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RESEARCH ARTICLE

The Role of Academic Self-Efficacy in Predicting Mathematical Confidence among University Students in Light of Some Demographic and Academic Variables

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ABSTRACT

This study aims to investigate the predictive role of academic self-efficacy in Predicting Mathematical confidence. Among University Students in Light of Some Demographic and Academic Variables among a sample of Saudi Arabian university students. The sample of the study consisted of (N=190) students from Imam Muhammad Ibn Saud Islamic University in Riyadh, Saudi Arabia, including (137 males and 53 females, with a mean age of 17.7 years SD = 2.6). Study tools: The Academic Self-Efficacy Scale (TASES), developed by Sagone & Caroli ,2014),the math confidence scale(Hendy,et al.,2014).Results revealed a significant positive correlation between math Confidence and academic self-efficacy of the students. The study revealed no statistically significant differences in math confidence were observed between Similarly, prior mathematical experience did not significantly influence math confidence However, a significant difference in math confidence was found based on academic specialization, with natural science students demonstrating higher levels of confidence. The study also revealed the ability of the dimensions of academic self-efficacy to predict math Confidence.

INTRODUCTION

Educational institutions strive to ensure that their curricula are effective by establishing clear cognitive, skill-based, and affective objectives for each course. Every course taught at any educational level is designed with specific goals that educational specialists aim to achieve. Mathematics, in particular, is one of the subjects taught with the intention of fulfilling cognitive, affective, and skill-based objectives. According to (Russfendi 2010), mathematics is the essence of science, meaning that it does not rely on other fields but rather serves as the foundation for all other applied and theoretical sciences. Mathematics is also precise and comprehensible because it combines simplicity and enjoyment through symbols and conditions agreed upon by experts in mathematics education.

In other words, mathematics is the foundation of science education and is more universal than other sciences due to its abstract nature. As a result, it finds numerous applications in fields such as commerce, engineering, as well as social and natural sciences (Alshehri. 2022). .

Moreover, mathematics plays a significant role in practical and scientific applications in everyday life. Its substantial contribution to technological advancements and modern industry is undeniable. There is no doubt that mathematics is one of the fundamental pillars of any scientific progress. Without the precision, creativity, and immense efficiency of mathematics, the sciences would not have reached the heights they have today (Al-Mashhadani, 2011).

Additionally, learning mathematics plays a crucial role in developing students' skills in logical thinking, problem-solving, reasoning and proof, communication, and imagination (Depdiknas, 2006; Amelia, 2000).

Hence, it is imperative for researchers to focus on studying the factors that may influence students' learning of mathematics. Recent research has consistently highlighted differences in mathematics achievement among students across various educational levels from diverse cultural backgrounds. This issue has garnered the attention of many educators and psychologists (Shen&Chan, 2002; House, 2006).

The role of various cognitive and social factors has emerged as critical motivators influencing students' achievement in mathematics. In light of these findings, studies have indicated that socio-cognitive factors, such as motivation and interests, serve as decisive elements impacting students' performance in mathematics (Trujillo et al., 2020; Lim, 2023; Mercader Rubio et al., 2022).

One of these factors is students' self-confidence in learning mathematics. Thomas (2007) asserts that without self-confidence, a student may miss many opportunities due to fear of potential consequences. It is important to note that self-confidence is not innate but rather acquired (Wiliam, 2010).,). A study by (Gulistan et al. 2017) identified self-confidence as a factor influencing students' achievement in mathematics courses. Several studies have shown that students' self-confidence in learning mathematics impacts their performance in mathematics courses. Consequently, self-confidence is believed to play a crucial role in enhancing students' achievement in learning mathematics. Additionally, a study by (Ganley et al. 2016) revealed some evidence of a reciprocal relationship between confidence in learning mathematics and overall academic performance in middle schools.

According to (Ganley & Lubienski 2016), confidence in learning mathematics is considered a metacognitive variable. It is important to consider whether metacognition is general or domain-specific. In other words, it is important to clarify the extent to which general points regarding individuals' metacognitive abilities, potential for error, and the underlying mechanisms across subject areas reflect the difficulties learners encounter in mathematics.

It is noteworthy that self-confidence in learning mathematics is shaped by various cognitive and social factors, such as self-regulation, academic self-efficacy, beliefs about the mathematics course, math anxiety, motivational beliefs—including the intrinsic value of mathematics—and self-concept in mathematics (Champion, et,al.2010). Additionally, certain academic and social factors, such as parental education level, academic specialization, prior experience with learning mathematics, and gender, also play a role (Ganley& McGraw,2016).

