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DOES MATH ANXIETY INFLUENCE STUDENTS' SELF-REGULATED LEARNING? A PREDICTIVE RELATIONSHIP STUDY AT TWO VOCATIONAL SCHOOLS AT BANDUNG REGENCY

Ida Nurhayati[1], Muhamad Fijar Rotul Akbar[2], Harry Dwi Putra[3], Nelly Fitriani[4]
[1]IKIP Siliwangi, Jl. Terusan Jend. Sudirman, Cimahi, Indonesia
idanur.hayati1213@gmail.com
[2]Universitas Bina Nusantara, Jl. Kebon Jeruk Raya, Jakarta Barat, Indonesia
vzhar.akbar@gmail.com
[3]IKIP Siliwangi, Jl. Terusan Jend. Sudirman, Cimahi, Indonesia
harrydp@ikipsiliwangi.ac.id
[4]IKIP Siliwangi, Jl. Terusan Jend. Sudirman, Cimahi, Indonesia
nhe.fitriani@gmail.com

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ABSTRACT

While mathematics is immensely imperative and regarded as a fundamental subject serving as one of the graduation requirements at every level of education in Indonesia, including vocational schools, adverse perceptions associated with it as a challenging subject are deeply ingrained in society, particularly among students. Despite there is a wealth of research exploring math anxiety and elf-regulated learning, a discernible gap exists in the literature, specifically within the Indonesian context, particularly among Vocational Students in the Bandung area. This research aims to explore the predictive relationship between math anxiety and students' self-regulated learning within the context of vocational education. Employing linear regression statistical analysis, and survey data collection method, this quantitative study involved 99 participants from two vocational schools in Bandung Regency. The results indicate a statistically significant impact of math anxiety on students' self-regulated learning. However, it's noteworthy that the degree of correlation is considered low. Furthermore, no significant differences were identified concerning variables such as age, sex, streaming, and class level. These findings contribute to the understanding of the dynamics between math anxiety and self-regulated learning, particularly within the context of vocational education in the Bandung region, and can serve as a valuable insight for future research in similar topics.

Corresponding Author:

Ida Nurhayati,
Department of Mathematics Education,
IKIP Siliwangi,
Jl. Terusan Jend. Sudirman, Cimahi, Indonesia
Email: idanur.hayati1213@gmail.com

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INTRODUCTION

Mathematics learning is a purposeful and methodical endeavour aimed at aiding students in grasping mathematical concepts, techniques, and their real-world. This field also is often described as a subject that demands systematic, well-organized, and rational thinking. Topics studied in math take form in a variety that includes problems that are represented through symbols and visual representation. Therefore, math education often revolves around presenting these problems, which encompass mathematical concepts, methods, and practical applications (Retnowati, 2016). These practical skills can extend beyond mathematics, contributing to a better understanding of various subjects (Kurniawan & Slamet, 2018).

While mathematics is immensely imperative and regarded as a fundamental subject serving as one of the graduation requirements at every level of education in Indonesia, including vocational schools, adverse perceptions associated with it as a challenging subject are deeply ingrained in society, particularly among students (Asrawati, 2021). Subsequently, learning math in vocational schools often presents significant challenges, with many math teachers expressing students' learning difficulties when learning this subject. These challenges can be attributed to three primary sources: cognitive, affective, and attitude (Retnowati, 2016).

Emphasizing the second source, which is the affective factor, this domain centres on the interpersonal skill of thinking and reasoning related to feelings, emotions, values, appreciation, enthusiasm, and motivations (Krathwohl et al., 1973). Subsequently, learning math in vocational schools often presents significant challenges, with many math teachers expressing students' learning difficulties when learning this subject. These challenges can be attributed to three primary sources: cognitive, affective, and attitude (Panadero, 2017).

