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Exploring teachers' awareness and challenges of artificial intelligence applications in mathematics instruction

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ABSTRACT

Artificial intelligence is quickly altering education, especially in mathematics instruction, by providing instructors with effective creatures that can develop how they teach and increase student engagement. The purpose of this study was to assess how basic education mathematics instructors integrate AI into mathematics instruction, focusing on their practical use, perceptions, and the challenges they face. The research used a mixed-methods design, using a highly designed 18-item questionnaire with a 5-point Likert scale. The questionnaire was distributed to 164 mathematics teachers across five governorates, while interviews were conducted with 12 instructors to identify the main challenges they face when integrating artificial intelligence tools into mathematics instruction. The study found that instructors possess a moderate level of AI knowledge but strongly recommend integrating AI to achieve key educational outcomes, notably boosting student motivation, enhancing understanding of mathematical concepts, and promoting higher-order thinking skills. Consequently, the main challenges to integration were identified as instructors' insufficient knowledge and experience, limited resources and inadequate infrastructure, and the additional time and effort required for lesson planning. Key recommendations include the immediate implementation of comprehensive capacity-building programs for instructors and the systematic enhancement of schools' technological infrastructure. These measures are essential to ensure the effective and sustainable integration of AI into mathematics instruction. Thus, AI empowers instructors to streamline lesson planning and assessment while providing students with personalized feedback and interactive practice opportunities.

Keywords: artificial intelligence, teachers' awareness, mathematics instruction, challenges

INTRODUCTION

Artificial intelligence (AI) has emerged as a potential force in today's technological era, deeply affecting many aspects of our lives, particularly in instruction. It offers the possibility of converting the educational scene, shifting how we learn, and accessing knowledge. Education and AI regularly appear on many conference agendas. The focus on the 4SDEM held in Kuala Lumpur, Malaysia, in July 2019 by SEAMEO is an example of this. It highlights the importance of a policy-informed decision and is a movement towards AI in education policy (SEAMEO Secretariat, 2021). The May 2019 International Conference on AI and Education drew officials from fifteen Southeast Asian countries to Beijing. The highlighted methods showcase how AI can support the first five areas: reducing administrative information overload; improving teachers' technical skills; increasing students' digital readiness; incorporating technology into assessments; and expanding distance education. AI technologies are essential to enhance learning outcomes and streamline educational processes (UNESCO, 2019).

International conferences emphasize that preparing teachers to use AI in mathematics is vital for effective classroom integration (Fancsali et al., 2023; Li et al., 2024; Shen et al., 2021). They suggest adopting a balanced professional development program that integrates both practical experience, which includes designing classroom exercises, developing adaptive exercises, and analyzing system reports, along with modules that deal specifically with mathematical content like error analysis and automatic grading of images and equations. It should also include basic training in machine learning and data ethics fundamentals as well, along with a discussion of what models were/aren't good at. Conference literature indicated a design using pre- and post-training assessments, technical support, and leadership training.

The educational potential of AI-based applications is enormous. It allows teachers to observe their students' participation and recommend tailored exercises based on each student's learning needs. This way of working provides a picture of where students

are doing well and where they need further support. Interventions can be used to effectively enhance learning (Mohamed & Mohamed, 2020). AI enables detailed student performance information to be monitored (e.g., correct responses at each level, goals completed, time on task, and error rate). Accordingly, AI can determine the best way to interact with a user and provide real-time feedback on what needs to be done to maximize the chances of success. Post-projects or work endeavors can also be implemented, where development is directed at filling gaps identified in the industry) (Murphy, 2019). The feedback loop is more personalized, quicker, and more frequent. In addition, the accuracy with which it individualizes all levels of learning has been heightened to eventually evaluate the performance result with personalized training applications. Adaptive Learning AI enables the system to adjust difficulty and intensity to suit each child's learning pace and style; however, not everybody has a system for adapting all types of learners while simultaneously practicing critical thinking and problem-solving skills. These personalized approaches lead to better levels of motivation, success, retention, and performance among students (Karsenti 2019).

Studies have shown that measurement and assessment tasks can be performed with high accuracy and speed using AI tools. This is consistent with the results of Zawacki-Richert et al. (2019), and Faggella (2019). In addition, these solutions lead to excellent learners and promote partnerships between the parents, community, educators, and stakeholders. They also focus on assessment, contribute to maintaining a safe learning environment, and can make difficult decisions using significant reasoning skills to solve problems with less readily available information. In addition, AI systems may process and resolve conflicting data and conditions so that learners do not have to; they can be given an alternative reality by which they may face challenging processes in human learning and keep pace with modern technology. They may further help display questions in a way individual strengths and mental preparation are exposed and monitor and investigate students' problem-solving strategies. Serholt and Barendregt (2014) found that students have a positive attitude towards humanoid robots as enablers of school environments.