The current study focuses on some of these variables to determine their role in predicting self-confidence in learning mathematics among university students. Among these variables is academic self-efficacy, which is considered a psychological construct that has garnered attention from psychologists and educators due to its association with learning motivation and academic achievement (Johnson, et al.,2024).

Studies (Zkal,et al 2019; Alpacion et al., 2014; Gulistan et al., 2017) have consistently demonstrated that academic self-efficacy beliefs are strong positive predictors of students' mathematics achievement and confidence in their ability to learn mathematics across middle, high school, and university levels. Conversely, behavioral and emotional disaffection towards mathematics has been identified as a significant negative predictor of both mathematics confidence and achievement.

Peng et al. (2024) found that despite the inherent challenges of mathematics courses, students with high levels of self-efficacy are capable of leveraging these courses to enhance their ability to utilize and apply mathematical concepts.

The influence of gender on mathematics self-efficacy and confidence has been a subject of ongoing investigation. While initial gender disparities in mathematics interest have often been posited as a driving force behind subsequent performance gaps, recent studies (Cho, 2017; McMurran et al., 2023; Nishen et al., 2024; Roncevic et al., 2023; Perez-Arias., 2023; Roberts et al., 2023)) have consistently revealed substantial gender differences in mathematics self-efficacy, with males exhibiting higher levels of confidence.

Piper (2023) attributed this disparity to negative expectations held by parents, teachers, and peers, which can foster negative self-perceptions and attitudes towards mathematics among female students. These findings underscore the complex interplay between societal expectations, individual beliefs, and academic outcomes. These negative expectations and attitudes can lead to decreased performance, further reinforcing the negative perceptions of parents and teachers. Thus, a cycle of low expectations and underachievement is perpetuated. Several factors contribute to this cycle: (1) girls, more so than boys, tend to hold a fixed mindset regarding mathematical ability, believing it to be an inherent trait; (2) females exhibit higher levels of mathematics anxiety compared to males; (3) girls may doubt their capability to solve mathematical problems; and (4) the belief among girls that their abilities are so limited that effort is futile can lead to a decrease in persistence.

The current study posits parental education level as a third variable influencing individuals' mathematics self-efficacy. This influence is particularly evident through parental involvement in mathematics education, such as assisting children with homework. Such involvement has been shown to enhance children's confidence in their mathematical abilities.

Research by (Nishen et al. 2024 ,Basak & Ghosh 2014) has substantiated the significant influence of parental factors on children's mathematics self-efficacy. These studies have revealed marked differences in both parental involvement in mathematics homework and children's mathematics self-confidence. Notably, children of parents with higher levels of education, who were more actively involved in their children's mathematics learning, exhibited significantly higher levels of self-efficacy.

Furthermore, the role of prior experiences in mathematics cannot be overlooked. Zhang,et al (2004) as well as (Adel-Fattah 2005) contend that low mathematics self-efficacy is not merely a consequence of insufficient practice, but rather a result of misconceptions about mathematics learning stemming from negative past experiences.

Numerous researchers have posited that academic major plays a role in mathematics self-efficacy. However, findings on this issue have been inconsistent. While several studies (Al-Mukhlafi, 2010; Ryan, 2008; Battin, 2015) have found no significant differences in mathematics self-efficacy between students in science and humanities majors, other research (Geraci,et al., 2023; Ganley et al., 2016; Roberts et al., 2023) has revealed substantial disparities, with science students exhibiting higher levels of confidence.

Purpose of the study

Building on the aforementioned findings, this study aims to investigate the predictive roles of academic self-efficacy (across its various dimensions), academic major, gender, and prior mathematics experience on Mathematical confidence among a sample of Saudi Arabian university students. Notably, to the best of our knowledge, no previous studies within the Arab context have comprehensively examined the predictors of Mathematical confidence among university students.

THEORETICAL FRAMEWORK

Academic self-efficacy

Self-efficacy exerts a profound influence on all human endeavors. It encapsulates an individual's beliefs, expectations, and confidence in their ability to complete a task. Within the academic realm, this construct is more specifically termed academic self-efficacy (Forester et al., 2004).

Within the educational context, self-efficacy serves as a pivotal factor contributing to learners' success. This is because self-efficacy influences the choices learners make and the pathways they pursue (Schunk & Pajares, 2005).

