 2012). It reflects the level of confidence one has in their ability to overcome challenges, make effective decisions, and produce desired outcomes. In the context of this research, self-efficacy is one of the predictor variables (designated as $X_1$) and represents the extent to which a student believes in their competence to accomplish tasks and reach their objectives.

Math anxiety is a psychological condition where an individual experiences feelings of fear, apprehension, or nervousness when faced with mathematical tasks or situations (Pirrone et al., 2022). It can lead to cognitive and emotional discomfort, affecting a person's performance and attitude towards mathematics. As one of the predictor variables in this research (designated as $X_2$), math anxiety represents the level of anxiety a student feels when dealing with mathematical concepts and problems.

Then, mathematical communication ability can be said to a person's proficiency in effectively conveying mathematical ideas, concepts, and solutions to others (Inganah et al., 2023). It involves the skill to articulate mathematical reasoning, express mathematical concepts in a clear and coherent manner, and engage in productive discussions related to mathematics. In this research, this is the outcome variable (represented as $Y$), indicating the degree to which a student can communicate mathematical information and ideas.

**Research Instruments**

For data collection purposes, a self-efficacy assessment instrument with a total of 18 statement items and employing a Likert scale ranging from 1 to 4 was utilized to gauge the students' self-efficacy levels. Additionally, a math anxiety questionnaire comprising 20 statement items and employing a Likert scale of 1 to 4 was employed to assess the anxiety levels among students. A 4-point Likert scale allows participants to express a range of
agreement, from low (1) to high (4). Moreover, descriptive questions consisting of 2 items related to concrete materials were employed to evaluate students' mathematical communication proficiency. We used a limited number of questions because it can help generate hypotheses and inform more targeted research in the future. The self-efficacy and math anxiety assessment tools were meticulously developed by the researcher following a rigorous process of expert validation and content validation. This meticulous approach was aimed at ensuring that the employed instruments effectively measure the required self-efficacy and math anxiety competencies within the context of this study.

Analysis Technique

The research employs various analytical techniques for hypothesis testing. These methods encompass multiple linear regression analysis, which is instrumental in examining the connections and quantifying the impacts of multiple independent variables (self-efficacy and math anxiety) on a singular dependent variable (mathematical communication ability). Additionally, a t-test is utilized to ascertain the statistical significance of mean disparities between two groups. An F-test is employed to assess the combined influence of the independent variables on the dependent variable, gauging the significance of mean differences across groups exceeding two. Preceding hypothesis testing, a preliminary assessment is carried out, including linearity and multi collinearity evaluations, to fulfill the necessary assumptions.

RESULTS AND DISCUSSION

Results

The outcomes derived from this research encompass the findings from hypothesis testing, t-tests, and F-tests. The data collected through the study were analyzed using SPSS 20.0 software. Table 1 provides an overview of the outcomes, including the results of the self-efficacy and math anxiety questionnaires, along with the outcomes of the mathematical communication ability assessment.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Shoes Max</th>
<th>Shoes Min</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-efficacy</td>
<td>69</td>
<td>26</td>
<td>47.27368</td>
<td>7.70685</td>
</tr>
<tr>
<td>Math Anxiety</td>
<td>30</td>
<td>70</td>
<td>105.526</td>
<td>18.3005</td>
</tr>
<tr>
<td>Mathematical Communication Skills</td>
<td>50</td>
<td>50</td>
<td>60.81053</td>
<td>19.87916</td>
</tr>
</tbody>
</table>

Based on the data presented in Table 1, it can be deduced that the self-efficacy variable demonstrates an average score of 47.27368. This indicates that respondents’ self-efficacy levels are situated at a moderate range. The math anxiety variable, with an average of 105.526, signifies that respondents experience moderate levels of math anxiety. Likewise, the mathematical communication ability variable presents an average of 60.81053, indicating a moderate level of proficiency in mathematical communication. These moderate levels reflect a balanced state, suggesting that respondents are neither excessively confident nor overly anxious. This equilibrium could potentially motivate them to engage actively in learning, fostering the enhancement of their mathematical communication skills.

