Mathematics Research and Education Journal
Vol 10, No 1, Page 1-12, April 2026
Doi: 10.25299/mrej.2026.vol10(1).22505.
Educational Assessment Development I Research Article OPEN ACCESS

Mathematics Anxiety and Learning Interest Among Students Preparing for Computer-Based National Assessments

Sri Rezeki[1], Sindi Amelia[1]
[1]mathematics Education Department, Faculty of Education and Teacher Training, Universitas Islam Riau, Pekanbaru, Riau Province, Indonesia
*) sindiamelia88@edu.uir.ac.id

ABSTRACT

This study examines students' mathematics anxiety and learning interest in the context of the Computer-Based National Assessment (ANBK), focusing on their psychological readiness for digital assessment environments. A quantitative descriptive design was employed involving 60 fifth-grade students from SDIP YLPI Pekanbaru. Data were collected using validated questionnaires and analyzed through descriptive statistics, including mean scores, standard deviations, and percentage distributions. The results show that mathematics anxiety (μ = 46.20; σ = 8.75) and learning interest (μ = 72.10; σ = 7.90) are predominantly in the moderate category, indicating a central tendency toward non-extreme levels. This pattern reflects a transitional psychological state in which students experience both engagement and emotional tension. The observed variability suggests that individual differences significantly influence students' responses in a digital assessment context. These findings indicate that readiness for ANBK is shaped not only by cognitive competence but also by the interaction between emotional and motivational factors. Moderate anxiety may still support engagement when accompanied by sufficient interest, whereas higher anxiety without strong interest may hinder performance. This study contributes empirical evidence on the interplay between mathematics anxiety and learning interest at the elementary level within a digital assessment framework. The findings highlight the importance of integrating psychological preparation and adaptive instructional strategies to better support students' transition to computer-based assessments.

ARTICLE HISTORY

Received 18 Mei 2026
Revised 1 March 2026
Accepted 20 April 2026

KEYWORDS

ANBK, Mathematics Anxiety, Mathematics Learning, Student Interest

SUBJECT

Mathematics Learning, Educational Assessment, National Assessment

1. Introduction

Education aims to optimize individual development. Formal education, such as schools and madrasas, serves as an institutional activity that shapes students' knowledge, attitudes, and habits [1], [2]. Elementary School or Elementary School (SD) in Indonesian, plays an important role in laying the foundation for student development, as this stage marks the beginning of systematic knowledge acquisition. Other research also confirms that basic education is a very important early stage in forming students' academic foundations, character, and social abilities as a provision for further education [3]. Moreover, basic skills developed at the elementary school level are an important foundation in the lifelong learning process [4], [5].

The evaluation system in Indonesian education is regulated under Undang Undang No. 20 Year 2003 on the National Education System, which states that educational evaluation is intended to improve quality, determine student achievement, and continuously monitor the learning process, progress, and outcomes. Evaluation is defined as the process of collecting, analyzing, and interpreting information to assess the extent to which learning objectives are achieved [6], [7]. Evaluation also serves as a tool to assess the effectiveness of learning while providing feedback for continuous improvement of learning processes and outcomes [8]. In addition, the evaluation not only focuses on the final outcome, but also includes the learning process that occurs during the learning activities [9]. Evaluations that are carried out systematically and based on data help teachers in making more appropriate learning decisions and improve the overall quality of education [10].

One of the national education evaluation instruments is the National Assessment (Asesmen Nasional/AN), a program initiated by the Indonesian government to evaluate the quality of educational institutions. The assessment spans from Elementary School to Senior High School and is implemented through three components: the Minimum Competency Assessment (Asesmen Kompetensi Minimum/AKM), Character Survey, and Learning Environment Survey [11], [12]. The computer-based version of this program is known as ANBK (Asesmen Nasional Berbasis Komputer), as stipulated in Regulation of the Minister of Education, Culture, Research, and Technology No. 17 Year 2021. The implementation of ANBK requires the readiness of schools both in terms of technological infrastructure and human resource competence in managing digital-based assessments [13]. In addition, the success of this assessment is also influenced by the level of digital literacy and the readiness of students to face the computer-based evaluation model [14]. Therefore, it is necessary for teachers to play an active role in guiding and preparing students to be able to adapt to the assessment system [10].

Teachers play a key role in preparing students to face ANBK. This is in line with [15] which explains that a conducive learning environment also plays a role in increasing student involvement and concentration so that it has a direct impact on optimal learning outcomes. Effective preparation can enhance students' chances of success. Previous studies have shown that psychological and environmental readiness positively influences learning outcomes [16], [17]. Well-prepared students tend to understand the material better, actively participate in learning activities, and perform well in assessments. In addition, students who are ready and actively engaged will show better learning performance [18].

In everyday life, mathematical concepts are frequently applied in various activities. Mathematics is strongly linked to real-life contexts [19]. However, not all students enjoy mathematics. According to [20], some students have negative experiences that make them perceive mathematics as difficult, boring, and intimidating. Consequently, many students feel uncomfortable and unmotivated when faced with math-related tasks. About 30% of students reportedly experience math anxiety that negatively affects their academic performance [21]. This condition shows that emotional factors have an important role in the mathematics learning process and can significantly affect student performance [22]. Negative perceptions of mathematics have also been shown to be closely related to increased math anxiety and low student achievement [23].

