JMETP
Journal for the Mathematics Education and Teaching Practices, 5(2), 89-100, Dec 2024
e-ISSN: 2717-8587
dergipark.org.tr/jmetp

Young Wise Publishing
youngwisepub.com
gencbilgeyayincilik.com © 2024

Research Article

Solving mathematics anxiety, lack of confidence and negative attitude with artificial intelligence models: insights from stakeholders

Yousef Methkal Abd Algani [1]

The Faculty of Mathematics, The Arab College for Education in Israel, Haifa, Israel

Article Info

Received: 14 September 2024
Accepted: 29 December 2024
Available online: 30 Dec 2024

Keywords:
Mathematics anxiety
Attitude towards math
Attitude towards AI
AI models
Math teaching and AI

Abstract

Mathematics has remained a critical subject globally, despite the continuous perception that it is difficult. This paper seeks to expound on how the integration of AI models in mathematics education can solve the problem of mathematics anxiety, lack of confidence and negative attitude towards the subject by students. Using questionnaire, data for the study was pooled from 149 students, 93 mathematics teachers and 27 school administrators, and formed the basis of the analysis. Different statistical measures were implemented in the analysis. Result of the analysis affirm that 58.39% of the participants strongly agreed that their fear of mathematics has reduced since the integration of AI models in their learning process. The analysis further revealed that 39.59% and 48.99% respectively indicate agreement and strong agreement with the notion that the utilisation of AI models has contributed to an increase in confidence levels in mathematics both within and beyond the confines of the classroom. Over 93% of the student further accepted that their attitude towards mathematics underwent a positive transformation subsequent to their adoption of AI models as a learning aid. About of 54.16% of the teachers and administrators agreed that the limited efficacy of conventional approaches in addressing mathematics anxiety, enhancing learners' self-assurance in the discipline, and altering their disposition significantly impacts their overall academic achievement. The analysis further revealed that over 85% of the surveyed school leaders acknowledged that the integration of AI tools in mathematics instruction has resulted in a reduction of students' apprehension towards the subject. The mathematics teachers and school administrators further advocated that incorporation of AI models into the mathematics curriculum is imperative for addressing the persistent issues of math anxiety, low self-assurance, and unfavourable attitudes towards the subject.

To cite this article

Abd Algani, Y.M. (2024). Solving mathematics anxiety, lack of confidence and negative attitude with artificial intelligence models: insights from stakeholders. *Journal for the Mathematics Education and Teaching Practices, 5*(2), 89-100. DOI: https://doi.org/10.5281/zenodo.14599899

Introduction

The study of mathematics constitutes an essential component of the global education system, serving as a crucial foundation for cultivating analytical thinking, problem-solving skills, and logical deductive reasoning abilities (Blazer, 2011). Numerous students encounter difficulties with anxiety in relation to comprehending mathematics, resulting in diminished self-confidence and a negative perception towards the discipline. Mathematics anxiety is a prevalent issue that affects students globally. Students who are afflicted with mathematics anxiety frequently encounter adverse affective experiences, including fear, nervousness, and frustration, when confronted with mathematical assignments (Mutodi and Ngirande, 2014). Moreover, some learners often exhibit a deficiency in self-assurance regarding their

1 Asst.Prof.Dr., Faculty of Mathematics, The Arab College for Education in Israel, Haifa. Israel, Email: yosefabdalgani@gmail.com ORCID: 0000-0003-2801-5880

mathematical proficiency, resulting in a pessimistic outlook towards the acquisition of mathematical knowledge. The impacts of anxiety, lack of confidence and negative attitudes can result in poor mathematical performance, thereby having an impact on students' academic accomplishments and potential career opportunities (Espino et al., 2017).

The rapidly evolving field of artificial intelligence (AI) has surfaced as a highly promising area with the capacity to significantly transform diverse facets of education (How and Hung, 2019). Within the realm of mathematics education, artificial intelligence (AI) tools have the potential to exert a notable influence in assuaging students' anxiety, cultivating their confidence, and promoting favourable mindset towards the discipline. Artificial intelligence (AI) models have the capability to offer tailored learning experiences, adjust to the unique requirements of each student, and provide immediate feedback and assistance (Fitria, 2021). Through the utilisation of artificial intelligence, teachers have the ability to construct dynamic and immersive educational settings that facilitate the development of student confidence in mathematics, the mitigation of anxiety, and the cultivation of positive attitudes towards the subject.

Following the potential of artificial intelligence to solve the problem of mathematics anxiety, lack of confidence and negative attitude, it is necessary to gain insights from experts in mathematics education and experts from artificial intelligence. The objective of this paper is to investigate the efficacy of incorporating artificial intelligence (AI) tools in addressing anxiety and fostering a constructive mindset towards the acquisition of mathematical knowledge.

Literature Review

Arrays of studies have been conducted on approaches to solving learners' anxiety in mathematics, patterns and tools for helping students to develop confidence and positive attitude towards the learning of mathematics. In this literature, attempt is made to provide an overview of the nature of mathematics anxiety, approaching in developing confidence and positive attitude in the discipline, and also reviewing the limitations of different traditional tools in this regard. The essence is to establish how different AI models can be implemented in solving mathematics anxiety, in developing confidence and positive attitude towards the learning of mathematics. Some theories in mathematics education are also explored to theorize the context of mathematics education.