Prerequisite Test Analysis

A preliminary assessment is performed to determine whether the data fulfills the prerequisites essential for the upcoming statistical analyses. The evaluation of the linearity of the self-efficacy test outcomes is displayed in Table 2. Using data from Table 2, the recorded Say value in the "Deviation from Linearity" category is 0.484, surpassing the significance threshold of 0.05. As a result, it can be inferred that the linear regression connection between self-efficacy and mathematical communication ability is substantiated.
Table 2. Linearity Test Results of Self-efficacy (ANOVA Table)

<table>
<thead>
<tr>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Say.</th>
</tr>
</thead>
<tbody>
<tr>
<td>mathematical communication skills * Self-efficacy</td>
<td>Between Groups (Combined)</td>
<td>15140,135</td>
<td>36</td>
<td>420,559</td>
</tr>
<tr>
<td>Linearity</td>
<td>1576,516</td>
<td>1</td>
<td>1576,516</td>
<td>1</td>
</tr>
<tr>
<td>Deviation from Linearity</td>
<td>13563,618</td>
<td>35</td>
<td>387,532</td>
<td>.996</td>
</tr>
<tr>
<td>Within Groups</td>
<td>59549,044</td>
<td>153</td>
<td>389,209</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>74689,179</td>
<td>189</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This suggests the potential presence of a link between self-efficacy ($X_1$) and mathematical communication ability ($Y$), indicating that variations in self-efficacy ($X_1$) correspondingly bring about changes in mathematical communication ability ($Y$). This correlation suggests that greater confidence in one's mathematical skills contributes to enhanced proficiency in conveying mathematical information. Subsequently, an evaluation of the linearity of Math Anxiety was conducted. The outcomes of the linearity test for math anxiety are displayed in Table 3.

Table 3. Linearity Test Results of Math Anxiety (ANOVA Table)

<table>
<thead>
<tr>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Say.</th>
</tr>
</thead>
<tbody>
<tr>
<td>mathematical communication skills * math anxiety</td>
<td>Between Groups (Combined)</td>
<td>34719,605</td>
<td>71</td>
<td>489,009</td>
</tr>
<tr>
<td>Linearity</td>
<td>1602,023</td>
<td>1</td>
<td>1602,023</td>
<td>1</td>
</tr>
<tr>
<td>Deviation from Linearity</td>
<td>33117,582</td>
<td>70</td>
<td>473,108</td>
<td>1.39</td>
</tr>
<tr>
<td>Within Groups</td>
<td>39969,574</td>
<td>118</td>
<td>338,725</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>74689,179</td>
<td>189</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Referring to Table 3, the value noted in the Say column, serving as the indicator for deviation from linearity, stands at 0.055, surpassing the predetermined significance threshold of 0.05. Consequently, it is deduced that the linear regression connection between math anxiety and mathematical communication ability is confirmed. This implies a plausible link between math anxiety ($X_2$) and mathematical communication ability ($Y$), suggesting that changes in math anxiety ($X_2$) correspondingly lead to variations in mathematical communication ability ($Y$). This correlation indicates that heightened levels of math anxiety might impede the capacity to effectively convey mathematical concepts.

Following the examination of self-efficacy and math anxiety, the outcomes of the multicollinearity test were assessed. The objective of conducting the multi-collinearity test is to determine whether a notable level of correlation exists between the independent variables, specifically self-efficacy and math anxiety. Multi-collinearity arises when self-efficacy and math anxiety in a regression analysis exhibit a substantial correlation with each other. The findings of the multi-collinearity test are presented in Table 4.

Table 4. Multi-collinearity Test Results

<table>
<thead>
<tr>
<th>Coefficients*</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>Collinearity Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
</tr>
<tr>
<td>1</td>
<td>(Constant)</td>
<td>42.1</td>
<td>9.064</td>
</tr>
<tr>
<td></td>
<td>Self-efficacy</td>
<td>.194</td>
<td>.350</td>
</tr>
<tr>
<td></td>
<td>math anxiety</td>
<td>.090</td>
<td>.147</td>
</tr>
</tbody>
</table>
| a. Dependent Variable: mathematical communication skills
Referring to Table 4, the value within the VIF column stands at 3.519, which is below the threshold of 10. In essence, this signifies the absence of multi-collinearity. Multi-collinearity refers to a statistical phenomenon where two or more independent variables in a regression analysis are highly correlated with each other (Midi et al., 2010). Multi-collinearity inflates the standard errors of regression coefficients. In simpler terms, no considerable inter-correlation or robust association exists between self-efficacy and math anxiety. In the context of the study, this suggests that students' self-efficacy beliefs concerning their mathematical competencies are not strongly entwined with their levels of math anxiety. This outcome could hold implications for the overall conclusions and interpretations of the study. Researchers might infer that, when influencing students' mathematical communication ability, self-efficacy and math anxiety tend to operate somewhat autonomously. It's noteworthy that while a potent relationship might not be evident, there could still be some degree of correlation or interaction between these variables, albeit not statistically substantial or significant enough to draw significant insights.