Considering the rapid spread of AI and its deep influence on teachers' teaching and mathematics instruction, it is necessary to determine teachers' attitudes and practices regarding AI in mathematics instruction. Knowledge of teachers' attitudes towards these products and the difficulties they face from their point of view will help introduce AI in education to work more effectively while receiving support for this shift.

The Study Problem

This study is in line with the objectives of the 2040 Vision of Oman, which advocates an overall digital transformation and application of modern technologies, particularly AI, as core drivers to improve the education sector. Oman seeks to develop technology-based educational frameworks that cultivate imagination and entrepreneurial skills so that more talented individuals have the competencies that future generations will require. In this way, an efficient workforce that meets world standards can be developed. As AI increases its integration into education, increasingly digital tools are being used to enhance pedagogical practices and cultivate regular links between dynamic learning environments and those in traditional school settings. From the mid-2000s onwards, these endeavors aimed to equip students with the skills necessary to succeed in 21st century societies and to make them active contributors of digital society themselves. As a result, the national development goals set forth in Oman Vision 2025 will receive support from this end if nothing else can be achieved (Oman Vision Follow-up Unit, 2025).

The National Conference of Artificial Intelligence and Education, held online on October 6, 2020, was hosted by the Ministry of Education through the National Committee for Education, Culture and Science. Under the theme "Future Prospects: Key Applications," the event aimed to upskill Omani teachers and prepare them to integrate AI solutions into their classrooms. This demonstrates Oman's commitment to using advanced educational technologies as a core part of its strategy to develop and improve the education system.

Omani Educational policy believes that modern scientific data processing techniques and advanced technology should be part of the educational process based on policies that include developing students to gain learning capabilities whilst enhancing research powers needed in their major study fields as well. This model prepares students for the requirements of modern strategic science-Tech economy activities nationwide concerning innovation and competitive environment (Ministry of Education, 2017; Omani National Committee for Education, Culture, and Science, 2020). As such, supplementing education (especially in the mathematics classroom) with AI applications may have the potential to computerize pedagogical theories and deepen students' understanding. As the situation in this field continues to change rapidly, AI is expected to play a key role in helping the educational environment grow. For the literature review on applications of AI, literature was read about schools in general and with respect to teaching mathematics through AIs tools at the basic education level for teachers in different countries, however, no research studies were established on teachers use of AI tools for using them as methodology to teach the school mathematics at basic education levels in Oman: Sultanate of Oman. This knowledge gap highlights the importance of further exploring this discrepancy, which has also been found in other studies, such as by Wang et al. (2020). Al-Farani and Al-Hajjali (2020), and Al-Yajzi (2019) call for increased AI application, keeping up with machine learning technology and ensuring its integration with educational activities. These studies highlight the critical nature of preparing teachers with the skills needed to use AI appropriately in schools. Furthermore, many studies have stressed the positive aspects of the teaching and learning process using these applications.

Undoubtedly, quality mathematics education requires teachers to undergo continuous training and professional development to keep abreast of new technologies and scientific discoveries prevalent in the digital age. This continual preparation supports teachers in achieving their educational goals as technology shifts. Mathematics teachers are at the core of mathematics education; therefore, mastering artificial intelligence technology and mastering application skills of artificial intelligence in the process of mathematics teaching are necessary and indispensable for mathematics teachers. Therefore, this study seeks to explore the use of AI applications in mathematics education in basic education schools, Sultanate of Oman, from teachers' viewpoints. The research questions that guided this study were as follows:

RQ1 What is the extent of knowledge among mathematics teachers regarding the concepts and applications of artificial intelligence in teaching mathematics at the basic education stage?

RQ2 From the teachers' perspective, what is the significance of using artificial intelligence in teaching mathematics at the basic education stage?

RQ3 What are the main challenges encountered by mathematics teachers in integrating AI applications into mathematics instruction at the basic education stage?

Significance of Study

This research is significant, as it aligns with Oman Vision the 2040s emphasis on integrating artificial intelligence across all sectors, including education. It provides a comprehensive analysis of the current application of AI in mathematics education, shedding light on the challenges and success experienced by educators and institutions. This study aimed to improve professional practices and enrich existing literature by deepening our understanding of AI adoption. Additionally, it seeks to identify effective strategies to promote innovative teaching and learning, paving the way for future advancements in this field.