With regard to Self-regulated learning (SRL), it is a multifaceted process encompassing cognitive, metacognitive, behavioural, motivational, and emotional elements of learning (Panadero, 2017). SLR is not an innate skill but a set of skills that can be cultivated and developed to empower students to guide themselves through the learning process (Azevedo & Cromley, 2004; Chen et al., 2017; Zimmerman, 2002). SLR plays a role in helping students learn Math by allowing them to develop skills and strategies needed to manage their learning process using its key components: forethought to assist them in setting goals and planning learning strategies, volitional control to monitor and regulate their actions toward learning goals by adjusting behaviours according to the environment, and self-reflection to evaluate their learning process and progress using self-evaluation or others feedback (Azevedo & Cromley, 2004; Chen et al., 2017; Zimmerman, 2002).

Relating to SLR, numerous research pertaining to this topic have been carried out; students who improve their ability to self-regulate learning may experience psychological advantages, such as an increased sense of control over their performance and reduced negative emotions associated with exams (Azevedo & Cromley, 2004; Chen et al., 2017; Pintrich, 2002; Zimmerman, 2002). In addition, utilizing self-regulation techniques enables students to adjust their course and become more autonomous learners. This is because they can identify the

effectiveness of different strategies through monitoring their study habits (Chen et al., 2017; Zimmerman, 2002). In line with that, SRL has been found to have a significant impact on students' math achievement (Duru & Okeke, 2021; Fauzi & Widjajanti, 2018). Further, students who have high self-regulated learning tend to have high motivation and achievement. Conversely, those with lower self-regulated learning tend to have lower achievement (Duru & Okeke, 2021). Another research has also shown that self-regulated learning can improve math achievement and metacognition levels of students taking developmental math courses (Fauzi & Widjajanti, 2018).

Despite these skills' functionality and possibilities to be taught, students are still struggling with math for various reasons, including their cognitive-related issues, both affective and attitude factors such as motivations, perceptions, anxiety, behaviour and others. Regarding perceptions, positive self-perception and self-confidence in mathematics can act as a powerful catalyst for students' overall well-being and academic success (Hakim, 2021; Sholihah et al., 2023). When students view themselves positively in math, it fosters a sense of confidence and optimism. This optimistic outlook becomes a driving force, encouraging them to embrace challenges, persist through difficulties, and ultimately develop a genuine liking for mathematics (Hidayah, 2016). On the flip side, negative self-perception can cast a shadow on a student's math learning. The feelings of fear, pessimism, and anxiety can create significant barriers, hindering their ability to engage with math effectively (Hidayah, 2016). As noted by Hidayah (2016) and Anita (2014), this negative self-perception can manifest in a sense of hopelessness and a feeling of inability to handle mathematical challenges, which is commonly called math anxiety.

To date, several studies have been conducted about math anxiety and its influence on students' self-regulated learning. Math anxiety is said to be a barrier to mathematical learning and is thought to hinder students' engagement and the efficiency of their metacognitive process (Gabriel et al., 2020). This study also stated that the antecedents of math anxiety are poorer control appraisals, which are associated with lower levels of self-regulated learning. Lavasani et al. (2011), found that math anxiety is negatively correlated with self-regulated learning (Říčan et al., 2022) and other mathematical metacognition (Lai et al., 2015). Conversely, self-regulated training can reduce students' math anxiety of dependent cognitive style of school students (Kahreh et al., 2018).

Indeed, while there is a wealth of research exploring the impact of math anxiety on students' self-regulated learning, there is a notable gap when it comes to studies within the Indonesian context, particularly among Vocational Students in the Bandung area. Further, this research aims to investigate whether math anxiety influences students' self-regulated learning among students in a vocational school in Bandung Regency or not. Furthermore, it becomes imperative to undertake research tailored to this specific demographic and locale. Understanding the unique challenges and dynamics that Vocational Students in Bandung face in relation to math anxiety and self-regulated learning is crucial for developing targeted interventions and educational strategies. On the basis of the literature review, the research question is hypothesized as follows: There is a significant influence of math anxiety towards students' self-regulated learning.