The concept of academic self-concept refers to individuals' knowledge and perceptions of themselves within academic contexts. Academic self-efficacy, a more specific construct, pertains to individuals' beliefs in their capacity to successfully perform particular academic tasks (Ferla et al., 2009).

Academic self-efficacy, moreover, refers to an individual's belief in their capability to attain a specific level of performance on an academic task or achieve a particular academic goal (Bandura, 1997; Wigfield, & Eccles, 2002; Elias & Loomis, 2002; Linenbrink & Pintrich, 2002; Schunk & Pajares, 2005).

Academic self-efficacy is grounded in Bandura's (1977) social cognitive theory. According to this perspective, self-efficacy is defined as 'an individual's belief in their capacity to organize and execute courses of action required to produce given attainments' (Eccles & Wigfield, 2002).

The theory of self-efficacy suggests that academic self-efficacy may vary in strength as a function—some individuals may perceive themselves as more capable of handling difficult tasks, while others may believe they can only succeed in easier tasks. Moreover, self-efficacy is considered to be situational in nature, though it is also viewed by some as a stable trait (Linenbrink & Pintrich, 2002).

The importance of academic self-efficacy beliefs lies in their role as intrinsic factors that facilitate learning. These beliefs influence a student's motivation and performance on academic tasks and contribute to determining the amount of effort exerted to complete these tasks. The degree of a student's belief in their ability to carry out the necessary actions to achieve these tasks depends on their self-efficacy beliefs (Cherian & Jacob, 2013).

This variable is also related to students' confidence in completing tasks that require specific research knowledge and skills within academic settings. For example, Cheng et al. (2019) identified that academic self-efficacy was significantly associated with academic resilience. It is important to recognize that academic self-efficacy is a crucial variable linked to task performance factors, reflecting the extent of a student's personal capabilities. This, in turn, enables them to exert greater effort in achieving their academic goals. Additionally, academic self-efficacy represents a student's actual performance in addressing and overcoming problems related to academic situations.

Mathematics confidence

For many students, learning mathematics in school can be a stressful experience, particularly when encountering complex and novel mathematical concepts (Maleh, 2010). However, the process of learning mathematics can also be rewarding and satisfying, especially when successfully solving challenging mathematical problems.

In traditional mathematics classrooms, students typically work independently on short, single-answer exercises. While this approach allows students to develop mathematical skills and concepts, it often neglects the opportunity for students to discover their own learning abilities (Anderson, 2006; Boaler, 2000; Boaler & Greeno, 2000). In fact, students can learn that they are capable of mastering mathematics when they successfully connect the smaller pieces of the 'mathematical puzzle' presented by the teacher.

It is noteworthy that fluctuations in students' mathematics achievement can be attributed to one of the most significant psychological factors: self-confidence or self-efficacy in mathematics. Self-confidence refers to an individual's belief in their ability to accomplish and complete various tasks. According to Bandura (1977), "Skills are not a measure of the abilities one possesses but rather a belief about what one can achieve (Waini et al., 2014).

Adler (2013) define it as the psychological components that influence a student's academic level and describe their behaviors in mathematics learning activities. It determines the student's confidence in their mathematical conceptual framework and its application in problem-solving, as well as in reaching correct solutions using procedural knowledge.

Waini et al. (2014) define confidence in mathematics as the belief or perception that an individual can organize and execute the necessary procedures to succeed in a specific mathematical task. Abdou,et al., (2020) describes confidence in mathematics as positive beliefs that influence a student's behavior towards learning mathematics and serve as a factor in shaping mathematical competence.

The importance of mathematical confidence and how to foster it in students

Mathematical confidence is one of the fundamental pillars on which the concept of mathematical strength is built. It represents the affective dimension of mathematical strength, and this strength cannot be fully realized without the accompanying psychological components that impact a student's academic performance and behavior during mathematics teaching and learning activities (Sabri, 2023).

For students to comprehend mathematics, they must believe in their capacity to understand and learn it. There is a pervasive cultural belief that mathematical ability is an innate gift. However, researchers such as Carol Dweck have extensively challenged this notion (Dweck, 2007).

According to Su et al. . (2020),, there is a prevailing belief that our abilities and intelligence are fixed and cannot be changed.

However, others contend that our capabilities can be enhanced through dedicated study, practice, and hard work. As educators, we must cultivate a growth mindset in our students. Confidence in mathematics is reflective of cognitive growth, a perseverance mindset, a positive attitude towards errors, a willingness to take risks, and self-reliance. Moreover, fostering mathematical confidence supports students' ongoing engagement in mathematics, increases their motivation to learn and exert effort, and encourages them to take intellectual risks, thereby aiding them in making sound decisions when confronted with diverse situations and problems (Abdul Aal, 2023).