Limitations of the Study

This study has the following limitations. First, regarding time and human limits, data were collected from a sample of mathematics teachers at the education offices of Dhofar, Al Dakhiliyah, Musandam, Al Wusta, and Buraimi governorates in Oman. Second, concerning the thematic focus of this study, we investigated the practical use of AI applications in math education by focusing on three main aspects: teachers' knowledge and information regarding AI and its applications in classrooms, the importance of incorporating AI in teaching programs in classes, and teachers' primary challenges in practice for implementing AI applications. These areas were defined by the research instruments used in this study. Third, the research relates to the Spring semester of 2024-2025.

Terms of the Study

Artificial intelligence involves systems or devices that imitate human cognitive abilities to execute various tasks, with the capacity to enhance and adapt their performance through continuous learning from the data gathered and analyzed (Al-Farani & Al-Hajili, 2020).

In this study, it is operationally defined as computational applications, software, and various systems that can produce inputs, processes, outputs, and multiple skills, enabling problem solving and decision making in different educational situations related to teaching mathematics.

LITERATURE REVIEW

AI in Education

Artificial intelligence is machines that simulate human-like intelligent behavior. It is a vast domain that extends well beyond machine learning and data processing, including complex functions such as problem solving and decision-making (Zawacki-Richter et al., 2019). AI has found applications in various industries, such as healthcare and finance, utilizing the capability to analyze vast amounts of data quickly and effectively (Awang et al., 2025).

Artificial intelligence is a computer system designed to simulate the neuronal mechanisms that people use for perceiving, reasoning, and acting. It can undertake activities classically associated with human intelligence, including visual perception, speech recognition, decision making, and language translation (Stone et al., 2016).

Artificial intelligence is any human-made entity that does not exist in nature; it is what we produce rather than what we arise from. In its broadest sense, AI is the intelligence that humans aspire to generate – it is not trying to mimic human cognition as much as to create it within a computer or other type of machine. In essence, AI is a study that examines how to make machines think like humans (Nguyen et al., 2023).

Intelligence is the ability to solve problems, and any methodical way a human performs it is artificial intelligence (Kouveliotis & Mansuri, 2022). With the development of AI technologies, the debate on what we can expect from and make use of these technologies in education is becoming more intense (Talan, 2021).

According to Verma (2018), AI is a Computer Science branch concerned with the design of intelligent machines that can perform tasks and respond in a manner similar to humans. This area includes activities such as designing artificial systems that can teach, speak, and plan. In addition, Bernstein (2025) described AI as a new scientific discipline to study and develop theories, methods, techniques, and application systems for simulating human intelligence.

These definitions indicate that AI is an area of specialization concerning the construction of machines and computer systems to perform tasks that normally require human-like intelligence. These tasks include learning, decision making, and speech recognition. The aim is to understand and build systems that mimic human thinking, allowing such systems to perform actions that are believed to be achievable only by humans. As AI matures and finds new use cases, it is hailed by many as a powerful tool that can drive massive changes in many areas of the world, including education.

There are three main types of AI frameworks according to Gherhes (2018) and Miailhe and Hodes (2017). Narrow AI or "Weak AI" nimble, narrow artificial intelligence engineered to perform a particular task such as internet search or facial recognition while General AI (or 'Strong AI') means the hypothetical ability of an A.I. coming up in Hollywood films: that can understand, learn, and

apply any intellectual task that a human being can. This category primarily uses machine learning and deep learning methods. The second category is General AI (also called 'Strong AI'), which seeks to develop machines that have human-like intelligence and can perform myriad tasks. The third category is Super AI, which consists of systems that surpass human intelligence on multiple levels.

AI is an essential driving force for education reform and has revolutionized the way in which educational content is delivered, accessed, and engaged with. Customized learning systems allow for an individual's pace and learning style. Intelligent tutoring systems offer tailored feedback without requiring a human teacher and automated grading tools quickly and dispassionately score student work (Aggarwal et al., 2023; Waters, 2025).

AI has the potential to transform education beyond personalized learning, enabling comprehensive data collection and analysis to provide deeper insights. This data may assist in recognizing some of the complex challenges of today and potentially anticipate future issues as well as suggest strategies to help reduce their impact. As AI can analyze different types of data more effectively, our understanding of educational materials grows and we can ultimately develop feasible real-world applications and strategies for the real world (Yuskovych-Zhukovska et al., 2022).

Artificial Intelligence in Education (AIED) fulfils several roles in enhancing the learning experience using cutting-edge technological facilities that can cater to a range of educational requirements. It is widely used, comprising chatbots, expert systems, intelligent tutors or agents, machine-learning algorithms, personalized learning environments, and virtual reality systems (Zhang & Aslan, 2021).

