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Zambian Secondary School Teachers' TPACK and their Attitude Towards Artificial Intelligence in Mathematics Classrooms: A Case of Mufulira District

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The authors declare no competing interests.

A STATEMENT ON PARTICIPANT CONSENT

The study's participants (Secondary school mathematics teachers) consented to participate in the study.

Zambian Secondary School Teachers' TPACK and their Attitude Towards Artificial Intelligence in Mathematics Classrooms: A Case of Mufulira District

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Abstract

It is common wisdom and academically known that TPACK competency is key to technology integration. As such, in this 21st century, having digital skills is a necessity as new technologies are being utilized everywhere and education has not been left out. Artificial Intelligence, AI, is the most pronounced technology today despite being received with mixed feelings from different aspects of the world. Thus, the need to determine whether TPACK levels of Zambian Secondary School Teachers is a factor to their attitude towards AI in mathematics classrooms. The study adopted a sequential embedded design on 127 mathematics teachers of Mufulira district who responded to an online questionnaire and 10 who were interviewed from three secondary schools. Pearson correlation analysis was also conducted to measure the strength of the relationship. Interestingly, findings indicated that teachers' TPACK levels has less to do with their attitude or intention towards adoption of AI in the teaching and learning of mathematics. Inasmuch as TPACK is vital in AI integration in education, policymakers and curriculum developers should pay more attention in addressing best practices of AI usage to change the general perspective of teachers regarding adoption of the technology in mathematics classrooms.

Keywords: TPACK, Attitude towards AI, Mathematics classrooms

INTRODUCTION

Background to the study

It is undeniable truth that the world is changing at a faster rate! New technologies are everywhere in all spheres of life and education inclusive (Cooper, 2025). Thus, today's classroom setup is different from yesterday's setup and how it should be handled by educators. Therefore, as the world is changing, it is necessary for humanity to change with it. This is because, in this digital world, some people will be able to write algorithms while others will be replaced by algorithms (Holmes et al., 2019).

Besides, mathematics researchers like Borah (2024), Egara and Mosimege (2024) as well as Elifas and Simuja (2025) found that Artificial Intelligence, AI, utilization in learning and teaching enhances learners' mathematical problem-solving skills. Nevertheless, a study conducted by

Microsoft indicates that overreliance on the tools diminishes independent problem-solving skills and this affects critical thinking negatively (Lee et al., 2025). Fascinatingly, Jose et al. (2025) found that although AI-based learning tools improves personalized learning, it also brings about decline in memory retention.

Paul and Paul (2024) asserted that AI integration into education has transformed educational processes in a sense that it offers enhanced learning experiences and personalized learning despite its potential threats to academic integrity. To this regard, the answer to this challenge is for educators to have a better understanding on how AI tools are used and come up with robust strategies to preserve the credibility of teaching and learning environment (Dowson & Sutherland-Smith, 2020).

However, Teachers' attitudes and beliefs about the adoption of AI in mathematics education dictates their actions about it (Mao Li, 2024). Also, Saharuddin et al. (2025) in their study concluded that teachers' TPACK levels helps in the effectiveness of AI integration in classrooms. Moreover, it can never be over emphasized that the world is changing and humanity have to change with it. Consequently, the technology is believed to replace human tasks in jobs and this calls for teachers to upskill for them to perform other teaching tasks that do not exist at the moment (Hlongwane et al., 2024). Hence the need to determine the relationship between Zambian Secondary School Teachers' Technological Pedagogical Content Knowledge, TPACK, and their Attitude Towards Artificial Intelligence in Mathematics Classrooms.

Problem Statement

Zambia's ministry of technology and science noted the need for skilled AI workforce for the country to make good use of technology. It is believed that this is capable of offering unique opportunity in terms of accelerated development in enhancing public services and elevating the quality of life for all Zambians (National Artificial Intelligence Strategy, 2024). With regards to the country's ministry of education, universities have been urged by permanent secretary, Kelvin Mambwe, to guard against AI-aided degrees by putting in place systems to make this possible (Chisalu, 2025).

There are two sides of every coin, therefore the technology offers both pitfalls and benefits. AI has come to stay and the secret of benefiting out of it lies in right use (Dowson & Sutherland-Smith, 2020). A good number of mathematics researchers and the like have noted the potential benefits of integrating it in mathematics classrooms such as enhanced problem solving skills, personalized learning and increased desire of learning (Alsharidah & Alkramit, 2024; Alwakid et al., 2025; Boadu & Boateng, 2024; Bright et al., 2024). However, little or no research in Zambia have talked about teachers' attitude towards AI in relation to their TPACK levels in mathematics.