Conversely, mathematics has a profound impact on bolstering students' self-confidence. Confidence is the most critical attribute for success in mathematics. Conversely, performance in mathematics significantly influences self-confidence. Therefore, mathematics provides an excellent opportunity to cultivate self-efficacy. (Su, et al., 2021).

Conversely, a lack of confidence and fear of making mistakes are among the most significant barriers to perseverance and self-belief in mathematics. When students fear errors, it hinders their ability to engage in authentic problem-solving. They become hesitant to experiment with strategies because they cannot be certain that they will yield the correct answer (Dweck, 2007).

Therefore, fostering students' confidence in mathematics is crucial for helping them develop a positive attitude towards the subject. Consequently, classroom teachers should:(1) Acknowledge all contributions positively, encourage learning from mistakes, and welcome incorrect answers as a starting point for new understanding, (2) employ positive language, (3) promote independent research and small group work, and (4) value diverse problem-solving approaches (Recco,et,al.,2022).

STUDY DESIGN AND METHODOLOGY

This study employs a descriptive research approach, chosen for its appropriateness to the objectives of the investigation. The study aims to elucidate the role of Academic Self-Efficacy in predicting Math Confidence, as well as to examine the extent to which Math Confidence varies based on gender (male/female), prior mathematical experience, and academic specialization.

Participants

Participants were selected through random sampling. Ethical approval for the study was obtained from the Institutional Review Board, and informed written consent was secured from all participants. The sample comprised 190 students from Imam Muhammad Ibn Saud Islamic University in Riyadh, Saudi Arabia, including 137 males and 53 females, with a mean age of 17.7 years (SD = 2.6). Table 1 presents the demographic characteristics of the participants.

Table 1. Demographic characteristics of participants (N = 190)

Item	Category	Frequency (f)	Percentage (%)
Gender	men	137	%72.10
	women	, 53	%27.8
Age (years)	17–18 years	92	%48.8
	19–22 years	98	%51.7
Parents' educational levels	Category	Frequency (f)	Percentage (%)
Father	Bachelor	116	%61
	Secondary	74	%38.9
	Total	190	%100
Mothers	Category	Frequency (f)	Percentage (%)
	Bachelor	100	%52.6
	Secondary	90	47.3%
	Total	190	%100
prior mathematical experience	No	24	%12.6
	yes	166	%87.3

Measures

The Academic Self-Efficacy Scale (TASES), developed by Sagone and Caroli (2014) through confirmatory factor analysis (CFA), was employed to assess perceived academic self-efficacy. This instrument comprised 30 items rated on a 7-point Likert scale ranging from 1 (not at all efficient) to 7 (completely efficient). The TASES delineated four primary dimensions: self-engagement, self-oriented decision-making, others-oriented problem-solving, and interpersonal climate. Self-engagement pertains to the capacity to address personal engagement challenges, while self-oriented decision-making reflects the ability to identify solutions through self-reliance. Others-oriented problem-solving encompasses the skill of resolving critical issues by leveraging external support, and interpersonal climate denotes the aptitude for fostering a cooperative and collaborative interpersonal environment (Sagone & Caroli, 2014).

Measure of math confidence

Participants' levels of mathematics confidence were assessed using the Math Confidence Scale (MCS; Hendy et al., 2014). This self-report measure, completed in approximately five minutes, consisted of a seven-item Likert-type scale anchored by "strongly disagree" (1) and "strongly agree" (5). Items tapped into mathematics behaviors where confidence might fluctuate, including comprehending mathematical concepts, achieving satisfactory grades, and completing homework problems. The MCS has demonstrated acceptable internal reliability, convergent validity, and test-retest reliability. In a study involving 368 participants, Hendy et al. (2014) reported a mean self-reported mathematics confidence score of 3.79 with a standard deviation of .90.

Procedure

Survey instruments comprising the Math Confidence Scale and the Academic Self-Efficacy Scale, along with demographic questions, were administered to randomly selected participants. Two research assistants, experienced academic advisors, oversaw the data collection process in accordance with established protocols. Ample time was allotted for questionnaire completion, and respondents were encouraged to provide honest and unbiased responses.