Although the benefits in education, there are several issues that must be addressed to succeed and be more widely implemented. Al-Khiebri's (2020) research indicated some barriers towards the implementation of AI, including a lack of knowledge regarding the importance and possible usage of AI by educators. Furthermore, as one has offered professional development for teachers, it would provide them with the necessary means to effectively use these tools. "Compounding this problem is the lack of teachers' time to skill up, and to then use tools effectively – and therefore difficult to scale." In addition, some educators are reluctant to embrace newer teaching methods, and the high price of both devices and software for classrooms (and support services for those who are not tech-savvy) are additional impediments. In addition, some teachers' views on the developed integration plan have been that it is harder to integrate AI compared to other methods, which could result in a slow process of adoption.

However, while AI tools could potentially be a boon to the education system, they also present several challenges that must be overcome for them to truly take hold. One of the reasons behind these challenges is teachers' limited knowledge of AI, which prevents them from realizing the possibilities of improving learning practices by using AI (Al-Khiebri, 2020). Second, few teachers have been trained on how to effectively implement these tools in the classroom through rigorous in-service training programs that teach them to use technology as a tool rather than simply demonstrating its availability. Time is also a complicated factor, as teachers tend to lack the expertise to use these AI tools, thus stagnating the spread of digital materials. Some teachers are stubborn to embrace diverse teaching methods, the high price of the devices and software, imperfect network environment, and technical support are also barriers. Moreover, teachers typically believe that using AI applications takes longer than other options and can therefore be scaled very well.

AI and Teachers' Awareness

As the role of AI in education increases, teachers, including mathematics teachers, are understanding its use for integration in their teaching and learning procedures. However, the full potential of AI in mathematics education can only be realized if teachers are knowledgeable about and respond positively towards using this new technology.

Successful teacher-AI collaboration supports better academic outcomes for students and allows teachers to develop a more objective view of each student (Holstein et al., 2018). In addition, AI in the classroom helps remove administrative tasks from teachers and gives them more time to help improve the learning of students or participate in enriching student experiences.

There is much potential for educators and students to use AI in mathematics education. These technologies involve systems for analyzing student data that enable each student's strengths and weaknesses to be ascertained, activities relevant to a given situation, and richer learning situations. When students' learning styles are considered, AI has potential to enhance the quality and speed of arithmetic teaching as well (Chaudhry & Kazim, 2022). In addition, AI incorporated into mathematics learning promotes personalization (Opesemowo & Ndlovu, 2024); adaptive feedback (Strielkowski et al., 2025), and real-time assessment (Owan et al., 2023). Students need to understand the logic underneath the mathematical solution (Opesemowo & Ndlovu, 2024).

You need to integrate AI into mathematics education, especially now as there's a growing emphasis on AI in schools.

An important goal for AI literacy is to help students develop critical thinking skills regarding the technical and mathematical foundations of AI, as well as how to use these tools to address real-world challenges. More broadly, it encourages students to evaluate the societal impacts of AI in a meaningful way (Zimmerman, 2018). Smart AI educational applications are evolving to become more intelligent by analyzing students' learning behaviors to gain a clearer understanding of their needs. These tools not only support learning and provide quick assistance but also create an engaging and well-structured environment for students. Additionally, AI can help students understand and work with teachers to develop more effective teaching methods (Keleş & Aydın, 2021).

In mathematics teaching, AI has a profound influence on how students interact and understand mathematical objects. Through personalized learning, AI helps students gain better depth and retention of mathematical concepts (Tahiru, 2021). It also

enriches the learning experience through personalized instructions, adaptive feedback, and interactive problem-solving contexts, based on each student's individualized learning style and progress rate.

Tashtoush et al. (2024) argued that AI can be a pedagogical instrument to help teachers with their teaching tasks and improve students' performance by incorporating AI systems and applications into the curriculum. It was also found that such systems and applications raise students' motivation to learn; contribute to challenges, competition, and excitement; and consider individual differences between learners. Furthermore, the results pointed out some of the major issues experienced by mathematics teachers who use AI systems and applications, including a high level of effort that better solutions use, and obstacles to introducing AI in education. In contrast, Al-Shalhoub et al. (2024) demonstrated how AI tools can help students learn to solve word problems in middle-school mathematics. Similarly, Vargas (2023) suggested that AI constitutes a relevant means of education in lower and higher secondary schools with reference to good professional training for school leaders, teachers, and students in the implementation of AI.