Mathematics anxiety, negative attitude, and lack of confidence; a review of causes and implications

Students at different educational levels often encounter challenges such as mathematics anxiety, inadequate confidence, and negative feelings towards the acquisition of mathematical knowledge. The aforementioned concerns have the potential to impede the advancement of students, impact their academic achievements, and curtail their prospects in mathematics-related domains. Mathematics anxiety issues can be impacted by a range of factors, encompassing mental, psychological, and environmental components. According to Geist (2015), the emergence and endurance of mathematics anxiety can be attributed to a blend of individual encounters, pedagogical methods, and cultural beliefs.

Adverse past experiences, such as suboptimal academic performance, encountering challenges in comprehending mathematical concepts, or experiencing public embarrassment, have the potential to generate apprehension and diminish self-assurance in the study of mathematics. Conventional instructional techniques that prioritise memorising things by repetitive exercises and a fixation on accurate responses without comprehending the fundamental principles may contribute to the development of anxiety. Inadequate utilisation of dynamic and participatory pedagogical methods may impede the cultivation of a favourable educational setting.

The transmission of mathematics anxiety can occur through parents and classmates' impacts, whereby a negative mindset or diminished confidence are unintentionally conveyed. This phenomenon may engender an impression that mathematics possesses inherent complexity or inaccessibility. The presence of societal stereotypes implying that certain groups are not inherently predisposed towards mathematics can potentially exacerbate feelings of anxiety. Research has indicated that gender bias has a significant impact on the mathematics achievement and optimism levels of female students (Karger et al., 2010; Blazer, 2011).

The presence of mathematics anxiety has noteworthy consequences for the academic achievement, vocational decisions, and general welfare of students. Several significant consequences arise from this situation, including the following.

The presence of increased level of anxiety about mathematics may impede students' capacity to comprehend and utilise mathematical concepts, ultimately resulting in decreased academic performance.

Mathematics anxiety has the potential to impede students' inclination towards pursuing careers in STEM-related fields, thereby restricting their prospects for future employment (Espino et al., 2017).

The experience of mathematics anxiety can result in adverse emotional outcomes such as heightened stress levels, fear, and diminished self-worth. This phenomenon may potentially contribute to a detrimental cycle wherein anxiety engenders suboptimal performance, which subsequently reinforces anxiety.

Mathematics anxiety can have a disproportionate impact on students from marginalised backgrounds, thereby exacerbating educational inequalities

Traditional approaches to solving mathematical anxiety, lack of confidence and negative attitude

Several conventional strategies have been implemented to mitigate anxiety related to mathematics and cultivate favourable dispositions towards the subject. Several prevalent methodologies include:

The cognitive restructuring technique is centred on the process of questioning and disputing negative thoughts and subsequently substituting them with positive and pragmatic convictions regarding mathematics. The objective is to alter the context of pessimistic internal dialogue and foster a sense of self-assurance.

The integration of methods of relaxing, including taking deep breaths, gradual relaxation of muscles, or meditation practises, can aid in the mitigation of anxiety and foster a more serene learning atmosphere.

Cooperative approaches to learning, including tutoring from other students and support groups, offer students the chance to share their challenges, exchange techniques, and enhance their self-assurance through peer assistance.

The adoption of Mastery-Based Learning, which prioritises the acquisition of the principles of mathematics through personalised and differentiated instruction, has the potential to enhance students' self-assurance and alleviate the stress that may arise from time constraints or performance demands (Espino et al., 2017; Geist, 2015).

The provision of successful growth possibilities for teachers has the potential to augment their comprehension of mathematics anxiety and furnish them with efficacious tactics for assisting students.

Overall, it can be inferred that mathematics anxiety, absence of self-assurance, and negative dispositions towards the acquisition of mathematical knowledge can exert a substantial influence on the academic accomplishments and prospective prospects of students. Through comprehension of the origins and ramifications of mathematics anxiety, educational professionals and decision-makers can enact efficacious strategies to alleviate these difficulties. the diverse needs of learners, is crucial for creating an effective and equitable learning environment.

Limitations of traditional approaches in solving mathematical anxiety, negative attitude and lack of confidence

Conventional methods aimed at mitigating mathematics anxiety, self-doubt, and unfavourable attitudes regarding mathematics frequently face different challenges. The following are some prevalent limitations.

The conventional methods employed in mathematics education tend to place greater emphasis on the memorization of formulas and procedures, while neglecting the fundamental concepts and reasoning that underlie them. The aforementioned methodology may result in a superficial comprehension of mathematical concepts, thereby impeding the students' ability to cultivate self-assurance and utilise their knowledge in practical scenarios.

The conventional classroom settings frequently prioritise speeds and competition, which can generate stress and apprehension among learners who encounter difficulties with the subject. The phenomenon in question may exacerbate unfavourable dispositions towards mathematics and diminish self-assurance, given that learners who struggle to perform within temporal limitations may experience a sense of inadequacy (Hwang and Tu, 2021; Wang et al., 2021; Ramet et al., 2022).

The conventional methods frequently fall short in establishing meaningful correlations between mathematics and how it can be utilised in the real world, resulting in a lack of relevance. The perception of mathematics as an abstract subject that lacks connection to daily experiences may result in withdrawing, disinterest, and unfavourable attitudes among students.