Math anxiety refers to the feeling of fear, nervousness, and tension experienced when dealing with mathematical problems, which can affect students physically, psychologically, and behaviorally [24], [25], [26]. It often arises from perceived threats related to the subject

[27], [28], [29]. Math anxiety not only interferes with learning but also with students' daily activities [30]. It stems from negative past experiences and impacts students on cognitive, emotional, and social levels [31]. According to [32], math anxiety can be categorized into three levels: high, moderate, and low. While normal anxiety may be managed through teacher support, high anxiety levels require more targeted interventions [33], [34].

The causes of math anxiety can be grouped into three main categories: personality traits, environmental factors, and intellectual capacity [35]. Stressful learning environments and inappropriate teaching methods can further intensify this anxiety. Cognitive, affective, and physiological factors also contribute to math anxiety [36]. In addition, research shows that academic stress and negative learning experiences can reinforce the emergence of math anxiety in students [22], [37]. This condition not only impacts the emotional aspects of students, but can also affect their motivation and interest in overall math learning.

In addition to anxiety, learning interest is another crucial factor affecting academic achievement. Interest significantly shapes students' learning attitudes. Students with high interest are typically more motivated and diligent than those with low interest [38]. Lack of interest in learning often leads to difficulties in understanding lessons and lower motivation to attend school. A strong interest in learning facilitates better learning processes [39]. In addition, learning interest is not only influenced by internal factors of the student, but also by a supportive learning environment and meaningful learning experience, which can increase student involvement in the learning process. Supporting positive interactions between teachers and students also plays an important role in fostering a sustained interest in learning [10].

Learning interest has several functions: influencing aspirations, encouraging activities, increasing achievement, and providing satisfaction in learning [40]. Interest in learning also plays a role in increasing students' attention, involvement, and perseverance in the learning process, thus having an impact on deeper understanding and better learning outcomes [18], [41]. This is also in line with the statement that students with high interest tend to be more active, understand the material more deeply, and try harder, thereby improving learning outcomes [42]. Therefore, fostering an interest in mathematics from an early age is essential.

Several factors influence students' learning interest, including motivation, family, teachers, learning facilities, and peer support [43], [44]. These factors reflect the influence of internal and external aspects that interact with each other in shaping students' interest and involvement in the learning process [45]. Indicators of learning interest include enjoyment, active participation, focused attention, positive emotions, comfort during learning, and the ability to make learning-related decisions [46].

Based on the aforementioned background, this study aims to identify the level of math anxiety and learning interest among students preparing for ANBK at SDIP YLPI. The findings are expected to assist teachers in developing appropriate strategies that help students feel more confident, calm, and focused during the ANBK process.

2. Methodology

This study employed a quantitative descriptive research design. This design was selected because the primary objective of the study was to systematically describe and quantify the levels of mathematics anxiety and learning interest among fifth-grade students preparing for the Computer-Based National Assessment (ANBK), rather than to test causal relationships or interventions. The descriptive quantitative approach enables the researcher

to summarize patterns, tendencies, and distributions of the variables using numerical data, which aligns with the study's focus on identifying students' psychological conditions prior to assessment.

The participants of this study consisted of 60 fifth-grade students from SDIP YLPI Pekanbaru, divided equally into three classes (5A, 5B, and 5C, with 20 students each). The study employed a total sampling technique, in which all members of the population were included as research participants. Although total sampling ensures complete coverage of the accessible population, it should be noted that the sample is limited to a single school context. Therefore, the findings of this study may not be generalized to broader populations, and should instead be interpreted within similar educational settings.

Data were collected using a closed-ended questionnaire designed to measure mathematics anxiety and learning interest. The instrument employed a four-point Likert scale, consisting of *Always, Often, Rarely,* and *Never*, to avoid neutral responses and encourage more definitive answers. The scoring scheme for both favorable and unfavorable items is presented in Table 1.

Table 1. Likert Scale for Students' Mathematics Anxiety and Interest

Response	Favorable Score	Unfavorable Score
Always (S)	4	1
Often (SR)	3	2
Rarely (JR)	2	3
Never (TP)	1	4

The inclusion of both favorable and unfavorable statements was intended to reduce response bias. For unfavorable items, reverse scoring was applied during data processing to ensure consistency in interpretation. Mathematics anxiety in this study is defined as students' cognitive, affective, and physiological responses when dealing with mathematical tasks. This construct was adapted from previous research and operationalized into measurable indicators across three aspects—cognitive, affective, and physiological—as presented in Table 2. Each indicator was translated into questionnaire items reflecting students' experiences in mathematics learning situations.

Table 2. Aspects and Indicators of Mathematics Anxiety

Aspect	Indicators
Cognitive	Self-efficacy
	Confidence
	Difficulty concentrating
	Fear of Failure
Affective	Nervousness
	Dislike
	Restlessness
Physiological	Nausea
	Cold sweats
	Heart palpitations
	Headache

The mathematics anxiety instrument used in this study was adapted from established frameworks, including the Mathematics Anxiety Rating Scale (MARS), the Abbreviated Mathematics Anxiety Scale (AMAS), and the Mathematics Anxiety-Apprehension Survey (MAAS) and their derivatives [47], [48], [49]. These instruments have demonstrated high reliability, with Cronbach's alpha coefficients ranging from 0.87 to 0.97. In the Indonesian context, similar instruments have also shown acceptable reliability ($\alpha \approx 0.76$) [50], [51]. Learning interest is defined as students' tendency to engage actively and positively in mathematics learning. This variable includes dimensions such as enjoyment, engagement, attention, and enthusiasm, with detailed indicators presented in Table 3.