Recent research stresses a remarkable educational void in AI adoption, as perceived by teachers. Al-Khiebri (2020) discovered that high school instructors possess weak skills in using AI tools and encounter many barriers to their application. Al-Sabahi (2020) also found that faculty members at Najran University use AI applications in teaching at a moderate level and face several challenges. Furthermore, Shin and Shin (2020) conducted an investigation in Korea, where they found that elementary school teachers had inadequate knowledge of AI applications to apply to instruction. This has been corroborated by Al-Aufi and Al-Rahili (2021), who found that mathematics teachers' knowledge of AI applications aimed at fostering creative abilities was moderate. However, they also found strong obstacles among teachers in their sample regarding AI use to foster creativity skills.

METHODOLOGY

The study employed a mixed methods design with explanatory sequential emphasis. Phase 1 (quantitative) involved administering a questionnaire to a sample of 164 mathematics teachers from various governorates of the Sultanate of Oman. Subsequently, Phase 2 (qualitative) employed purposive sampling to conduct in-depth interviews with 12 in-service mathematics teachers selected for variation in school level and teaching experience. The quantitative data guided the qualitative interviews, and integration was achieved by triangulating survey results with thematic insights to elaborate and explain the quantitative findings.

Sample sizes were chosen to ensure adequate statistical precision for the survey and sufficient depth in the interview phase for interpretive elaboration.

Study Population and Sample

The study population comprised all basic-education mathematics teachers in the Al Dhahirah, Al Dakhiliyah, Musandam, Al Wusta, and Al Buraimi governorates of the Sultanate of Oman. They total 1,103 teachers, according to Ministry of Education data for the 2025–2026 academic year. From this population, a sample of 164 mathematics teachers from the same governorates was drawn for the 2025–2026 academic year. The questionnaire was administered online from February to June 2025 (spring term). A subset of respondents was randomly selected for interviews, which were conducted between September and November 2025.

The survey was distributed electronically, and interviews were conducted via Zoom, which made obtaining written consent impractical. With the ethics committee's approval, verbal consent was obtained. Participants were in-service mathematics teachers from multiple governorates and were all adults.

Instruments of the Study

Questionnaire

The data collection instrument was a questionnaire developed to measure teachers' awareness and reported use of AI applications in mathematics instruction at basic-education schools in the Sultanate of Oman. The questionnaire had two sections: the first collected demographic information, whereas the second investigated evidence of the real use of AI applications. The second section is organized into three axes. The first axis assesses teachers' knowledge of artificial intelligence and its applications (five items). The second axis examines the perceived significance of AI utilization (seven items). The third axis addresses the challenges teachers face when using AI (six items). The questionnaire consisted of 18 items designed to investigate different aspects of AI use in mathematics education from the teachers' point of view. The questionnaire was reviewed by six experts in mathematics curricula and teaching methods. They provided suggestions to revise the wording of several items, and the proposed modifications were implemented before field administration.

Construct validity was examined via a pilot study with 25 teachers from the target population. Item–total correlations were computed for each item against its respective subscale and against the total scale. Internal consistency reliability coefficients for the subscales ranged from 0.42 to 0.78, and for the full instrument from 0.51 to 0.79. These results indicate acceptable validity and reliability and support the instrument's suitability for use with this sample.

Instrument stability was evaluated using Cronbach's alpha for each subscale and for the total instrument based on the pilot sample responses. Subscale alpha coefficients ranged from 0.769 to 0.821, and the overall alpha was 0.883, indicating good internal consistency. These results support the instrument's reliability and suitability for use with the study sample.

Table 1. The means and standard deviations of the responses of mathematics teachers in the study sample concerning the first axis, titled "Teachers' knowledge about artificial intelligence and its applications"

No	Statement	Mean	SD	Level
1	I know enough about what artificial intelligence is and how it works.	3.77	0.86	High
2	I understand the main ways AI can be used in teaching mathematics.	4.02	0.86	High
3	I keep myself updated with the latest news and developments in using AI in teaching.	3.69	1.27	Medium
4	I can find solutions to challenges when applying AI in teaching mathematics.	3.16	1.37	Medium
5	I can develop lesson plans that include AI to help achieve math teaching goals.	3.35	1.38	Medium
The first axis		3.60	0.90	Medium

Interview

A semi-structured interview form was developed and tested with 12 mathematics teachers from the Sultanate of Oman at the basic education stage. The validity of the interview form was confirmed by consulting a group of faculty members specializing in the curricula and teaching methods. The form comprises questions about teachers' knowledge levels of the concept artificial intelligence and its main purposes could be utilized for teaching mathematics. It also investigated the perceptions of AI-based applications in mathematics education among teachers, students, and classrooms. In addition, the form also asked about barriers that basic education teachers might encounter when using AI in their classrooms and provided them with potential solutions created by fellow teachers. The questions were piloted by three mathematics teachers who did not participate in the main study for clarity and to give an indication of how long the interviews needed to be. All interviews lasted for approximately 30 minutes. The interview form was administered to these three teachers to certify the reliability of the study instrument, and the interviews were conducted with them on more than one occasion. The results showed a prominent stability in their responses across the different executives, representing that the interview form has a suitable level of reliability and can be dependent upon for data collection.