METHOD

This study uses quantitative methode. Purposive sampling was used to collect the data, which was generated from a sample of 99 students across two vocational schools in Bandung Regency using Google Forms voluntarily as a mean survey for data collection. All measures in the survey, initially written in English, were derived from Mahmood and Khatoon for mathematical anxiety. Concurrently, the assessment for self-regulated learning originated from the research by Hidayati & Listyani (2010), underwent translation to the Indonesian version, and was subsequently validated by Sakinah (2021).

Math Anxiety Scale (MAS) was used to measure students' math anxiety. The measure is a concise, bi-dimensional instrument designed with seven positively worded items and seven negatively worded items. Utilizing a 5-point Likert scale, it evaluates both the positive and negative aspects of math anxiety. The instrument has been validated and demonstrates a split-half reliability of 0.89 and a Cronbach's alpha of 0.87.

Next, to measure students' self-regulated learning, a scale developed by (2010). This scale has 20 items and consists of 6 different dimensions, with 7 of them being reversed items. Utilizing a 5-point Likert scale, this scale has been validated and shows a reliability of Cronbach's alpha of 0.88. For statistical analysis, SPSS Version 25 was employed in this research. Normality was assessed using the One Sample Kolmogorov-Smirnov Test, and homogeneity of variance was examined through One-Way ANOVA to explore differences among independent variables. Pearson correlations were conducted to assess the correlation between independent and dependent variables. At the same time, Linear Regression was employed to determine the significance of the role played by math anxiety in influencing the increase or decrease of students' self-regulated learning.

RESULTS AND DISCUSSION

Results

The participants included 57 males and 42 females, with the mean age of participants being 16.51 years (ranging from 15 to 18 years old; standard deviation [SD]=0.907. All of them represent their streaming accounting for seven sectors and domicile at 16 different sub-districts within the Bandung regency. This data can be found at Table 1.

In the process of conducting validity and reliability testing for both the Math Anxiety and Self-Regulated Learning scales, it was determined that both measures are generally reliable. However, a specific item (item number 4) from the self-regulated learning scale exhibited low validity (0.124) and poor reliability (-0.128) during the reliability test, as indicated by the Corrected Item-Total Correlation analysis. Consequently, this item was deemed unsuitable and was subsequently removed from the scale.

After the removal of the problematic item, the Cronbach’s alpha values for both scales demonstrated improvement. The Math Anxiety scale now possesses a Cronbach’s alpha of 0.869, indicating a high level of internal consistency, while the Self-Regulated Learning scale shows a Cronbach’s alpha of 0.846, suggesting strong reliability among its items.

Normality test has been conducted prior to predictive and correlative analysis to determine which statistical analysis that will be used. One Sample Kolmogorov-Smirnov Test was conducted to determine whether both variable math anxiety and self-regulated learning data was normally distributed. The result indicated that null hypothesis could not be rejected for both variable (p = 0.68) and concluded that the data is normally distributed.

Subsequently, based on table 2, it is revealed that null hypothesis should be rejected which means, math anxiety has a significant influence toward students' self-regulated learning at β (= 0.420, $p < 0.00$). However, math anxiety prediction toward students' self-regulated learning is categorised as low at $R^2 = 0.177$, $F(1, 97) = 20.832$, $p < 0.00$ with the fitted regression model Self-Regulated Learning = 56.987 + 0.397 (math anxiety). Further, no significant differences noticed among variable with regards to both independent and dependent variable of this research.

Table 1. Descriptive Statistics

		Frequency	**%**
Gender	Male	57	57.6
	Female	42	42.4
	Total	99	100
Age	15	12	12.1
	16	40	40.4
	17	31	31.3
	18	16	16.2
	Total	99	100
Class	X	29	29.3
	XI	29	29.3
	XII	41	41.4
	Total	99	100
Streaming	Teknik Otomotif	42	42.4
	Teknik Kendaraan Ringan	13	13.1
	Teknik Penyempurnaan Tekstil	12	12.1
	Teknik Elektronika Industri	7	7.1
	Rekayasa Perangkat Lunak	4	4
	Teknik Komputer Jaringan	12	12.1
	Tata Busana	9	9.1
	Total	99	100