Hypothesis test

Hypothesis testing serves as a fundamental statistical method employed to assess the accuracy of a conjectured hypothesis regarding a population parameter. This process entails contrasting collected sample data with anticipated results based on a null hypothesis. The aim is to ascertain whether there exists substantial evidence to endorse or refute the hypothesis in question. The hypotheses posited for examination are as follows:

a. $H_0$: There is no significant influence between self-efficacy ($X_1$) and mathematical communication skills ($Y$).

$H_1$: There is a significant influence between self-efficacy ($X_1$) and mathematical communication skills ($Y$).

b. $H_0$: There is no significant influence between math anxiety ($X_2$) and mathematical communication skills ($Y$).

$H_1$: There is a significant influence between math anxiety ($X_2$) and mathematical communication skills ($Y$).

A summary of the computed regression outcomes for the variable impacts is presented in Table 5.

Table 5. Recapitulation of Regression Calculation Results of Variable Effects

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>Collinearity Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
</tr>
<tr>
<td>1</td>
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</tr>
<tr>
<td></td>
<td>math anxiety</td>
<td>.090</td>
<td>.147</td>
</tr>
</tbody>
</table>

a. Dependent Variable: mathematical communication skills

Referring to Table 5, the observed Say value is recorded as 0.000, while for the self-efficacy variable, the computed t-score is 0.555, compared to the critical t-value of 1.92733. Since the computed t-score is less than the critical t-value, the null hypothesis ($H_0$) is accepted, indicating the absence of a significant impact of self-efficacy ($X_1$) on mathematical communication skills ($Y$). This implies that changes in self-efficacy levels do not consistently correspond to significant changes in students' mathematical communication skills as measured in the study. Similarly, for the math anxiety variable, the calculated t-score is 0.611, in contrast to the critical t-value of 1.9273. As the computed t-score is lower than the critical t-value, the null hypothesis ($H_0$) is again accepted, indicating that there is no significant influence of math anxiety ($X_2$) on mathematical communication skills ($Y$).
Additionally, the F-test was executed. The purpose of the F-test is to ascertain whether notable distinctions in means exist among multiple groups. This statistical tool aids researchers in evaluating whether the observed variations in the data stem from differences among groups or if they are more likely a result of random variability. The hypotheses formulated for examination are outlined as follows:

\( H_0 \): There is no joint influence of self-efficacy \( (X_1) \) and math anxiety \( (X_2) \) on students' mathematical communication ability \( (Y) \) within the regression model.

\( H_1 \): There is a joint influence of self-efficacy \( (X_1) \) and math anxiety \( (X_2) \) on students' mathematical communication ability \( (Y) \) within the regression model. The results of the F test are in Table 6.

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Say.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>1722,075</td>
<td>2</td>
<td>861,037</td>
<td>2,207</td>
<td>.113b</td>
</tr>
<tr>
<td>Residual</td>
<td>72967,104</td>
<td>187</td>
<td>390,198</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>74689,179</td>
<td>189</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\( a \): Dependent Variable: mathematical communication skills
\( b \): Predictors: (Constant), math anxiety, Self-efficacy

Utilizing information from Table 6, it is apparent that the calculated \( F_{\text{count}} \) is 2.207, whereas the critical \( F_{\text{table}} \) value is 3.07. As the computed \( F_{\text{count}} \) is less than the critical \( F_{\text{table}} \) value, the null hypothesis \( (H_0) \) is upheld, indicating the absence of a collective influence from both self-efficacy \( (X_1) \) and math anxiety \( (X_2) \) on students' mathematical communication skills \( (Y) \). It's means that, changes in self-efficacy and math anxiety, when considered together, do not consistently lead to meaningful or noticeable changes in how well students are able to convey mathematical concepts and ideas. This suggests that, within the context of the study, the relationship between these factors and students' mathematical communication skills is weak or insignificant.