Table 3. Aspects and Indicators of Interest in Learning

Aspect	Indicators
Enjoyment of the Subject	Enjoyment of the subject material
	Group learning enjoyment
	Not easily bored
Student Engagement in Learning	Active participation
	Active in discussion
	Asking and answering questions
Interest in Learning Activities	Discipline in task completion
	Enthusiasm
Attention Toward the Lesson	Listening to the teacher
	Note-taking
	Awareness of the learning
	Awareness of the learning process

The learning interest instrument used in this study was adapted from several previous studies [52], [53], [54], [55] and has demonstrated good reliability, with Cronbach's Alpha values ranging from 0.743 to 0.935. Data were analyzed using descriptive statistics, including total scores, mean (μ), standard deviation (σ), and percentage distributions. Percentage analysis was used to describe the proportion of students in each category, while mean and standard deviation were used to summarize central tendency and variability.

To interpret the results, scores were classified into five categories using a normal distribution approach based on mean and standard deviation. The categorization criteria are presented in Table 4.

Table 4. Anxiety and Interest Levels

Score Interval (X)	Category
$X \leq \mu - 1{,}5\sigma$	Very Low
$\mu - 1{,}5\sigma < X \leq \mu - 0{,}5\sigma$	Low
$\mu - 0{,}5\sigma < X \leq \mu + 0{,}5\sigma$	Moderate
$\mu + 0{,}5\sigma < X \leq \mu + 1{,}5\sigma$	High
$X > \mu + 1{,}5\sigma$	Very High

Note:
μ = Mean
σ = Standard Deviation

This study adhered to ethical research standards. Permission was obtained from the school prior to data collection. Informed consent was secured from students and their

guardians, and all responses were treated confidentially and used solely for research purposes.

3. Results and Discussion

This study analyzed students' mathematics anxiety and learning interest using descriptive statistics, including mean (μ), standard deviation (σ), frequency, and percentage distributions. The distribution of students' mathematics anxiety levels is presented in Table 5.

Table 5. Price and Demand

Anxiety Score Interval	Frequency	Percentage (%)	Category
X ≤ 29	6	10	Very Low
29 < X ≤ 40	16	26,67	Low
40 < X ≤ 51	19	31,67	Moderate
51 < X ≤ 61	14	23,33	High
X > 61	5	8,33	Very High
Total	**60**	**100**	

The results indicate that the mean score of mathematics anxiety (μ = 46.20; σ = 8.75) falls within the moderate category, suggesting that, on average, students experience a noticeable yet manageable level of anxiety. The relatively moderate standard deviation further indicates that students' anxiety levels are not homogeneous, reflecting meaningful individual differences.

The distribution shows that the largest proportion of students is concentrated in the moderate (31.67%) and low (26.67%) categories, suggesting that mathematics anxiety is a common but generally controlled experience among fifth-grade students. From a psychological perspective, a moderate level of anxiety may still be considered typical in academic settings, particularly in subjects perceived as challenging. This aligns with the [56], [57], [58], which suggests that moderate levels of arousal or tension are commonly present during task engagement.

However, the presence of 23.33% of students in the high anxiety category and 8.33% in the very high category warrants serious attention. High levels of mathematics anxiety have been consistently associated with cognitive interference, reduced working memory capacity, and lower academic performance [59], [60], [61], [62], [63]. This indicates that nearly one-third of the students may be at risk of experiencing learning disruption, particularly in problem-solving contexts that require sustained concentration.

Interestingly, the relatively small proportion of students in the very low anxiety category (10%) suggests that complete comfort with mathematics is uncommon, which may reflect students' prior negative experiences or the inherently challenging nature of the subject. This supports findings by [64], [65], who argued that mathematics anxiety often develops gradually through repeated exposure to stressful learning situations.

Overall, the results indicate that mathematics anxiety is present across the student population, with most students experiencing it at a moderate level, while a notable proportion exhibits elevated anxiety that may require pedagogical attention.

The analysis of students' interest in learning mathematics (see Table 6) shows a mean score of μ = 72.10 (σ = 7.90), which also falls within the moderate category, indicating that students generally demonstrate a sufficient level of engagement in learning activities. The

standard deviation suggests a moderate variation, reflecting differences in students' levels of interest.

Table 6. Score Category Norms for Interest in Learning

Interest Score Interval	Frequency	Percentage (%)	Category
X ≤ 59	5	8,33	Very Low
59 < X ≤67	15	25	Low
67 < X ≤ 75	21	35	Moderate
75 < X ≤ 83	17	28,33	High
X > 83	2	3,33	Very High
Total	**60**	**100**	

The distribution reveals that most students are grouped in the moderate (35%) and high (28.33%) categories, indicating that learning interest is fairly well-developed but not yet optimal. According to [41], [42], interest develops progressively, beginning from situational interest and potentially evolving into a more stable individual interest. The current findings suggest that many students may still be in the developing phase of interest, rather than having fully internalized motivation.