Table 2. Regression Analysis Summary for Math Anxiety Predicting Students' Self-Regulated Learning

Variable	**B**	**95% CI**	**β**	**t**	**P**
Constant	56.987	[48.966, 65.007]		14.102	0.00
Kemandirian Belajar	0.397	[0.224, 0.569]	0.420	4.564	0.00

Discussions

Extensive literature been written about math anxiety and self-regulated learning across diverse educational levels, demographic context and various other dimensions. Gabriel et al. (2020) argued that self-regulated has been exhibited to have a positive and enduring impacts on students' academic development, career trajectories and employability. They further

emphasized that emotions, motivation and metacognition have a crucial impact on students ability to monitor and regulate their learning. This finding aligns with this research, which underscores the important role of self-regulation, irrespective of the form of its relationship with math anxiety. Identically, Keski & Erdogan (2009) found that motivational beliefs and self-regulated learning strategies are significant predictors of students' anxiety while learning math. On the contrary, Cahyawati et al. (2023) suggested that although math anxiety has an impact on self-regulated learning, the causal relationship between these two variable was negative explaining that the more students become anxious while learning math, the weakest their ability to learn independently. Villavicencio and Bernardo (2016) took slightly different approach in understanding affective dimensions of mathematic learning by placing greater emphasis on positive emotion instead of the otherwise. The finding revealed that certain emotional facets, specifically pride and enjoyment could explain a significant amount of variance among dependant variables that include math anxiety. Nonetheless, no causal relationship is identified between these variables.

CONCLUSION

The outcome of this study indicated that math anxiety that students experience play a significant role in students' self-regulated learning despite of its low correlational degree. This research outcome is understood to be inherently variable, shaped by contextual factors such as cultural distinctions, educational systems, socioeconomic states, language, methods and approaches used. Finally, regardless of these diversities, each result can contribute significantly to the literature particularly in the context of math anxiety and self-regulated learning which can serve as a valuable insight for future research.

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REFERENCES

Anita, I. W. (2014). Pengaruh kecemasan matematika (mathematics anxiety) terhadap kemampuan koneksi matematis siswa SMP. *Infinity Journal*, *3*(1), 125–132.

Asrawati, N. (2021). Pengaruh Mathematics Anxiety Terhadap Hasil Belajar Matematika Siswa Kelas X Smk Kartika Makassar. *Jurnal Riset Dan Inovasi Pembelajaran*, *1*(1), 23–31.

Azevedo, R., & Cromley, J. G. (2004). Does training on self-regulated learning facilitate students' learning with hypermedia? *Journal of Educational Psychology*, *96*(3), 523.

Cahyawati, D., Delima, N., & Gunarto, M. (2023). The impact of undergraduate students' mathematics anxiety and self-concept on their self-regulated learning and academic achievement. *Jurnal Elemen*, *9*(1), 183–196.

Chen, P., Chavez, O., Ong, D. C., & Gunderson, B. (2017). Strategic resource use for learning: A self-administered intervention that guides self-reflection on effective resource use enhances academic performance. *Psychological Science*, *28*(6), 774–785.

Duru, D. C., & Okeke, S. O. C. (2021). Self-regulated learning skill as a predictor of mathematics achievement: a focus on ability levels. *Malikussaleh Journal of Mathematics Learning (MJML)*, *4*(2), 86–89.

Fauzi, A., & Widjajanti, D. B. (2018). Self-regulated learning: the effect on student's mathematics achievement. *Journal of Physics: Conference Series*, *1097*(1), 12139.

Gabriel, F., Buckley, S., & Barthakur, A. (2020). The impact of mathematics anxiety on self-regulated learning and mathematical literacy. *Australian Journal of Education*, *64*. https://doi.org/10.1177/0004944120947881

Hakim, R. N. (2021). Analisis Tingkat Kecemasan Matematis Siswa SMA. *JPMI (Jurnal Pembelajaran Matematika Inovatif)*, *4*(4), 809–816.