The researchers conducted the interview analysis through four clear procedural steps: first, they transcribed all recordings and checked transcripts against the audio for accuracy; second, each researcher read the transcripts multiple times and performed independent open coding of meaningful segments, then merged codes into a shared table; third, the researchers discussed the resulting categories, agreed on axial codes, and developed main themes with documented definitions and supporting excerpts; fourth, they implemented trustworthiness checks (peer review and member checking where possible), calculated inter-coder agreement, recorded all outputs in a database, and linked the qualitative themes to survey results via an integration matrix to interpret quantitative patterns and provide representative quotations.

FINDINGS AND DISCUSSION

Results for the First Research Question

To address this question, means and standard deviations were computed for each statement within the instrument's axes. These were then ordered from the highest to lowest levels of agreement, as detailed below.

Table 1 indicates that the overall mean score for the axis assessing teachers' knowledge of artificial intelligence, and its applications is 3.60, with a standard deviation of 0.90, reflecting a moderate level of agreement. Additionally, the statement 'I understand the main ways AI can be used in teaching mathematics' recorded the highest mean score for agreement, which was 4.02, with a standard deviation of 0.86, demonstrating a high level of agreement with this statement.

The table also indicates that the statement, I can find solutions to challenges when applying AI in teaching mathematics," received the lowest average score for agreement, totaling 3.16, with a standard deviation of 1.37. This reflects a moderate level of agreement.

To investigate the extent to which mathematics teachers had knowledge about the use of artificial the basic education level, 12 mathematics teachers with different experiences from all over the Sultanate of Oman were interviewed. The interviews aimed to understand teachers' views on AI in education, how familiar they are with the latest tools, and their ideas for integrating AI into math instruction. We selected participants to represent a range of perspectives.

The interviews showed a clear gap in math teachers' knowledge about how AI can be used in core education. While many are aware of AI and its potential, they pointed to limited understanding of current tools and how to apply them in the classroom. This raises the question of why it is crucial to provide pre- and in-service training and workshops, which should not only explain what great apps are available, but also enable teachers' skills development as they learn how to integrate efficiently with ICT in education experiences.

Although most teachers showed some reservations about using artificial intelligence in teaching mathematics, they did not dismiss its potential benefits. This suggests that teachers are willing to explore these tools; however, they require support and guidance to evaluate whether these applications align with their educational goals and curricula. Perhaps the reluctance of mathematics teachers in Oman to adopt AI applications stems primarily from clear professional and technical concerns: doubts about the accuracy and reliability of AI outputs in explaining mathematical concepts, loss of control over teaching or marginalization of the teacher's role, worries about student data privacy and security, and fear of technology's impact on job stability, coupled with insufficient hands-on training and administrative support. Perhaps because this is my perspective as a researcher.

Table 2. The mean scores and standard deviations of the responses from the mathematics teachers in the sample regarding the statements of the second axis, titled "The importance of using artificial intelligence"

No	Statement	Mean	SD	Level
1	The use of artificial intelligence stimulates students' intrinsic motivation to learn.	4.32	0.76	High
2	It helps deepen students' scientific understanding of specific topics within the subject.	4.11	0.92	High
3	It facilitates the connection between mathematics and real-life applications.	4.26	0.79	High
4	It promotes a comprehensive understanding of mathematical problems.	4.08	0.97	High
5	It supports the design of effective practical activities in educational settings.	4.16	0.91	High
6	It enhances students' skills in higher-order thinking.	3.85	1.07	High
7	It encourages the effective use of modern technologies and educational resources.	4.05	0.97	High
The second axis		4.12	0.75	High

These results agree with the work of Al-Aufi and Al-Rahili (2021), which shows that mathematics teachers have moderate skill levels in knowledge of AI applications, as well as the findings of Al-Shibl (2020), who argued that mathematics teachers have a moderate level of artificial intelligence applications. They are contrary to Sifr's (2024) findings, which indicate that both teachers and students have high knowledge and understanding of AI technology and methods. Furthermore, these results are inconsistent with those of Al-Khiebri (2020), who showed that high school teachers had poor competencies in using AI applications for teaching. In contrast, the findings are consistent with Al-Sabahi (2020), in which the knowledge and use of AI applications in education was low. Moreover, these results stand in contrast to Shin and Shin's (2020) research, which discovered that teachers did not have a well-appreciated understanding of AI applications that were applicable for education.