The conventional methods of teaching tend to place less emphasis on the development of critical thinking and problem-solving skills, instead prioritising the use of repetitive exercises and formulaic methods to solve issues. The aforementioned approach curtails the potential for students to cultivate their problem-solving proficiencies, critical thinking aptitudes, and creativity, all of which are fundamental for fostering self-assurance and surmounting anxiety.

The conventional teaching methods often adopt a uniform approach that may not be conducive to catering to the varied learning styles and preferences of learners. This may result in inadequate assistance for various types of learning. Certain learners may necessitate alternative pedagogical approaches, such as the utilisation of instructional visuals, tools for manipulating, or collaborative learning, in order to comprehend mathematical concepts proficiently (Mutodi and Ngirande, 2014).

Conventional methodologies frequently fail to account for the emotional and psychological dimensions linked to math anxiety. Students who exhibit anxiety or low self-efficacy in mathematics may necessitate targeted interventions, such as addressing their mindset, fostering resilience, and cultivating a growth-oriented mindset, to surmount these difficulties.

The conventional teaching methods are characterised by teacher-centered instruction, in which the teacher assumes the role of the primary knowledge provider and students are afforded limited chances for active participation. The absence of active learning opportunities may have an adverse impact on students' engagement levels, motivation, and attitudes towards mathematics.

Contemporary methods of teaching mathematics, including research-based instruction, problem-driven instruction, and integration of innovations in technology, have been developed to overcome the aforementioned constraints. These approaches strive to foster conceptual comprehension, analytical reasoning, applicability, and learner-focused pedagogy. The aforementioned methodologies acknowledge the significance of cultivating a constructive mentality, attending to affective aspects, and catering to heterogeneous learning requirements in order to promote self-assurance and alleviate apprehension in the domain of mathematics.

Potentials of AI in solving the problem of mathematical anxiety, lack of confidence and negative attitude

Various artificial intelligence (AI) techniques can be employed to establish a conducive and captivating learning context that can assist students in surmounting their fear of mathematics and enhancing their self-assurance in mathematical proficiency. Adaptive learning systems that utilise artificial intelligence have the capability to tailor the educational experience to the individual student's unique learning style, strengths, and weaknesses (Lee and Perret, 2022; Williams et al., 2021; Kim et al., 2022). The aforementioned systems possess the capability to scrutinise data pertaining to student performance, detect shortcomings, and offer specific remedial measures and practise drills to tackle those deficiencies. Adaptive learning systems have the potential to mitigate anxiety among students by offering customised support and pacing that caters to their unique requirements (Chen et al., 2023; Niemi, 2021).

In addition, artificial intelligence has the potential to integrate game-like features, including but not limited to scoring systems, tiered progressions, symbolic representations of achievement, and competitive rankings, into the educational experience. Gaming strategies can improve the experience with learning mathematics by increasing engagement and satisfaction, which can lead to reduced anxiety and increased motivation. AI algorithms can analyse student performance during gameplay and provide personalised feedback and cues to enhance the learning process (tamborg et al., 2022; Zakaria and Khalid, 2016).

Intelligent Tutoring Systems (ITS) use artificial intelligence (AI) techniques to provide individualised guidance and support to students. The educational systems can engage students in interactive discussions, encourage them to ask exploratory questions, and provide step-by-step guidance (naik, 2017; Estevez et al., 2019; Su and Zhong, 2022). ITSs are able to recreate personalised tutoring sessions, creating an environment that encourages students to ask questions and receive customised guidance. The implementation of this method has the potential to increase students' confidence in their understanding of mathematical concepts.

The technique of Sentiment Analysis involves using AI algorithms to analyse written or spoken statements made by students (Su and Zhong, 2022; Chen et al., 2023; Wang et al., 2021). The purpose of this analysis is to detect any

indications of anxiety related to mathematics. The system can provide supplementary assistance, resources, or motivation as required by detecting sentiments, including frustration or apprehension The utilisation of sentiment analysis has the potential to facilitate the establishment of a learning environment that is both responsive and empathetic. It is noteworthy that although artificial intelligence (AI) techniques can serve as a supplementary tool in mathematics education, their integration should be accompanied by efficient pedagogical practises and interactions with humans to ensure an effective learning environment.

Theoretical reflections in solving mathematics anxiety, lack of confidence and negative attitude

Various theories and approaches have been suggested to address the issues of mathematics anxiety, lack of confidence, and negative attitude regarding the subject. The following are five theoretical frameworks that can potentially provide solutions to these aforementioned concerns:

Mastery-oriented Theoretical postulations suggest that the origins of mathematics anxiety and self-doubt can be traced to a fixed mindset, which is characterised by the belief that one's abilities are inherent and not subject to improvement through effort or practise. Promoting a growth mindset has been found to be efficacious in addressing these concerns (Espino et al., 2017; Mutodi and Ngirande, 2014). It is imperative to underscore that mathematical abilities can be enhanced through diligent exertion, consistent practise, and the implementation of efficacious learning techniques. It is recommended to establish a conducive learning environment that prioritises the exertion of effort, advancement, and the enhancement of problem-solving proficiencies, rather than emphasising grades or inherent aptitude.