Hidayah, L. L. N. (2016). *Hubungan konsep diri dan kecemasan matematika dengan hasil belajar matematika siswa SMPN 5 Sidoarjo*. Skripsi.

Hidayati, K., & Listyani, E. (2010). Improving Instruments of Students Self-Regulated Learning. *Jurnal Penelitian Dan Evaluasi Pendidikan*, *4*(1), 85–99.

Kahreh, S. V., Imani, S., Haseli, Y. M., & Mansour, F. K. (2018). Study of effectiveness of self-regulated learning strategies on math anxiety of dependent cognitive style of school students. *International Journal of Educational and Psychological Researches*, *4*(2), 89.

Kesici, Şa., & Erdogan, A. (2009). PREDICTING COLLEGE STUDENTS'MATHEMATICS ANXIETY BY MOTIVATIONAL BELIEFS AND SELF-REGULATED LEARNING STRATEGIES. *College Student Journal*, *43*(2).

Krathwohl, D. R., Bloom, B. S., & Masia, B. B. (1973). Taxonomy of educational objectives, the classification of educational goals. Handbook II: affective domain. David McKay Co. *Inc., New York*, *1*, 956.

Kurniawan, A. W., & Slamet, H. W. (2018). *Analisis kesulitan siswa dalam pembelajaran matematika pada materi peluang kelas X SMK Muhammadiyah 4 Surakarta tahun ajaran 2016/2017*. Universitas Muhammadiyah Surakarta.

Lai, Y., Zhu, X., Chen, Y., & Li, Y. (2015). Effects of mathematics anxiety and mathematical metacognition on word problem solving in children with and without mathematical learning difficulties. *PloS One*, *10*(6), e0130570.

Lavasani, M. G., Hejazi, E., & Varzaneh, J. Y. (2011). The predicting model of math anxiety: The role of classroom goal structure, self-regulation and math self-efficacy. *Procedia-Social and Behavioral Sciences*, *15*, 557–562.

Panadero, E. (2017). A review of self-regulated learning: Six models and four directions for research. *Frontiers in Psychology*, *8*, 422.

Pintrich, P. R. (2002). The role of metacognitive knowledge in learning, teaching, and assessing. *Theory into Practice*, *41*(4), 219–225.

Retnowati, E. (2016). Kajian masalah pembelajaran matematika di Sekolah Menengah Kejuruan dan alternatif solusinya. *Artikel Dipublikasikan Dalam Pelatihan Pembelajaran Matematika Berbasis GeoGebra, Jurusan Pendidikan Matematika, Universitas Negeri Yogyakarta*.

Říčan, J., Chytrý, V., & Medová, J. (2022). Aspects of self-regulated learning and their influence on the mathematics achievement of fifth graders in the context of four different proclaimed curricula. *Frontiers in Psychology*, *13*, 963151.

Sakinah, D. A. (2021). *PENGARUH KECEMASAN MATEMATIKA TERHADAP KEMANDIRIAN BELAJAR DAN KEMAMPUAN PEMAHAMAN KONSEP MATEMATIKA DI MASA PANDEMI*. Universitas Muhammadiyah Gresik.

Sholihah, R. M., Putra, H. D., & Hendriana, H. (2023). The Relation Between Self-Confidence and Mathematical Problem Solving Ability on Islamic Junior High School Students. *(JIML) JOURNAL OF INNOVATIVE MATHEMATICS LEARNING*, *6*(2), 113–123.

Villavicencio, F. T., & Bernardo, A. B. I. (2016). Beyond Math Anxiety: Positive Emotions Predict Mathematics Achievement, Self-Regulation, and Self-Efficacy. *The Asia-Pacific Education Researcher*, *25*(3), 415–422. https://doi.org/10.1007/s40299-015-0251-4

Zimmerman, B. J. (2002). Becoming a self-regulated learner: An overview. *Theory into Practice*, *41*(2), 64–70.