At the same time, 25% of students fall into the low category and 8.33% into the very low category, indicating that a portion of students demonstrates limited engagement in learning mathematics. This condition may reflect challenges such as lack of perceived relevance, limited instructional variation, or insufficient stimulation during learning activities. Within the field of educational psychology, low interest is often associated with reduced attention and persistence during learning tasks [66], [67].

On the other hand, only 3.33% of students are categorized as having very high interest, suggesting that strong enthusiasm toward mathematics is relatively rare. This may indicate that while classroom instruction supports basic engagement, it may not yet fully foster deeper curiosity or intrinsic motivation. Overall, the findings suggest that students' interest in learning mathematics is generally adequate but still requires enhancement, particularly to move students from moderate engagement toward higher levels of sustained interest.

3.1. Discussion and Implications

The findings of this study provide a more nuanced understanding of students' psychological readiness in the context of the Computer-Based National Assessment (ANBK). Both mathematics anxiety and learning interest demonstrate a central tendency toward the moderate category, indicating that most students are not positioned at extreme levels. However, this statistical categorization should be interpreted with caution, as the label "moderate" reflects a distributional grouping rather than a qualitatively neutral condition. Instead, it suggests a transitional psychological state in which students are neither fully comfortable nor entirely disengaged when facing mathematics in a digital assessment environment.

The variability observed in both variables, as indicated by the standard deviation, further highlights that students' experiences differ meaningfully across individuals. This finding aligns with previous research suggesting that mathematics anxiety is shaped by a combination of individual and contextual factors [68]. In the context of ANBK, such variability

becomes particularly important, as students are required not only to demonstrate mathematical competence but also to adapt to digital interfaces, time constraints, and structured testing conditions. These additional demands may intensify anxiety for some students while remaining manageable for others.

From the perspective of mathematics anxiety, the dominance of moderate levels suggests that most students experience a noticeable degree of tension when engaging with mathematical tasks. In a computer-based assessment context, this condition may reflect the interaction between subject-related difficulty and the cognitive demands of digital environments. However, the presence of students in the high and very high anxiety categories indicates a potential risk for cognitive interference. Prior research has shown that elevated mathematics anxiety can disrupt working memory and problem-solving processes, which may be further exacerbated in time-sensitive, computer-based assessments.

In contrast, students' learning interest appears to be relatively better developed, with most students distributed across the moderate to high categories. This pattern is consistent with previous findings [38], [39], which suggest that students' engagement in mathematics tends to vary rather than concentrate at extreme levels. The current results reinforce the view that learning interest is present but not yet strongly internalized as intrinsic motivation. In the context of ANBK, this is particularly relevant, as computer-based assessments require sustained attention and a degree of self-regulated learning that may not be fully supported by moderate levels of interest alone.

Importantly, the coexistence of moderate anxiety and moderate-to-high interest reflects a complex motivational dynamic. Rather than functioning as opposing constructs, anxiety and interest may operate simultaneously, where students remain engaged in learning while experiencing emotional tension. This interplay suggests that students' readiness for ANBK is not solely determined by cognitive ability, but also by the balance between emotional and motivational factors.

From a pedagogical perspective, these findings imply that instructional strategies should extend beyond content delivery to include psychological preparation. Teachers may need to create learning environments that reduce unnecessary pressure while simultaneously enhancing meaningful engagement. The integration of digital tools in everyday instruction, exposure to low-stakes computer-based practice, and supportive classroom interactions may help students gradually adapt to the ANBK format.

It is important to acknowledge that this study is limited to a single school context and relies on self-reported data. Therefore, the findings should be interpreted within these constraints. Future research is recommended to expand the scope by involving more diverse populations, employing longitudinal or mixed-method designs, and examining how mathematics anxiety and learning interest evolve over time in relation to students' performance in computer-based assessments.

4. Conclusion

The findings show that students preparing for the Computer-Based National Assessment (ANBK) generally experience moderate levels of mathematics anxiety and learning interest. Rather than indicating a neutral condition, this suggests a transitional state in which students stay engaged in learning while also feeling a certain level of emotional tension. This highlights that readiness for digital assessments is shaped not only by cognitive ability but also by the balance between emotional and motivational factors.

At the same time, students' experiences vary considerably. Some are able to stay engaged despite feeling anxious, while others may struggle, especially in digital testing situations that require sustained focus and familiarity with technology. In addition, only a small proportion of students demonstrate very high learning interest, indicating that intrinsic motivation toward mathematics still needs to be strengthened.

These findings suggest that preparing students for ANBK should go beyond academic instruction. Teachers can support students by gradually introducing digital tools, providing low-pressure practice opportunities, and creating a more supportive learning environment. Such efforts may help reduce anxiety while maintaining students' engagement. This study is limited to a single school and relies on self-reported data. Future research could explore how these psychological factors relate to actual performance in computer-based assessments across more diverse contexts.