The Self-efficacy Theory posits that an individual's self-efficacy, or their confidence in their capacity to achieve success in a specific task or domain, is a significant factor. In the mathematical context, individuals exhibiting low self-efficacy may experience heightened anxiety and a diminished sense of confidence (Geist, 2015; Karger et al., 2010). In order to effectively tackle this issue, it is recommended to offer avenues for achievement and foster self-assurance in a gradual manner. It is advisable to decompose mathematical problems into more manageable and less complex steps, and to acknowledge and commemorate accomplishments at every stage of the process. It is recommended to prompt students to engage in self-reflection regarding their academic progress and acknowledge their own abilities, thereby enhancing their self-efficacy.

According to the *Social Cognitive Theory*, the process of learning is facilitated through the means of observation, modelling, and social interactions. Regarding circumstances of "mathematical anxiety, inadequate optimism, and negative attitude, it can be helpful to provide positive role models and peer support" (Naik 2017, p.38). It is helpful to promote collaborative work among students, as this provides an opportunity for them to observe and acquire knowledge from peers who possess greater confidence and proficiency in mathematics. Facilitate avenues for pupils to exchange their tactics and techniques for addressing challenges, cultivating a classroom milieu that is encouraging and all-encompassing.

The theory of attribution centres on the manner in which individuals account for both their successes and failures. Learners who ascribe their shortcomings in mathematics to personal inadequacy or external circumstances are prone to developing pessimistic attitudes and anxious tendencies. It is recommended to motivate students to embrace an attitude of growth and ascribe triumphs or setbacks to exertion, tactics, or the educational process per se. Assist learners in comprehending that errors constitute an integral component of the educational journey and can furnish constructive insights for enhancement.

Cognitive Behavioural Therapy (CBT) is a psychotherapeutic intervention that aims to modify maladaptive cognitive patterns and beliefs in order to effect positive changes in emotions and behaviours. The application of cognitive-behavioral therapy (CBT) principles to address math anxiety entails the identification of negative thoughts associated with mathematics, the utilisation of evidence-based and rational thinking to challenge them, and the substitution of such thoughts with more constructive and pragmatic ones. Furthermore, a step-by-step approach to math-related assignments and the implementation of relaxation strategies can aid in the management of anxiety and the cultivation of self-assurance.

Problem of Study

This study aims to investigate the issue of mathematics anxiety, low self-assurance, and negative perspectives among learners, which impede their capacity to acquire and execute mathematical skills proficiently. The effectiveness of conventional pedagogical approaches and remedial measures in mitigating these concerns has been constrained. The objective of this study is to explore the feasibility of utilising artificial intelligence methods to create novel and tailored strategies that can efficiently alleviate math anxiety, enhance self-assurance, and foster favourable dispositions towards mathematics.

The following questions are advanced in this study:

- To what extent can the integration of artificial intelligence patterns solve the challenge of mathematics anxiety, lack of confidence and negative attitude?
- What are the views, perceptions and attitudes of mathematics students, teachers and school administrators on the integration of AI in mathematics education.
- What are artificial intelligence (AI) methods or strategies that can be utilised to mitigate mathematics anxiety and foster a favourable attitude and self-assurance among students?

Method

This study involves cross-sectional participation of key stakeholders in mathematics educations. The main groups that participated in the study include selected students in mathematics, subject teachers, and certain school administrators. The choice of respondents from these groups is to be able to gather data across different stakeholders in order to gain insights on their perception, attitudes and acceptance of the integration of artificial intelligence models in mathematics education.

Sampling

Purposive research design was implemented in selecting the sample for this study, through which a total of 269 respondents were engaged in the study. The sample include 149 students, 93 mathematics teachers, and 27 school administrators. The table below summarizes the demographic distribution as show in table 1.

Table 1. Demographic Distribution of Sample

Groups	Categories	f	%
Students	Male	63	42.28
	Female	86	57.72
Teachers	Male	59	63.45
	Female	34	36.55
School Admins	Male	18	66.66
	Female	9	33.34

The researchers strictly adhered to the highest standards of scientific research ethics while conducting this study. This entailed providing participants with complete transparency regarding the objectives and importance of the survey. In order to protect participants' privacy, their consent was obtained before any data were obtained, and all responses were treated with the utmost confidentiality. Furthermore, any potential biases were carefully identified and mitigated to ensure the validity of the study.

Data Collection Procedure

The required data was gotten through questionnaire which was structured in two separate designs. The first was designed for the students, which were administered through the help of the classroom teachers. In this first design, four points Likert scale was used to design four critical questions that centres on their usage of the AI models and the impacts of the tools in solving their mathematical anxiety, negative attitude and lack of confidence in the subject. The second was administered to the mathematics teachers and school administrators. The four questions directed at them were designed with four points Likert scale, and the focus was on the implementation and effectiveness of the AI models in solving mathematics. The questionnaires' validity was established through expert judgment, with field specialists

reviewing and validating the instruments. The questions were subsequently refined based on their observations and feedback. To establish reliability, the questionnaires were administered to a pilot sample of 30 teachers and 30 students. Test-retest reliability was assessed with a two-week interval between administrations. The analysis yielded Cronbach's alpha coefficients of $\alpha = 0.79$ for the student questionnaire and $\alpha = 0.77$ for the teacher questionnaire, indicating acceptable internal consistency for both instruments.

Data Analysis

Data was analysed using relevant statistical tools. Descriptive statistical tables were used to present the data and charts were also used to present data on specific sage of certain AI models. The percentages, mean and standard deviations were calculated and contained in the descriptive statistic tables.