**Discussion**

In this part of the discussion, the relationship between the independent variables and the dependent variable is discussed.

**Self-efficacy with Mathematical Communication Skills**

Drawing from the outcomes of the data analysis examination, it can be inferred that a discernible impact between self-efficacy and mathematical communication skills is absent. This diverges from the findings of Bertills et al. (2018) study, which established a correlation between self-efficacy and mathematical communication skills—indicating that heightened self-efficacy corresponds to improved communication aptitude.

The inconsistencies in this study can be attributed to several assumptions put forth by the researcher. Primarily, the utilization of a less specific instrument is a contributing factor, as it encompasses self-efficacy in mathematics as a whole rather than focusing on self-efficacy specifically in the context of triangular and quadrilateral topics. This notion aligns with the perspective put forth by Schukajlow et al. (2012), emphasizing the task-specific nature of self-efficacy. In essence, while students might exhibit a favorable self-efficacy towards mathematics in general, their self-efficacy levels might diverge when addressing specific topics. Secondly, student engagement with the provided tests might have been compromised due to a perceived lack of impact on their overall math scores. Thirdly, the autonomy granted to student respondents in selecting responses introduces the possibility of incongruence between their chosen statements and their actual experiences. This highlights that varying levels of self-efficacy correspond to differing problem-solving abilities, which deviates from theoretical expectations. Consequently, the study concludes that the self-efficacy levels of Class VII.
students across Depok District's State Junior High Schools do not exert an influence on their mathematical communication skills. In other words, regardless of their self-efficacy levels, students' mathematical communication abilities remain unaffected.

**Math Anxiety with Communication Skills Mathematical**

Drawing from the outcomes of the data analysis examination, it can be deduced that a lack of correlation exists between math anxiety and proficiency in mathematical communication. This outcome diverges from the findings of a prior study by Zanabazar et al. (2023), which indicated a clear connection between math anxiety and students' aptitude in mathematical communication. Specifically, the investigation established that heightened math anxiety corresponded to diminished mathematical communication skills among students, and conversely.

The disparity in this outcome compared to the findings of the earlier study conducted by Zanabazar et al. (2023) carries noteworthy implications for the study's objectives. The current research aimed to examine the relationship between math anxiety and mathematical communication skills, seeking to contribute to the understanding of this dynamic among students. However, the present results, contrary to the previous study, suggest that there is no significant connection between math anxiety and proficiency in mathematical communication. This divergence challenges the existing assumption that heightened math anxiety consistently leads to reduced mathematical communication skills, and vice versa. It prompts a reevaluation of the complex interplay between these variables. The implications extend to pedagogical practices and interventions designed to enhance mathematical communication abilities. Educators and researchers need to consider the variability in how math anxiety may impact students' communication skills, acknowledging that this relationship might not be universally applicable.

As stated by Olsen et al. (2022), anxiety is not invariably detrimental, as it is an inherent emotional experience in all individuals. This aligns with the viewpoint of Jackson and Chen (2018) which suggests that students, when confronted with unfamiliar subject matter, may experience anxiety, prompting them to invest additional effort in comprehension. However, excessive anxiety can yield adverse consequences by diminishing both efficacy and exertion. The notion that anxiety does not necessarily impede mathematical communication proficiency also hinges on adept self-regulation, wherein moderate anxiety levels can positively impact students' engagement. This underscores the significance of teachers' comprehension of their students' experiences within the classroom and their role in aiding students' management of anxiety.

**Self-Efficacy and Math Anxiety Against Communication Skills Mathematical**

Computed results with a significance value of 0.113, which is greater than the threshold of 0.05, the null hypothesis \( H_0 \) can be affirmed. Consequently, it can be inferred that the influence of self-efficacy and math anxiety on mathematical communication proficiency is not substantial. This concurs with the findings of de la Hera et al. (2023), which demonstrated the absence of a noteworthy impact from self-efficacy and math anxiety on mathematical communication skills. In other words, students with low self-efficacy levels or high math anxiety levels do not necessarily exhibit correspondingly low levels of mathematical communication skills, and vice versa. Thus, it becomes evident that additional factors wield significant sway over students' capabilities in mathematical communication.