Teachers TPACK levels determine their attitude towards technology in general and how they use it (Bwalya & Rutegwa, 2023; Schubatzy et al., 2025; Uslu & Guner, 2022; Yabola, 2025). The aim of this study is to assess if this is so even to Artificial Intelligence integration in mathematics classroom. In essence, helping policymakers and curriculum developers to make well informed decision on where to pay more attention in making the adoption of the technology a success. Hence the need to determine the relationship between Zambian Mathematics Teachers' TPACK and their Attitude Towards the Integration of AI in Classroom.

Research Question

- What are the perceptions among Secondary School teachers on the integration of AI in mathematics classrooms?
- What is the relationship between teachers' Technological Pedagogical Content Knowledge, TPACK, and their attitudes towards AI in mathematics?

Objective

The specific objective of this study is to assess the perceptions of Secondary School Teachers regarding AI integration in mathematics teaching and learning. Thereafter, to determine the relationship between their TPACK levels and attitude towards it in mathematics.

REVIEW OF RELATED LITERATURE

Working with Artificial Intelligence involves the use of digital tools. Consequently, it is inevitable that for an educator to successfully implement this in their classroom they must have knowledge of the tools. In Malaysia, Hidayat et al. (2024) did a study on the relationship between technology

pedagogical content knowledge and belief among preservice mathematics teachers. This was a quantitative study involving correlational design where Structural Equation Modeling was also employed on 159 Malaysian pre-service teachers. The findings showed that there is a direct impact between teachers' TPACK and their beliefs with regards to teaching mathematics with technology. This is in total agreement to another study in Turkey by Uslu and Guner (2022). It was a mixed method approach on 65 preservice mathematics student teachers about their TPACK competency perceptions and their views on Use of Technology in Education. The study indicated that high levels of TPACK perceptions of teachers goes with high positive views of technology use in education. Still in Turkey but in AI perspective, Cayak (2024) found that positive attitude of teachers towards AI strongly predicts their AI literacy levels.

Additionally, AI-Abdullatif (2024) also conducted a quantitative study involving Structural Equation Modeling on Modeling Teachers' Acceptance of Generative Artificial Intelligence Use in Higher Education: The Role of AI Literacy, Intelligent TPACK, and Perceived Trust. It was discovered that teachers' perception of ease of GenAI was directly proportion to their AI literacy levels. Further, TPACK and perceived trust were found to be the mediating variables in this relationship. Talking of mediating variables, Tan et al. (2025) of China conducted a study where they investigated the mediating role of TPACK on teachers' AI competency and their teaching performance in higher education. Findings showed that teachers competency in AI is a prediction of their TPACK levels which later predicts their teaching performance. Thus, TPACK was found to be a mediating variable of AI competency and teaching performance.

In Germany, Runge et al. (2025) looked at Acceptance of Pre-service Teachers Towards Artificial Intelligence (AI): The Role of AI-Related Teacher Training Courses and AI-TPACK Within the Technology Acceptance Model. It was a quantitative study involving path models on 143 pre-service teachers. This resulted in a positive correlation between AI-TPACK and perceived AI-related usefulness as well as ease of use, which in turn positively correlated to the behavioral intention to use AI in future mathematics teaching. "TPACK influences perceived usefulness and this indirectly affects intention (Schubatzky et al., 2025)." Hava and Babayigit (2024) of Turkey, explored the relationship between teachers' competencies in AI-TPACK and digital proficiency. The results showed that digital proficiency is a significant predictor of AI-TPACK competencies.

This study was also quantitative and involved correlational survey model on 401 teachers from various provinces and departments of Turkey.

Further, Ismaniati et al. (2025) of Indonesia conducted an online survey of 200 teachers in the country from different educational backgrounds on Harnessing Self-efficacy: Mediating the Connection between TPACK and AI integration among teachers. According to the findings, Self-efficacy is believed to be a mediating variable between TPACK and the intention of adopting AI.