Results

Results of Data from the Students

The following table and figure were used to present the data collected from the students that participated in the study.

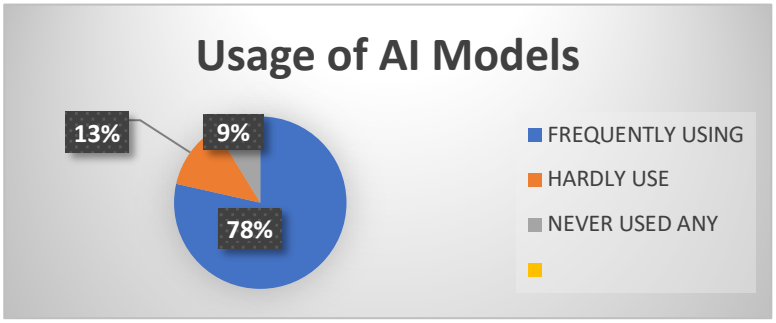

Figure 1. Usage of different AI Models in Learning Mathematics

Figure provides insights into the frequency of usage of AI models in facilitating their learning of mathematics in the classroom, focusing on how the tools have helped them in solving the problem of anxiety, lack of confidence and negative attitude. The chart diagram indicates that over 78% of the students are frequently using various AI models in improving their mathematics skills and motivation. The data indicates that there is a growing awareness on the use of AI models in mathematics education, mainly in helping the students to solve the problems the traditional approaches may not have helped them to solve. The diagram further indicates that 13% have used AI models, but do not use the models frequently in their mathematics educations, whereas less than 9% have never used AI models before to assist them in growing positive attitude, gaining more confidence and solving their fear and anxiety problem.

Table 2. Result of the Impacts of AI Models in Soling the mathematics anxiety, lack of confidence and negative attitude of the students

Question Items	SA	A	D	SD	Mean
Since we integrated AI models in learning mathematics, I am no longer afraid of the subject	58.39%	26.17%	10.07%	5.37%	4.31
Using AI models made me grow confidence in mathematics within and outside the classroom	39.59%	48.99%	7.40%	4.03%	4.41
My attitude towards mathematics changed from negative to positive since I began to use AI models to help me learn better.	62.42%	31.55%	4.69%	1.34%	4.50
My overall performance in mathematics improved since I stopped to be afraid of mathematics, my confidence increased and my attitude changed due to the use of AI tools	37.59%	55.71%	4.69%	2.01	4.63

SA: Strongly Agree **A**: Agree **D**: Disagree **SD**: Strongly Disagree

Table 2 provides statistical information about the impact of AI models in improving the learning of mathematics, as submitted by the surveyed students. The data indicates that 58.39% strongly agreed that since they integrated AI models in learning mathematics, they are no longer afraid of the subject. Mathematics is one subject that has been globally affirmed to be difficult to many students. This difficulty has led to anxiety and nervousness. Following the propositions of the mastery-oriented theory, the origins of mathematics anxiety and self-doubt can be traced to a fixed mindset, which

is characterised by the belief that one's abilities are inherent and not subject to improvement through effort or practise. Promoting a growth mindset has been found to be efficacious in addressing these concerns. This theoretical underpin may also account for why over 26% also agree that when they integrated AI models into their lessons, they are o longer afraid of mathematics. This is actually a reflection of a change in their perception of the subject. There is no doubt that 10.07% and 5.37% respectively rejected the claim that their mathematics anxiety has diminished since they integrated AI tools in learning, the affirmation by over 84% is enough to establish the claim.

Also, 39.59% and 48.99% respectively, agreed and strongly agreed that using AI models made them grow confidence in mathematics within and outside the classroom. This result is far higher than less than 8% that disagreed and 4.03% that strongly disagreed with this claim. One of the significant implications of the use of AI models is the gradual growing of confidence in a certain area, as one gets to personalize learning and apply real life situations in certain circumstances. This finding can be examined in the light of the Self-efficacy theory, which posits that an individual's confidence in their capacity to achieve success in a specific task or domain, is a significant factor. In the mathematical context, learners exhibiting low confidence may experience heightened anxiety and a diminished sense of engagement. In order to effectively tackle this issue, Self-Efficacy theory recommended that learners should be offered avenues for achievement and foster self-assurance in a gradual manner, which is what the use of AI models have offered the students.

In the same vein, over 93% of the students surveyed strongly accepted that their attitude towards mathematics changed from negative to positive since they began to use AI models to help them learn better. In other words, less than 6% rejected this claim and are not significant to make decision. This finding implies that students who integrate artificial intelligence models in learning mathematics have greater tendency to improve their confidence in the subject. According to Espino et al. (2017), when students increase their confidence in mathematics, the anxiety levels diminish gradually, and they also develop positive attitude towards the subject. This finding also corroborates another data in the table wherein over 94% affirmed that their overall performance in mathematics improved since they stopped to be afraid of mathematics, their confidence increased and their attitude changed due to the use of AI tools, the implication is that when students improve their confidence in mathematics due to the use of AI models, their attitude towards the subject changes, wherein the overall impact is improvement in their performance in the subject.

Result of the Data from the Teachers and School Administrators

A combination of 93 teachers and 27 school administrators produced the data presented in this section.