Data analysis

Data were coded, entered, and subjected to statistical analysis using SPSS version 26 (IBM Corp., Armonk, NY, USA). Descriptive statistics, including means, were calculated to characterize the sample. Independent sample t-tests were employed to examine the association between socio

demographic variables and levels of math confidence. A significance level of $p < .05$ was adopted. To explore the predictive relationship between multiple variables and math confidence, a multiple regression analysis was conducted, incorporating gender, parental educational attainment, prior mathematics course experience, and academic self-efficacy as predictors.

RESULTS

Relationship between academic self-efficacy and math confidence

A primary objective of this study was to investigate the relationship between academic self-efficacy and math confidence among participants. Pearson correlation coefficients were employed to examine the association between these two primary variables and their respective dimensions. The results of these analyses are presented in Table 2.

Table 2: Pearson correlation coefficient of dimensions of academic self-efficacy and math confidence (N 190)

Dimensions of Academic Self-Efficacy	Math Confidence
self-engagement	.597**
self-oriented decision making	.408**
others-oriented problem solving	.446**
interpersonal climate	.278**

Table 2 shows that correlation coefficients of all Dimensions of Academic Self-Efficacy with Math Confidence is significant at $p<0.01$.

Group differences in math confidence

The study aimed to determine whether statistically significant differences in math confidence existed among participants based on gender, prior mathematical experience, and academic specialization. To achieve this, mean math confidence scores and standard deviations were calculated for each group defined by these variables. Independent sample t-tests were conducted to assess group differences. Results are presented in Table 3.

Table 3: Differences in Math Confidence Based on gender, prior mathematical experience, and, academic specialization (N=190)

Gender	N	Mean	Std. Deviation		t-values	Sig.
men	137	24.3212	7.44483	.63605	-.803-	.538
women	53	25.3019	7.82153	1.07437		
academic specialization	N	Mean	Std. Deviation	Std. Error Mean	t-values	Sig.
, Humanities	107	22.9533	7.81796	.75579	-3.506	.001
Natural science	83	26.7108	6.64157	.72901		
prior mathematical experience	N	Mean	Std. Deviation	Std. Error Mean	t-values	Sig.
No	24	22.5000	6.85248	1.39876	-1.460-	.146
yes	166	24.8976	7.60991	.59064		

As indicated in Table 3, no significant differences in math confidence were observed between genders ($t = 0.803$, sig. = .538). Similarly, prior mathematical experience did not significantly influence math confidence ($t = 1.460$, sig. = .146). However, a significant difference in math confidence was found based on academic specialization, with natural science students demonstrating higher levels of confidence ($t = 3.506$, sig. = .001).

Predictive influence of academic self-efficacy on math confidence

To assess the predictive influence of academic self-efficacy on math confidence, a multiple regression analysis was conducted. The findings of this analysis are detailed in Tables 4 and 5.

Table 4: Summary of multiple regression analysis between the predictor's variables and the criterion measure

Multiple R = . 616 Multiple R-square = .379 Adjusted R-square = .366. standard error of the estimate 6.00677.						
Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
1	Regression	4080.748	4	1020.187	28.275	.000[a]
	Residual	6675.047	185	36.081		
	Total	10755.795	189			
a. Predictors: (Constant), interpersonal climate, self-engagement others-oriented problem solving, self-oriented decision making b. Dependent Variable: Math Confidence						

Table 4 presents the results of the multiple regression analysis, indicating that the combined dimensions of academic self-efficacy accounted for 37.9% of the variance in math confidence (R = .616, R^2 = .379). These findings suggest a substantial relationship between academic self-efficacy and math confidence. Furthermore, the analysis of variance yielded a significant F-ratio (F = 28.275, sig. = .000), confirming the overall predictive power of the model.

Table 5: relative contribution of the independent variables to the prediction

Predictor Variables	**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
	B	**Std. Error**	**Beta**		
(Constant)	2.071	2.742		.755	.451
self-engagement	.848	.122	.639	6.925	.000
self-oriented decision making	-.238-	.134	-.184-	-1.772-	.078
others-oriented problem solving	.279	.122	.215	2.283	.024
interpersonal climate	-.123-	.124	-.081-	-.990-	.323

The data presented in Table 5 reveal that certain independent variables significantly contribute to the prediction of Math Confidence.

- **-Self-engagement**: Academic Self-Efficacy demonstrated a substantial contribution to Math Confidence through the dimension of self-engagement, with a standardized coefficient (β\betaβ) of .639(t=6.925, sig. = .000)
- **-Others-oriented problem solving**: Academic Self-Efficacy also made a notable contribution to Math Confidence via others-oriented problem solving, with a β\betaβ of .215, t=2.283, sig. = .0.024).