Teachers Technological Pedagogical Content Knowledge, TPACK, is one of the contributing factors that can significantly influence AI adoption and effective use in education processes (Li & Manzari, 2025). Therefore, including it into teacher trainings becomes imperative in Africa since there is need of rapid growth in skilled professionals (Ajani, 2024). Also, AI tools does as well help educators learn about Technological Pedagogical Knowledge, TPK, and as such preservice teachers must be supported in using AI Chatbots critically (Aga et al., 2024). Besides, Saharuddin et al., (2025) found that age of teachers determines their TPACK and further encouraged for targeted AI training for older teachers to bridge generational gaps. Thus, enhancing AI integration and that in the long run improve educational outcomes.

Beyond all reasonable doubt, Moura and Carvalho (2023) asserted that attitude of teachers and their classroom management style are key factors for a successful implementation of AI in educational setting. Therefore, it was the study's plea that teachers must be adequately trained in this technology so that eventually they also help learners in developing skills like "prompt literacy" that is inputs and commands needed for effective use of AI software applications. The cardinal point not to forget the study emphasized on, is the knowledge of teachers, parents and most importantly learners on when, how and why AI technology should or should not be used in education.

In addition, "The most critical challenges that mathematics teachers face in applying AI systems and applications is that they need to exert more effort than traditional method when using different AI softwares (Wardat et al., 2023)." This is an indication that for educators to use the technology to its full capacity, there must be an investment in Technological Pedagogical Content Knowledge. Magat and Sanglang (2024), conducted a study in Philippines and found that a number of teachers

were unfamiliar with ChatGPT. This called for a need for training educators in order to attain deep understanding and practical knowledge of the uses.

Notwithstanding the need for trainings, beliefs and attitudes toward technology amongst teachers greatly influence how confident they feel in integrating it into education. This was one of Bwalya and Rutegwa (2023) study's findings on Technological pedagogical content knowledge self-efficacy of pre-service science and mathematics teachers which was a comparative study between two Zambian universities. Yabola (2025) also points out that using technology in mathematics classrooms have a positive impact on learners' outcome. It was a case study of Mwansabombwe district of Zambia which aimed at investing the impact of Technology Use in the Teaching and Learning of Mathematics in Secondary Schools.

METHODOLOGY

Overview

This section gives a clear guideline on how the two research questions on teachers' perceptions of AI and the relationship of their TPACK and attitude were answered. The study employed a mixed method approach which made use of the concept that the world is not entirely quantitative or qualitative; it is not always one "straight path" world, but a mixture of "paths" world (Cohen et al., 2018).

Research Design

The study employed a sequential embedded research design. Embedded designs are used when there is one main form of data which may be quantitative or qualitative then a researcher decides to add on a second form of data to supplement or argument the main form of data (Cohen et al, 2018; Creswell & Clark, 2018).

Thus, the study was meant to be quantitative but however, qualitative data was embedded within it for supplementary sake. It was done sequentially. Quantitative data was collected first and qualitative followed thereafter.

Research Paradigm

Life is beyond one plus one is equals to two, the route one person takes today to reach a destination, may not be the same route another will take tomorrow to reach to the same destination. Therefore, this study is based on Pragmatist philosophical point of view which believes in knowledge being an objective reality that is only realized through individual human experiences (Dube et al., 2024). Although, this study being quantitative dominated, the researcher thought that even qualitative part, interviews, be included in order to explore more on teachers' perceptions regarding the integration of AI in mathematics education for better understanding.

Population and Sample

Population:

The study's population was Mufulira district's secondary school mathematics teachers.

Sample:

❖ **Quantitative**

The district has about 200 mathematics teachers and according to Cochran (1977), the sample size is calculated by using the following formula:

$$n = \frac{N}{1 + N(e^2)}$$

Where: n = sample size

N = population size

Margin error (e) = 0.05

Therefore, the sample was found to be 134 mathematics teachers to represent the population.

❖ **Qualitative**

10 mathematics teachers were conveniently picked from 3 schools to probe more on their views on AI in mathematics education.

Instrumentation

A **questionnaire** was the primary data collection method for quantitative while **semi-structured interviews** was for qualitative.

Data Collection Procedures

Permission was granted by school authorities including school boards and principals to conduct the research.

The questionnaires were administered online by means of google forms and a link was shared through individual teachers whatsapp contacts and groups to ensure high response rates. Teachers were instructed to answer honestly, and the process was anonymous to promote candid responses. Also and more importantly, those who were interviewed were followed from their respective schools.

Data Analysis

Research Question 1: What are the perceptions among Secondary School teachers on the integration of AI in mathematics classrooms? This question generated descriptive statistics i.e. mean, standard deviation, frequency tables, pie charts and bar charts.