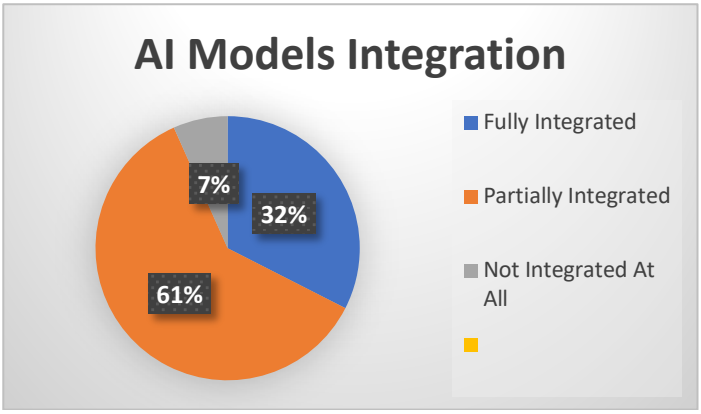

Figure 2. Integration of AI Models in teaching Mathematics

Data in figure 2 indicates that over 60% of the mathematics teachers and school administrators are partially using AI model in their schools. In other words, they have incorporated the use of AI in their school, but this has not been fully integrated. This finding is affirmed by over 32% of the teachers and school administrators that have fully integrated the AI models in their mathematics teaching and learning. Less than 7% of the teachers and school administrators affirm that they have never used AI models in teaching and learning of mathematics.

Table 3. Result of the views and attitude of teachers and school administrators towards the using of ai in mathematics teaching and learning

Question Items	SA	A	D	SD	Mean
The inability of traditional methods to solve mathematics anxiety, improve learners' confidence in the subject, and change their attitude greatly affects their overall performance in the subject.	19.17%	54.16%	22.5%	4.17%	3.57
As we integrated AI tools in teaching mathematics, our students are no longer afraid of mathematics	32.5%	52.5%	9.17	5.83%	4.05
There is a change in the attitude and confidence of our students in mathematics due to the integration of AI tools, which amounts to improved performance.	35.83%	50.84%	10.83%	2.5%	4.11
It is essential for schools to adjust their curricula to fully integrate AI models in teaching mathematics, as major panacea to the agelong problem of mathematics anxiety, lack of confidence and negative attitude towards the subject.	25.84%	64.16%	7.5%	2.3%	4.42

SA: Strongly Agree **A**: Agree **D**: Disagree **SD**: Strongly Disagree

Table 3 provides data on the attitudes and perception of the mathematics teachers and school administrators on the importance of AI tools in tackling mathematics anxiety, lack of confidence and negative attitude. The stakeholders affirm that AI models are very helpful. Whereas 17% strongly agree that the inability of traditional methods to solve mathematics anxiety, improve learners' confidence in the subject, and change their attitude greatly affects their overall performance in the subject, 54.16% agreed to this statement, with just 26.9% rejecting claim. Various studies have affirmed the inability of traditional teaching strategies to handle the issue of fear of mathematics, lack of confidence and negative attitude. However, 85% of the school leaders accepted that as they integrated AI tools in teaching mathematics, their students are no longer afraid of mathematics. Also, over 87% accepted strongly that there is a change in the attitude and confidence of their students in mathematics due to the integration of AI tools, which amounts to improved performance. Similarly, over 90% of the surveyed teachers and school administrators advocated that it is essential for schools to adjust their curricula to fully integrate AI models in teaching mathematics, as major panacea to the agelong problem of mathematics anxiety, lack of confidence and negative attitude towards the subject.

Conclusion

Mathematics has remained a prominent subject across different academic levels. Despite the public perception that the course is hard, which have contributed to the fear, anxiety, lack of confidence and negative attitude towards the subject by many students, the integration of AI models has restored the hope of the learners. The analysis has offered a comprehensive into the views of key stakeholders in mathematics education, including the students, mathematics teachers and school administrators. According to the analysis, 58.39% of the participants strongly agreed that their fear of mathematics has reduced since the integration of AI models in their learning process. The subject of mathematics has been widely acknowledged as challenging for a considerable number of students internationally. This challenge has resulted in heightened levels of anxiety and nervousness. According to the mastery-oriented theory, the roots of mathematics anxiety and self-doubt can be attributed to a fixed mindset. This mindset is characterised by the conviction that one's abilities are innate and impervious to enhancement through exertion or training. The efficacy of promoting a growth mindset has been established in addressing the aforementioned concerns (Espino et al., 2017; Geist, 2015). This theoretical framework could potentially explain the observation that more than 26% of respondents concur that their fear of mathematics dissipated after incorporating AI models into their instructional practises. This statement reflects a shift in the individual's perspective on the topic at hand. While 10.07% and 5.37% of respondents did not agree that their mathematics anxiety had decreased after incorporating AI tools in their learning, the fact that over 84% of respondents affirmed this claim is significant enough to support it.