Interpersonal climate and self-oriented decision making: Conversely, the dimensions of interpersonal climate and self-oriented decision making did not show a statistically significant relationship with Math Confidence.

DISCUSSION

This section explores the relationship between the independent variables and the dependent variable.

Academic self-efficacy and math confidence

This study contributes to the ongoing research on the significant role that academic self-efficacy plays in predicting math confidence among students at Imam Muhammad Bin Saud Islamic University and Bin Khaldoun Secondary School in Riyadh.

The overall results of the current study revealed that the dimensions of academic self-efficacy are capable of predicting confidence in learning mathematics among the study's participants. This is evident from the findings related to the first and third research questions, which highlighted a statistically significant positive relationship between the various dimensions of academic self-efficacy and confidence in learning mathematics. This relationship is further supported by the results of the third question.

The results of the first and third questions indicate that the beliefs and perceptions of individuals with high academic self-efficacy in the study sample enhance their confidence, abilities, and mathematical skills, enabling them to generate a large number of ideas or solutions when it comes to solving mathematical problems. Moreover, these individuals are quick to produce solutions. Additionally, the same judgments and beliefs in their academic self-efficacy drive them to easily diversify and adapt these ideas or solutions according to the specific requirements of the mathematical problem or situation at hand. When one solution or idea fails, they are able to quickly generate an entirely different solution.

Consistent with previous research (Ganley et al., 2016; Champion, 2010; Johnson, 2024), the findings of the first and third questions underscore the multifaceted nature of self-confidence in mathematics. This construct is influenced by a complex interplay of cognitive and social factors, such as self-regulatory strategies, beliefs about one's ability in mathematics, and attitudes toward the subject.

In accordance with previous research (Zkal, 2019; Alpacion et al., 2014; Gulistan et al., 2017), the data from the first and third questions provide further evidence of the robust relationship between academic self-efficacy and mathematics outcomes. These findings suggest that students' beliefs in their ability to succeed in mathematics are powerful predictors of their achievement and confidence, spanning from adolescence to young adulthood.

Differences in mathematics learning confidence according to demographic variables

If we move on to discuss the results of the comparison between sample members in mathematics learning confidence according to gender, field of study, and prior experience in studying mathematics, we find that the results of the second question, which addressed this comparison, did not reveal any significant differences in mathematics learning confidence according to these variables except for the field of study where the results in this context revealed a significant and positive impact of studying natural sciences on increasing confidence in mathematics learning. This result is expected given the existence of knowledge, abilities, and skills in mathematics among students majoring in natural sciences, as most of their studies depend on mathematics, and admission to natural science majors requires high grades in mathematics.

CONCLUSION

This paper examines confidence in learning mathematics among high school and university students. Below, we will discuss some of the weaknesses in our research, outline the conclusion, and offer observations and potential future directions for research.

One weakness of this study is the relatively low response rate to the online survey among students enrolled in high schools and Imam Muhammad bin Saud Islamic University. Out of approximately 500 targeted students, only 190 valid responses were received, resulting in a response rate of just 21.6%. One possible explanation for this low response rate is the timing of data collection. June coincides with the end of the academic term for students, and therefore, the majority of students—more than three-quarters—likely preferred to focus on their studies rather than participate in the survey for the current research.

Another weakness of this study is the verification of prior experience in learning mathematics, specifically the final grade achieved in mathematics during high school. The results indicate that there was only a very slight variation in the distribution of grades among the surveyed students.

Another weakness lies in the distribution of students according to their academic majors. The collected data shows that a significant portion of the sample—56.7%—consists of students from the humanities.

In contrast, only 43% of the surveyed students are majoring in natural sciences. There is a possibility that our statistical results might yield different outcomes if there were a more balanced or varied distribution of majors among the survey participants. Beyond academic achievement, gender differences, and study program specialization, it would also be interesting to explore other backgrounds, including students' hometowns or places of origin (urban or rural) and their socio-economic status.

In conclusion, the present study suggests that future research could delve more deeply into these interactions. For instance, exploring how academic self-efficacy and confidence in learning mathematics interact with focus and enthusiasm in various learning settings could reveal nuanced effects.

Additionally, examining how interventions aimed at improving the learning environment may enhance students' confidence in learning mathematics would be valuable.

Academic self-efficacy and academic self-concept: Reconsidering structural relationships.

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