This finding aligns with the suggestions of Chounta et al. (2021), who stressed the need to support teachers in improving their digital literacy, providing proper training, and promoting the use of artificial intelligence applications as effective educational tools during classroom instruction.

Results for the Second Research Question

The means and standard deviations of the responses from the participating mathematics teachers were calculated for each statement within the second axis, titled "The importance of using artificial intelligence." The results are presented in **Table 2**.

The analysis in **Table 2** reveals that the overall mean score for the second domain, which pertains to the significance of utilizing artificial intelligence, is 4.12 with a standard deviation of 0.75, indicating a high level of consensus among respondents. Furthermore, the statement, the use of artificial intelligence stimulates students' intrinsic motivation to learn." received the highest mean agreement score of 4.32, with a standard deviation of 0.76, reflecting strong support and high degree of agreement with this specific aspect.

The table further shows that the statement "6 It enhances students' skills in higher-order thinking." obtained the lowest mean score of 3.85, with a standard deviation of 1.07. This finding indicates a high level of agreement with this statement.

This study concurs with the findings of Al-Shalhoub et al. (2024), who highlight the crucial role of artificial intelligence applications in solving verbal problems. Additionally, it aligns with Vargas (2023), who emphasized the importance of incorporating artificial intelligence applications into the educational process.

The importance of AI in education was brought to the fore during interviews with the 12 mathematics teachers. Finally, the teachers noted that this significance stemmed from AI's wide range of features and applications of AI, which attracted their attention. They also added that "AI introduces interactive features and a much broader pool of stimuli in the learning process, which can reinforce students' interest, especially in mathematics where concepts tend to be abstract." AI tools that, like other resources and audio-visual materials, support making math more concrete, that is, less abstract through a connection of different math algorithms and procedures to real-life applications, including various interactive events or games. This method helps cultivate various thinking faculties, particularly higher-order thinking. Also, the teachers mentioned that although certain math notions are abstract, students may be made to understand through the appropriate technological tools how a teaching aid can enable the content to become more dynamic and attractive for decision-making.

These results agree with those of Tashtoush et al. (2024), who pointed out that integrating AI systems and applications into teaching increases motivation and competition, as well as addresses some of the problems students encounter because they depend on traditional textbooks. AI seems to fit well with students' desires and current trends, as it provides flexibility in terms of content for different user needs and helps generate when the best-witted educational decisions are applied to facilitate the learning process of the students to better understand the education. Furthermore, AI is a powerful tool. Tashtoush et al. (2024) echo this view that adding AI and smart applications to the learning material may improve motivation, create constructive competition, and solve users' textbook dependence. This method ensures that AI educational content is consistent with the psychological needs of students, caters to individualized learning practices, and makes appropriate pedagogical decisions. Moreover, AI is an invaluable solution for educators, allowing IHT lessons to be easily translated into mathematical or visual records (by converting images to digital text and even handwriting). Teachers have also found Speak Q useful for converting images and notes to text while on the go, as well as tools for changing lesson plans into diagrams and mathematical symbols. Several studies have confirmed that AI technology meaningfully expands teaching efficacy through the procedures of math lessons (Martins et al., 2024). In terms of math classroom management, the application of VR/AR technology in geometry instruction permits 3D geometry interactive procedures. For teacher and AI collaboration, AI generates classroom lesson plans (such as Diffit tools), automatic test paper generation, and learning situation analysis reports. With the development of AI In the classroom, the teacher's role is transformed from a knowledge transmitter to a learning guide (İnci & Kaya, 2022).

Table 3. The means and standard deviations of the responses from the mathematics teachers concerning the third axis, "Barriers faced by teachers in using artificial intelligence applications"

No	Statement	Mean	SD	Level
1	AI applications require greater effort in lesson preparation.	4.16	0.97	High
2	Teachers receive inadequate technical and support assistance.	4.09	0.96	High
3	The availability of training programs on AI applications is limited.	4.01	1.02	High
4	Teachers' ownership and understanding of AI technologies are limited.	4.20	0.88	High
5	There are few dedicated classrooms in schools for utilizing AI applications.	4.13	0.95	High
6	The increasing student enrollment in classrooms limits the effective use of AI technologies.	4.18	0.90	High
The third axis		4.13	0.77	High

Results for Third Research Question

Findings pertaining to this question were analyzed by calculating the mean scores and standard deviations of the responses given by the teachers in the sample for each statement within the third axis: "Obstacles faced by teachers in using AI applications." The results are presented in **Table 3**.