References

[1] O. M. Owojori, R. Mulaudzi, and J. N. Edokpayi, "Student's Knowledge, Attitude, and Perception (KAP) to Solid Waste Management: A Survey towards a More Circular Economy from a Rural-Based Tertiary Institution in South Africa," *Sustainability*, vol. 14, no. 1310, pp. 1–23, 2022, doi: https:// doi.org/10.3390/su14031310.

[2] C. Chen, P. Shahbaz, and S. ul Haq, "Transforming students' green behavior through environmental education: the impact of institutional practices and policies," *Front. Psychol.*, vol. 15, no. January, pp. 1–13, 2025, doi: 10.3389/fpsyg.2024.1499781.

[3] G. Yarmi, "Social Sciences & Humanities Open Developing a writing instruction model for primary schools based on ISM-DEMATEL to enhance students ' literacy competence : An empirical evidence in Indonesia," *Soc. Sci. Humanit. Open*, vol. 12, no. May, p. 101963, 2025, doi: 10.1016/j.ssaho.2025.101963.

[4] R. Wildová, "Initial Reading Literacy Development in Current Primary School Practice," *Procedia - Soc. Behav. Sci.*, vol. 159, pp. 334–339, 2014, doi: 10.1016/j.sbspro.2014.12.383.

[5] M. A. Veldman, M. Hingstman, S. Doolaard, T. A. B. Snijders, and R. J. Bosker, "Studies in Educational Evaluation Promoting students ' social behavior in primary education through Success for All lessons," *Stud. Educ. Eval.*, vol. 67, p. 100934, 2020, doi: 10.1016/j.stueduc.2020.100934.

[6] V. J. Owan, K. B. Abang, D. O. Idika, E. O. Etta, and B. A. Bassey, "Exploring the potential of artificial intelligence tools in educational measurement and assessment," *Eurasia J. Math. Sci. Technol. Educ.*, vol. 19, no. 8, p. em2307, 2023.

[7] S. M. Ismail, D. R. Rahul, I. Patra, and E. Rezvani, "Formative vs . summative assessment: impacts on academic motivation , attitude toward learning , test anxiety , and self-regulation skill," *Lang. Test. Asia*, vol. 12, no. 40, pp. 1–23, 2022, doi: 10.1186/s40468-022-00191-4.

[8] M. W. T. Cheng and C. K. Y. Chan, "An experimental test: Using rubrics for reflective writing to develop reflection," *Stud. Educ. Eval.*, vol. 61, pp. 176–182, 2019, doi: https://doi.org/10.1016/j.stueduc.2019.04.001.

[9] Q. Liu, S. Geertshuis, and R. Grainger, "Understanding academics' adoption of learning technologies: A systematic review," *Comput. Educ.*, vol. 151, p. 103857, 2020, doi: https://doi.org/10.1016/j.compedu.2020.103857.

[10] E. RECEPOĞLU, "Analyzing job motivation level of high school teachers in Turkey,"

Procedia - Soc. Behav. Sci., vol. 116, pp. 2220–2225, 2014, doi: 10.1016/j.sbspro.2014.01.547.
[11] E. S. P. O. Wuwur, "Analisis Kesiapan Asesmen Nasional Berbasis Komputer (ANBK) di Sekolah Dasar Daerah 3T," *SIMPATI J. Penelit. Pendidik. dan Bhs.*, vol. 1, no. 1, pp. 1–8, 2023.
[12] M. Manik, "Kesiapan Siswa dalam Menghadapi Asesmen Nasional Berbasis Komputer," *Asatiza J. Pendidik.*, vol. 3, no. 1, pp. 1–10, 2022, doi: https://doi.org/10.46963/asatiza.v3i1.244.
[13] X. Li and S. K. W. Chu, "Using design-based research methodology to develop a pedagogy for teaching and learning of Chinese writing with wiki among Chinese upper primary school students," *Comput. Educ.*, vol. 126, pp. 359–375, 2018, doi: https://doi.org/10.1016/j.compedu.2018.06.009.
[14] J. Jang, H. Hessel, and J. Dworkin, "Parent ICT use, social capital, and parenting efficacy," *Comput. Human Behav.*, vol. 71, pp. 395–401, 2017, doi: https://doi.org/10.1016/j.chb.2017.02.025.
[15] E. Edgerton, J. Mckechnie, and J. Maltby, "Developing a psychological understanding of students ' perceptions of their school environment and the relationship with academic achievement," *J. Environ. Psychol.*, vol. 109, no. March 2025, p. 102862, 2026, doi: 10.1016/j.jenvp.2025.102862.
[16] M. K. U. BK and Hamna, "Strategi Pembentukan Karakter Islami Siswa Sekolah Dasar di Masa Transisi Covid-19 Menuju Aktivitas New Normal," *J. Bid. Pendidik. Dasar*, vol. 6, no. 2, pp. 135–148, 2022, doi: https://doi.org/10.21067/jbpd.v6i2.6866.
[17] A. Rahim and L. Rusman, "Pelaksanaan Asesmen Nasional Berbasis Komputer (ANBK) di SMP Negeri 3 Tolitoli," *J. Teknol. Pendidik. Madako*, vol. 1, no. 1, pp. 33–40, 2022.
[18] M. Sedaghat, A. Abedin, and E. Hejazi, "Motivation , cognitive engagement , and academic achievement," *Procedia - Soc. Behav. Sci.*, vol. 15, pp. 2406–2410, 2011, doi: 10.1016/j.sbspro.2011.04.117.
[19] K. N. S. Effendi, Zulkardi, R. I. I. Putri, and P. Yaniawati, "Reading Text for School Literacy Movement in Mathematics Learning," *J. Pendidik. Mat.*, vol. 14, no. 2, pp. 145–154, 2020, doi: https://doi.org/10.22342/jpm.14.2.6731.145-154.
[20] D. Nolasco, "unearthing mathematics anxiety: a qualitative exploration of student experiences," *J. Technol. Sci. Educ.*, vol. 15, no. 2, pp. 223–239, 2025, doi: https://doi.org/10.3926/jotse.2950.
[21] R. Wijaya, Fahinu, and Ruslan, "Pengaruh Kecemasan Matematika dan Gender Terhadap Kemampuan Penalaran Adaptif Matematika Siswa SMP Negeri 2 Kendari," *J. Pendidik. Mat.*, vol. 9, no. 2, pp. 173–184, 2018.
[22] T. van Marlen, M. van Wermeskerken, H. Jarodzka, and T. van Gog, "Effectiveness of eye movement modeling examples in problem solving: The role of verbal ambiguity and prior knowledge," *Learn. Instr.*, vol. 58, pp. 274–283, 2018, doi: https://doi.org/10.1016/j.learninstruc.2018.07.005.
[23] F. Guay, A.-S. Denault, and S. Renauld, "School attachment and relatedness with parents, friends and teachers as predictors of students' intrinsic and identified regulation," *Contemp. Educ. Psychol.*, vol. 51, pp. 416–428, 2017, doi: https://doi.org/10.1016/j.cedpsych.2017.10.001.
[24] S. H. Omar, S. R. S. Aris, and T. S. Hoon, "Mathematics Anxiety and its Relationship with Mathematics Achievement among Secondary School Students," *Asian J. Univ. Educ.*, vol.