Based on the calculation results obtained sig. 0.113 > 0.05, it can be stated that \( H_0 \) accepted. It means, self-efficacy and math anxiety does not really affect the ability of mathematical communication. This congruence between the study's outcomes and the research conducted by de la Hera et al. (2023) resonates with the study's objectives in several ways. The primary aim of the current research was to investigate the potential impact of self-efficacy and math anxiety on students' mathematical communication skills. By revealing that the calculated significance value (0.113) exceeds the predetermined significance level of 0.05, the study
concludes that the null hypothesis ($H_0$) is accepted. This implies that neither self-efficacy nor math anxiety has a substantial effect on students' mathematical communication abilities, in alignment with the study's intention to discern the potential relationship between these variables.

Furthermore, the parallel findings with Shafira's research in 2020 further strengthen the study's alignment with its objectives. The reference to Shafira's study underscores the consistency in results across multiple investigations, thereby reinforcing the validity and reliability of the findings. Both studies collectively emphasize that students with varying levels of self-efficacy and math anxiety do not necessarily exhibit corresponding variations in their mathematical communication skills. This coherence supports the initial goals of understanding the nuanced dynamics between these factors and their impact on mathematical communication.

Tong et al. (2021) have indicated that several elements influence the mathematical communication proficiency of students. These factors encompass: (1) intrinsic factors such as students' focus and eagerness, their grasp of formulaic concepts' application, and their efficiency in problem-solving; (2) extrinsic factors, which encompass unsupportive learning environments. Regarding internal factors, such as concentration, enthusiasm, and understanding of formula concepts, these can intersect with self-efficacy (Kuncoro, et al., 2023). Students with higher levels of self-efficacy might exhibit greater concentration and enthusiasm, which could positively influence their understanding of formula concepts and problem-solving abilities. Exploring how self-efficacy interacts with these internal factors could offer deeper insights into the mechanisms through which self-efficacy affects mathematical communication skills. External factors, particularly the learning environment's impact, might intersect with math anxiety. An unsupportive learning environment could potentially exacerbate math anxiety, leading to further difficulties in mathematical communication. Investigating how math anxiety interacts with external factors could provide a comprehensive understanding of how these dynamics collectively impact students' performance in this context.

Future research could delve into these interactions more explicitly. For instance, exploring how self-efficacy and math anxiety interact with concentration and enthusiasm in different learning settings could reveal nuances in their effects. Additionally, examining how interventions aimed at improving the learning environment might mitigate the impact of math anxiety on communication skills could yield practical insights for educators.

**DECLARATION**

Author Contribution: AJH: Conceptualization, Writing - Original Draft, Methodology, Editing and Visualization, Writing - Review & Editing, and Formal analysis. II and BK: Conceptualization, Writing - Review & Editing, and Formal analysis, Validation and Supervision. EAP: Writing - Review & Editing, and Formal analysis.

Funding Statement: -

Conflict of Interest: The authors declare no conflict of interest.

Additional Information: Additional information is available for this paper.

**CONCLUSION**

In summary, a comprehensive research effort was conducted to analyze the relationship between Self-efficacy, Math Anxiety, and Mathematical Communication Ability in Class VII students of Public Middle Schools in the Depok District. The results indicate that self-efficacy does not significantly affect the mathematical communication skills of Class VII students in State Junior High Schools in Depok. Similarly, math anxiety does not notably impact the mathematical communication abilities of Class VII students in these schools. When considering both self-efficacy and math anxiety together, their combined influence is insignificant. The
study suggests future research directions, including investigating topic-specific self-efficacy effects, conducting longitudinal studies, exploring contextual factors, designing interventions, and using qualitative approaches to deepen the understanding of the interplay between self-efficacy, math anxiety, and mathematical communication skills. Limitations include sample homogeneity and reliance on self-reported measures, potentially affecting generalizability and accuracy of findings.

REFERENCES