Table 3 indicates that the overall mean score for the third domain, " Barriers faced by teachers in using artificial intelligence applications," is 4.13, with a standard deviation of 0.77, suggesting a high level of agreement among respondents. The highest mean score was observed for the statement " teachers' ownership and understanding of AI technologies are limited," which reached 4.20 with a standard deviation of 0.88, indicating a strong consensus. Conversely, the statement " the availability of training programs on AI applications is limited" recorded the lowest mean score of 4.01 and a standard deviation of 1.02, yet it still reflects a relatively high level of agreement.

This study is in line with several previous studies that have faced challenges related to the incorporation of AI into education. Echoing Al-Shalhoub et al. (2024) recognized significant challenges in AI for word problem-solving. It also echoes Al-Aufi and Al-Rahili's (2021) finding of significant barriers to AI applications for promoting innovation among female teachers. These findings confirm the conclusions of Al-Khiebri (2020) and Al-Sabahi (2020) that there are several problems with AI use in education.

Mathematics teachers were interviewed, and potential difficulties in incorporating AI in their instruction were observed. Difficulty with comprehension and effective use of AI was also reported by teachers, as well as practical issues such as overly large class sizes and greater time/attention required to prepare lessons, lack of adequate dedicated resources (space, devices, materials) for AI delivery, and insufficient technical support/training. Participants also commonly mentioned that the abstract nature of some mathematical ideas makes it difficult to find appropriate applications for AI, particularly at higher levels. A further barrier was reported as a lack of funds, with many tools and platforms available only for fees.

These results corroborate prior studies. Specifically, the effective deployment of AI tools depends on robust technological infrastructure and dependable internet connectivity—assets frequently absent in under-resourced schools—thereby impeding the rollout of AI-enhanced educational resources and exacerbating disparities in access to personalized learning (Chalkiadakis et al., 2024; Tang, 2025; Yi et al., 2023).

RECOMMENDATIONS AND SUGGESTIONS

Through analysis and interpretation of the collected data, several important findings appeared regarding the use of AI in math teaching, along with the challenges teachers face. Teachers showed varying levels of knowledge about AI applications and differing awareness of AI's potential to shape education. However, there are various obstacles that hamper their effectiveness. Following the information gathered from the feedback obtained from the interviewees, various recommendations were made to help achieve effective use of artificial intelligence in the area of mathematics. This can be accomplished, for example, through improving the technical competence of the instructors with relevant training so that the math instructors will know how to create appropriate applications for AI.

It shows why it's essential to equip schools with proper hardware, up-to-date software, and reliable internet access, making it easier to integrate AI-based tools into teaching. At the same time, teachers have embraced improved math teaching methods and explored a wide range of AI resources. This research also suggests taking an approach that consists of promoting investment in an advanced technology platform to enable the use of AI. This further emphasizes the importance of on-demand technical support by trained teams. Moreover, the approach recommends using AI applications intended to automate and personalize lesson planning in accordance with the different needs of students, an equation that can add up significantly, even in large classrooms. The primary purpose of this approach is to bring the benefits of artificial intelligence to teachers with minimal operational challenges.

CONCLUSION

This research presents a comprehensive overview of the application of AI in basic-education mathematics teaching practices in Sultanate Oman. By examination teachers' insights and identification of barriers, the study highlights that institutional and professional coordinated efforts are required to adequately prepare and empower teachers to spearhead impactful AI technology classroom integration processes with the goal of securing sustainable educational outcomes while positively influencing student

learning. Programs like these can increase AI potential to enhance student learning and create environments for ensuring the development of skills. Furthermore, the researchers recommend handling extra studies to expand and deepen the examination and to assess the actual application of AI integration across varied instructive situations. In conclusion, it is recommended to accept artificial intelligence applications in mathematics instruction—particularly intelligent tutoring and assistant tools for explanations, summarization, and example generation (e.g., ChatGPT, Google Gemini, Microsoft Copilot); platforms for revising student work and bringing immediate, tailored feedback (e.g., Gradescope); and tools for producing question banks and exercises at advanced difficulty levels to support discriminated assessment and assist distinct learner variances. When integrated considerately and systematically into instruction, these applications can serve as active pedagogical tackles that improve students' conceptual understanding and diversify the modalities for presenting mathematical content, thereby supporting deeper learning and formative assessment.

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