18, no. 4, pp. 863–878, 2022.
[25] A. D'Agostino, F. S. Spagnolo, and N. Salvati, "Studying the relationship between anxiety and school achievement: evidence from PISA data," *Stat. Methods Appt.*, vol. 31, no. 1, pp. 1–20, 2022, doi: 10.1007/s10260-021-00563-9.
[26] A. K. Mishra and A. R. Varma, "A Comprehensive Review of the Generalized Anxiety Disorder," *Cureus*, vol. 15, no. 9, pp. 1–8, 2023, doi: 10.7759/cureus.46115.
[27] J. Vazard, "Feeling the Unknown: Emotions of Uncertainty and Their Valence," *Erkenntnis*, vol. 89, no. 4, pp. 1275–1294, 2024, doi: 10.1007/s10670-022-00583-1.
[28] S. Luttenberger, S. Wimmer, and M. Paechter, "Spotlight on math anxiety," *Psychol. Res. Behav. Manag.*, vol. 11, pp. 311–322, 2018, doi: 10.2147/PRBM.S141421.
[29] E. Moreno-García, A. García-Santillán, V. S. Molchanova, and N. Larracilla-Salazar, "From Anxiety as a Psychological and Biological Phenomenon to Mathematics Anxiety: A Theoretical Approach," *Eur. J. Contemp. Educ.*, vol. 6, no. 4, pp. 757–774, 2017, doi: 10.13187/ejced.2017.4.757.
[30] L. D. Cohen and O. Rubinsten, "Math anxiety and deficient executive control: does reappraisal modulate this link?," *Ann. N. Y. Acad. Sci.*, vol. 1513, pp. 108–120, 2022, doi: 10.1111/nyas.14772.
[31] F. S. Syafri, "ada apa dengan kecemasan matematika?," *MEDIVES*, vol. 1, no. 1, pp. 59–65, 2017.
[32] I. Nurjanah and F. Alyani, "Kecemasan Matematika Siswa Sekolah Menengah pada Pembelajaran Matematika dalam Jaringan," *J. Elem.*, vol. 7, no. 2, pp. 407–424, 2021, doi: 10.29408/jel.v7i2.3522.
[33] Hermansyah, S. W. Rahayu, Nurfadilla, and Ferryansyah, "The Effect of Mathematics Anxiety and Mathematics Self-Efficacy on Mathematics Academic Achievement," *Int. J. Technol. Educ. Res.*, vol. 03, no. 04, pp. 983–993, 2025.
[34] M. Ikhsan, "pengaruh kecemasan matematis terhadap hasil belajar matematika siswa," *Fermat J. Pendidik. Mat.*, vol. 2, no. 1, pp. 1–6, 2019.
[35] D. P. Sari, T. Rahmat, W. Aprison, and H. Fitri, "Pengaruh Kecemasan Matematika (Math Anxiety) Terhadap Hasil Belajar Siswa Kelas VIII MtSN 6 AGAM Tahun Pelajaran 2020 / 2021," *Innov. J. Soc. Sci. Res.*, vol. 3, no. 2, pp. 2514–2526, 2023.
[36] S. N. Mujahidah and H. Khusna, "Analisis kecemasan matematika ditinjau dari kemampuan pemecahan masalah pada pembelajaran luring pasca pandemi," *J. Pembelajaran Mat. Inov.*, vol. 6, no. 4, pp. 1345–1356, 2023, doi: 10.22460/jpmi.v6i4.17977.
[37] I. Villanueva, M. Di, L. Gelles, P. Vicioso, S. Benson, and U. States, "A race re-imaged , intersectional approach to academic mentoring : Exploring the perspectives and responses of womxn in science and engineering research," *Contemp. Educ. Psychol.*, vol. 59, no. June, p. 101786, 2019, doi: 10.1016/j.cedpsych.2019.101786.
[38] O. J. Dores, F. A. Huda, and R. Riana, "analisis minat belajar matematika siswa kelas iv sekolah dasar negeri 4 sirang setambang tahun pelajaran 2018/2019," *J-PIMat*, vol. 1, no. 1, pp. 38–48, 2019.
[39] Syaiful, Kamid, D. A. Kurniawan, and P. A. Rivani, "The Impact of Students' Learning Interest on Students' Process Skill in Mathematics," *J. Educ. Res. Eval.*, vol. 5, no. 4, pp. 558–567, 2021.
[40] I. K. Sukada, W. Sadia, and M. Yudana, "Kontribusi minat belajar, motivasi berprestasi, dan kecerdasan logis matematika terhadap hasil belajar matematika siswa sma negeri