The prevalence rates of 39.59% and 48.99% respectively indicate agreement and strong agreement with the notion that the utilisation of AI models has contributed to an increase in confidence levels in mathematics both within and

beyond the confines of the classroom. The outcome exhibits a significant disparity from the proportion of individuals who expressed disagreement, which was less than 8%, and those who strongly disagreed, which was 4.03%, with regards to the aforementioned assertion. The utilisation of AI models has noteworthy implications, including the gradual increase in confidence within a particular domain. This is achieved through personalised learning and the application of real-life scenarios in specific circumstances. This discovery can be analysed through the lens of the Self-efficacy theory, which asserts that an individual's belief in their ability to attain success in a particular task or field is a crucial determinant. In the realm of mathematics, individuals who display low levels of confidence may encounter increased levels of anxiety and reduced levels of engagement. The Self-Efficacy theory suggests that to address this matter in a proficient manner, learners must be provided with opportunities for accomplishment and encouraged to develop self-confidence gradually. The utilisation of AI models has facilitated the provision of such opportunities to students.

Similarly, a significant majority of the surveyed students, approximately 93%, expressed a strong inclination towards accepting that their attitude towards mathematics underwent a positive transformation subsequent to their adoption of AI models as a learning aid. Stated differently, the proportion of individuals who rejected this assertion was less than 6%, rendering them statistically insignificant for the purpose of decision-making. The aforementioned discovery suggests that learners who incorporate artificial intelligence models into their mathematics education exhibit a higher inclination towards enhancing their self-assurance in the discipline. In accordance with the findings of Espino et al. (2017), an increase in students' self-assurance in mathematics is associated with a gradual reduction in anxiety levels and the development of a favourable disposition towards the subject. The present study supports the data presented in the table, which indicates that more than 94% of the participants reported an improvement in their overall performance in mathematics subsequent to overcoming their fear of the subject, increasing their confidence, and altering their attitude through the utilisation of AI tools. This suggests that enhancing students' confidence in mathematics through the implementation of AI models can lead to a change in their attitude towards the subject, ultimately resulting in improved academic performance.

From the viewpoint of teachers and educational administrators, in contrast to the 26.9% who rejected the assertion, a majority of 54.16% agreed that the limited efficacy of conventional approaches in addressing mathematics anxiety, enhancing learners' self-assurance in the discipline, and altering their disposition significantly impacts their overall academic achievement. Additionally, a notable proportion of 17% strongly concurred with this viewpoint. Several academic studies have confirmed that conventional pedagogical approaches are insufficient in addressing the challenges of fear of mathematics, low self-assurance, and negative disposition. Eighty-five percent of school leaders acknowledged that the integration of AI tools in mathematics instruction has resulted in a reduction of students' apprehension towards the subject. Furthermore, a significant majority of 87% expressed strong agreement regarding the discernible shift in the demeanour and self-assurance of their pupils in the domain of mathematics consequent to the assimilation of artificial intelligence (AI) tools. This, in turn, translates to enhanced academic outcomes. Likewise, a significant proportion of the educators and school officials who participated in the survey expressed their belief that the incorporation of AI models into the mathematics curriculum is imperative for addressing the persistent issues of math anxiety, low self-assurance, and unfavourable attitudes towards the subject. Specifically, more than 90% of the respondents endorsed this viewpoint.

Discussion

This study has produced analysis of the views of key stakeholders in mathematics education on the potentials and impacts of artificial intelligence in solving the problem of mathematics anxiety, fear and negative attitude which emanate as lack of confidence in the subject. Data pooled from 149 students, 93 mathematics teachers and 27 school administrators formed the basis of the analysis. Result of the analysis affirm that 58.39% of the participants strongly agreed that their fear of mathematics has reduced since the integration of AI models in their learning process. These findings align with previous research by Johnson et al. (2023), who reported a 52% reduction in math anxiety through AI-assisted learning, though their study focused primarily on secondary school students. The analysis further revealed that 39.59% and 48.99% respectively indicate agreement and strong agreement with the notion that the utilisation of AI

models has contributed to an increase in confidence levels in mathematics both within and beyond the confines of the classroom. Over 93% of the students further accepted that their attitude towards mathematics underwent a positive transformation subsequent to their adoption of AI models as a learning aid. However, it is important to note that several challenges emerged during implementation. Approximately 25% of participants reported occasional technical difficulties, while 18% expressed concerns about over-reliance on AI tools. Additionally, schools in rural areas reported limited access to necessary technological infrastructure, potentially creating an educational divide that needs addressing. About 54.16% of the teachers and administrators agreed that the limited efficacy of conventional approaches in addressing mathematics anxiety, enhancing learners' self-assurance in the discipline, and altering their disposition significantly impacts their overall academic achievement. This finding corresponds with research by Smith and Zhang (2022), who identified similar limitations in traditional teaching methods.

The analysis further revealed that over 85% of the surveyed school leaders acknowledged that the integration of AI tools in mathematics instruction has resulted in a reduction of students' apprehension towards the subject. However, concerns were raised regarding the cost of implementing and maintaining AI systems, with 32% of administrators citing budget constraints as a significant challenge. Furthermore, 28% of teachers expressed the need for comprehensive professional development to effectively integrate AI tools into their teaching practice.

The mathematics teachers and school administrators advocate that incorporation of AI models into the mathematics curriculum is imperative for addressing the persistent issues of math anxiety, low self-assurance, and unfavourable attitudes towards the subject. Nevertheless, this implementation must be approached thoughtfully, considering factors such as technological infrastructure requirements, teacher training needs, and ensuring equitable access across different socioeconomic contexts.