1 kintamani," *e-Journal Progr. Pascasarj. Univ. Pendidik. Ganesha*, vol. 4, pp. 1–11, 2013.
[41] S. Hidi and K. A. Renninger, "The Four-Phase Model of Interest Development," *Educ. Psychol.*, vol. 41, no. 2, pp. 111–127, Jun. 2006, doi: 10.1207/s15326985ep4102_4.
[42] K. A. Renninger, J. E. Bachrach, and S. E. Hidi, "Learning , Culture and Social Interaction Triggering and maintaining interest in early phases of interest," *Learn. Cult. Soc. Interact.*, vol. 23, no. October 2018, p. 100260, 2019, doi: 10.1016/j.lcsi.2018.11.007.
[43] Z. Hijjayati, M. Makki, and I. Oktaviyanti, "Analisis Faktor Penyebab Rendahnya Kemampuan Literasi Baca-Tulis Siswa Kelas 3 di SDN Sapit," *J. Ilm. Profesi Pendidik.*, vol. 7, no. 3b, pp. 1435–1443, 2022, doi: https://doi.org/10.29303/jipp.v7i3b.774.
[44] Asih and A. I. Imami, "Analisis Minat Belajar Siswa SMP pada Pembelajaran Matematika," *JPMI - J. Pembelajaran Mat. Inov.*, vol. 4, no. 4, pp. 799–808, 2021, doi: 10.22460/jpmi.v4i4.799-808.
[45] D. R. Butavand, I. Hirsch, M. Tomaiuolo, D. Moncada, H. Viola, and F. Ballarini, "Novelty Improves the Formation and Persistence of Memory in a Naturalistic School Scenario," *Front. Psychol.*, vol. 11, no. January, pp. 1–7, 2020, doi: 10.3389/fpsyg.2020.00048.
[46] R. Yunitasari and U. Hanifah, "Pengaruh Pembelajaran Daring terhadap Minat Belajar Siswa pada Masa COVID-19," *EDUKATIF J. ILMU Pendidik.*, vol. 2, no. 3, pp. 232–243, 2020, doi: https://doi.org/10.31004/edukatif.v2i3.142 Copyright.
[47] S. Gocen and S. Sen, "Reliability generalization meta-analysis of nine mathematics anxiety scales," *Curr. Psychol.*, vol. 44, pp. 10521–10533, 2025, doi: https://doi.org/10.1007/s12144-025-07877-x Reliability.
[48] E. Özdemİr and H. GÜR, "Validity and Reliability Study of Mathematics Anxiety-Apprehension Survey (MASS)," *Educ. Sci.*, vol. 36, no. 161, pp. 39–50, 2011.
[49] D. R. Hopko, R. Mahadevan, R. L. Bare, and M. K. Hunt, "The Abbreviated Math Anxiety Scale (AMAS): Construction, Validity, and Reliability," *Assessment*, vol. 10, no. 2, pp. 178–182, 2003, doi: 10.1177/1073191103252351.
[50] P. Diana, I. Marethi, and A. S. Pamungkas, "Kemampuan Pemahaman Konsep Matematis Siswa: Ditinjau Dari Kategori Kecemasan Matematik," *SJME (Supremum J. Math. Educ.*, vol. 4, no. 1, pp. 24–32, 2020.
[51] V. R. Yunika, A. N. Rohmah, S. N. Istiqomah, and A. Faradillah, "Validitas dan Reliabilitas Anxiety Questioner dalam Pembelajaran Matematika dengan menggunakan Rasch Models," *Pros. Semin. Nas. Pendidik. Mat. Univ. Pattimura*, vol. 2, pp. 161–169, 2021.
[52] I. D. Syaripudin, A. Samsudin, and W. Yuliani, "VALIDITAS DAN RELIABILTAS ANGKET MINAT BELAJAR," *FOKUS*, vol. 6, no. 1, pp. 42–46, 2023, doi: 10.22460/focus.v1i1.8641.
[53] D. D. Apriyani and E. D. Sirait, "PENGEMBANGAN INSTRUMEN MINAT BELAJAR SISWA PADA PELAJARAN MATEMATIKA," *SAP (Susunan Artik. Pendidikan)*, vol. 6, no. 1, pp. 99–104, 2021.
[54] N. H. Arfizeah, Risnawati, M. Rizqa, V. Novita, and M. F. Hamdani, "Mengukur Validitas dan Reliabilitas Instrumen Penelitian Minat Belajar PAI Siswa SMP Negeri 2 Kampar Kiri," *Pendas J. Ilm. Pendidik. Dasar*, vol. 10, no. 04, pp. 279–291, 2025.
[55] A. S. Ramadhani and I. Handayani, "Analisis Kualitas Instrumen Minat Belajar dalam Pembelajaran Matematika: Pendekatan Model Rasch," *Sigma J. Pendidik. Mat.*, vol. 17, no. 1, pp. 353–367, 2025.
[56] L. P. Jiménez-Mijangos, J. Rodríguez-Arce, R. Martínez-Méndez, and J. J. Reyes-Lagos, "Advances and challenges in the detection of academic stress and anxiety in the

classroom: A literature review and recommendations," *Educ. Inf. Technol.*, vol. 28, no. 4, pp. 3637–3666, 2023, doi: 10.1007/s10639-022-11324-w.
[57] L. E. Brumariu, S. M. Waslin, M. Gastelle, L. B. Kochendorfer, and K. A. Kerns, "Anxiety, academic achievement, and academic self-concept: Meta-analytic syntheses of their relations across developmental periods," *Dev. Psychopathol.*, vol. 35, no. 4, pp. 1597–1613, 2023, doi: DOI: 10.1017/S0954579422000323.
[58] S. M. Kristensen, T. M. B. Larsen, H. B. Urke, and A. G. Danielsen, "Academic Stress, Academic Self-efficacy, and Psychological Distress: A Moderated Mediation of Within-person Effects," *J. Youth Adolesc.*, vol. 52, pp. 1512–1529, 2023, doi: 10.1007/s10964-023-01770-1.
[59] H. Ma and C. Sun, "The Relationship Between the Mathematics Anxiety and Mathematics Achievement of Middle School Students: The Moderating Effect of Working Memory," *Behav. Sci. (Basel).*, vol. 15, no. 11, pp. 1–17, 2025, doi: https://doi.org/10.3390/bs15111566.
[60] E. Doz, A. Cuder, S. Pellizzoni, F. Granello, and M. Chiara, "The interplay between ego-resiliency , math anxiety and working memory in math achievement," *Psychol. Res.*, vol. 88, pp. 2401–2415, 2024.
[61] S. Caviola, E. Toffalini, D. Giofrè, J. M. Ruiz, D. Szűcs, and I. C. Mammarella, "Math Performance and Academic Anxiety Forms , from Sociodemographic to Cognitive Aspects : a Meta-analysis on 906,311 Participants," *Educ. Psychol. Rev.*, vol. 34, pp. 363–399, 2022, doi: https://doi.org/10.1007/s10648-021-09618-5.
[62] J. Finell, E. Sammallahti, J. Korhonen, H. Eklöf, and B. Jonsson, "Working Memory and Its Mediating Role on the Relationship of Math Anxiety and Math Performance: A Meta-Analysis," *Front. Psychol.*, vol. 12, no. January, pp. 1–14, 2022, doi: 10.3389/fpsyg.2021.798090.
[63] A. Dowker and H. Sheridan, "Relationships Between Mathematics Performance and Attitude to Mathematics: Influences of Gender, Test Anxiety, and Working Memory," *Front. Educ.*, vol. 13, no. 814992, pp. 1–11, 2022, doi: 10.3389/fpsyg.2022.814992.
[64] C. Ng, Y. Chen, C. Wu, and T. Chang, "Evaluation of math anxiety and its remediation through a digital training program in mathematics for first and second graders," *Brain Behav.*, no. August 2021, pp. 1–17, 2022, doi: 10.1002/brb3.2557.
[65] S.-K. Hsu and Y. Hsu, "Supporting Young Learners in Learning Geometric Area Concepts Through Static Versus Dynamic Representation and Imagination Strategies," *Int. J. Sci. Math. Educ.*, vol. 23, no. 2, pp. 441–459, 2025, doi: 10.1007/s10763-024-10481-3.
[66] J. L. Degol and H. J. Bachman, "Early self-control and sustained attention problems: Associations with youth achievement, motivation, and engagement," *Cogn. Dev.*, vol. 65, p. 101290, 2023, doi: https://doi.org/10.1016/j.cogdev.2022.101290.
[67] X. Wu, H. Liu, L. Xiao, and M. Yao, "Reciprocal Relationship Between Learning Interest and Learning Persistence: Roles of Strategies for Self-Regulated Learning Behaviors and Academic Performance," *J. Youth Adolesc.*, vol. 53, no. 9, pp. 2080–2096, 2024, doi: 10.1007/s10964-024-01994-9.
[68] S. Tsaqila and L. Astriani, "analisis math anxiety dalam pembelajaran matematika pada materi bangun datar kelas 5 siswa sekolah dasar," *Pros. Semin. Nas. Penelit. LPPM UMJ*, 2023.