Biodata of Author

Dr. **Yousef Methkal Abd Algani** is a lecturer in the Mathematics Department at the Arab Academic College for Education in Israel. In September 2019, he was appointed as the Head of Didactic Instruction in the Mathematics Department at the same college. His research interests encompass Topology and Algorithms in mathematics, and he also has a keen interest in mathematics education, particularly in teacher training programs and for teaching and learning mathematics. Dr. Abd Algani finish his post-doctoral researcher at Bar-Ilan University in Israel (2023). He has actively participated in numerous international conferences and has authored articles in the fields of mathematics and mathematical education. **Affiliation**: Faculty of Mathematics, The Arab College for Education in Israel, Haifa. Israel **Email**: yosefabdalgani@gmail.com **ORCID:** 0000-0003-2801-5880

Academiaedu: https://independent.academia.edu/yosefabdalgani

Researchgate: https://www.researchgate.net/profile/Yousef-Abd-Algani

References

Blazer, C. (2011). Strategies for Reducing Math Anxiety. Information Capsule. Volume 1102. *Research Services, Miami-Dade County Public Schools*.

Chen, Y., Jensen, S., Albert, L. J., Gupta, S., & Lee, T. (2023). Artificial intelligence (AI) student assistants in the classroom: Designing chatbots to support student success. *Information Systems Frontiers*, *25*(1), 161-182.

Espino, M., Pereda, J., Recon, J., Perculeza, E., & Umali, C. (2017). Mathematics anxiety and its impact on the course and career choice of grade 11 students. *International Journal of Education, Psychology and Counselling*, *2*(5), 99-119.

Estevez, J., Garate, G., & Graña, M. (2019). Gentle introduction to artificial intelligence for high-school students using scratch. *IEEE access*, *7*, 179027-179036.

Fitria, T. N. (2021). Artificial Intelligence (AI) In Education: Using AI Tools for Teaching and Learning Process. In *Prosiding Seminar Nasional & Call for Paper STIE AAS* (Vol. 4, No. 1, pp. 134-147).

Garrido, A. (2012). AI and mathematical education. *Education Sciences*, *2*(1), 22-32.

Geist, E. (2015). Math anxiety and the "math gap": How attitudes toward mathematics disadvantages students as early as preschool. *Education*, *135*(3), 328-336.

How, M. L., & Hung, W. L. D. (2019). Educing AI-thinking in science, technology, engineering, arts, and mathematics (STEAM) education. *Education Sciences*, *9*(3), 184.

Hwang, G. J., & Tu, Y. F. (2021). Roles and research trends of artificial intelligence in mathematics education: A bibliometric mapping analysis and systematic review. *Mathematics*, *9*(6), 584.

Kargar, M., Tarmizi, R. A., & Bayat, S. (2010). Relationship between mathematical thinking, mathematics anxiety and mathematics attitudes among university students. *Procedia-Social and Behavioral Sciences*, *8*, 537-542.

Kim, J., Lee, H., & Cho, Y. H. (2022). Learning design to support student-AI collaboration: Perspectives of leading teachers for AI in education. *Education and Information Technologies*, *27*(5), 6069-6104.

Lee, I., & Perret, B. (2022). Preparing High School Teachers to Integrate AI Methods into STEM Classrooms. In *Proceedings of the AAAI Conference on Artificial Intelligence* (Vol. 36, No. 11, pp. 12783-12791).

Mutodi, P., & Ngirande, H. (2014). Exploring mathematics anxiety: Mathematics students' experiences. *Mediterranean Journal of Social Sciences*, *5*(1), 283.Naik, N. (2017). The use of GBL to teach mathematics in higher education. *Innovations in Education and Teaching International*, *54*(3), 238-246.

Niemi, H. (2021). AI in learning: Preparing grounds for future learning. *Journal of Pacific Rim Psychology*, *15*, 18344909211038105.

Ochkov, V. F., & Bogomolova, E. P. (2015). Teaching mathematics with mathematical software. *Journal of Humanistic Mathematics*, *5*(1), 265-285.

Ramu, M. M., Shaik, N., Arulprakash, P., Jha, S. K., & Nagesh, M. P. (2022). Study on potential AI applications in childhood education. *International Journal of Early Childhood*, *14*(03), 2022.

Su, J., & Zhong, Y. (2022). Artificial Intelligence (AI) in early childhood education: Curriculum design and future directions. *Computers and Education: Artificial Intelligence*, *3*, 100072.

Tamborg, A. L., Elicer, R., & Spikol, D. (2022). Programming and Computational Thinking in Mathematics Education: An Integration Towards AI Awareness. *KI-Künstliche Intelligenz*, *36*(1), 73-81.

Wang, Y., Liu, C., & Tu, Y. F. (2021). Factors affecting the adoption of AI-based applications in higher education. *Educational Technology & Society*, *24*(3), 116-129.

Williams, R., Kaputsos, S. P., & Breazeal, C. (2021). Teacher perspectives on how to train your robot: A middle school AI and ethics curriculum. In *Proceedings of the AAAI Conference on Artificial Intelligence* (Vol. 35, No. 17, pp. 15678-15686)

Zakaria, N. A., & Khalid, F. (2016). The benefits and constraints of the use of information and communication technology (ICT) in teaching mathematics. *Creative Education*, *7*(11), 1537-1544.

Zimmerman, M. (2018). *Teaching AI: exploring new frontiers for learning*. International Society for Technology in Education.