Research Question 2: What is the relationship between teachers' TPACK and their attitude towards AI in mathematics? This question was answered with the help of Pearson correlation by measuring the strength of the relationship.

Validity and Reliability

Instrument Validity: The questionnaire underwent **content validity** testing by a group of colleagues who are also mathematics educators to ensure it measured the intended constructs. The researcher gave out a draft questionnaire to 10 educators before coming up with a final one which was sent to the actual respondents.

Ethical Considerations

The study was adhered to ethical research practices, including:

- **Confidentiality**: All data was anonymized, and individual results were not shared with schools or third parties.
- **Right to Withdraw**: Participants were informed that they had the right to withdraw from the study at any time if they felt so.

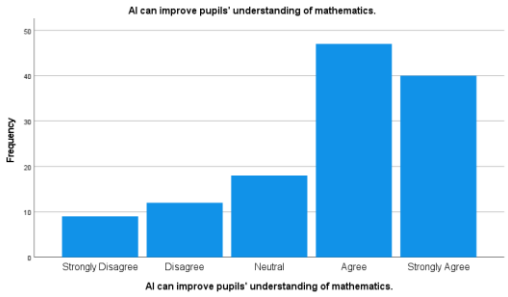
RESULTS

Data was collected to only 127 respondents for quantitative and 10 respondents for qualitative. This gave a response rate of 94.8% for quantitative analysis while a 100% response rate for qualitative analysis since all the planned 10 respondents responded to the interviews.

❖ QUANTITATIVE ANALYSIS

Mathematics Teachers' Perceptions of AI in Mathematics Classrooms

Figure 1 *Teachers' responses on whether AI can improve pupils' understanding of mathematics*



According figure 1, 69.05% (88 out of 127) teachers believe that AI can improve pupils' understanding of mathematics while 14.29% (18) are not sure whether it can or not. Nevertheless, 16.66% (21) do not believe that it can.

If, however it can improve understanding, can it then improve the poor performance which continuously has been recorded? Regarding figure 2, 57.6% (73) teachers are in agreement while 24.8% (32) are neutral and 17.6% (22) are in disagreement.

Figure 2 *Teachers' responses on whether AI could help improve the poor mathematics performance*

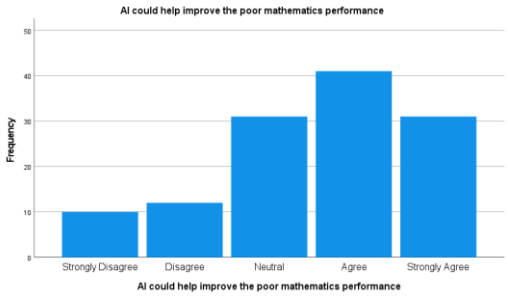


Figure 3

Teachers' responses on whether AI can enhance Problem-Solving skills in mathematics

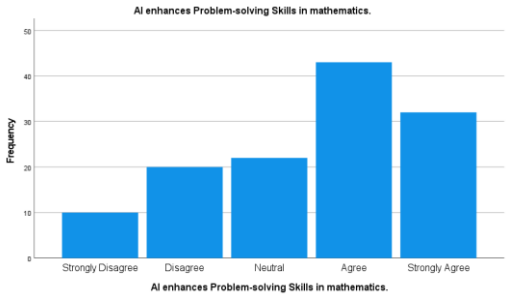


Figure 3 shows that 59.06% (75) teachers think that AI enhances problem-solving skills in mathematics while 23.62% (30) think otherwise and 17.32% (22) are not sure.

Are AI tools too complex for classroom use? Figure 4 shows that only 47.2% (60) believe that AI tools are not complex for classroom use, 25.6% (33) are neutral about it and 27.2% (34) believe so.

Figure 4 *Teachers' responses on AI tools complexity for classroom use*

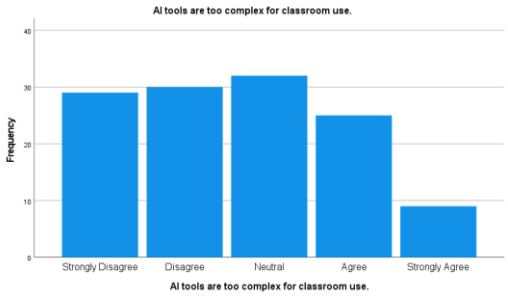


Table 1

Relationship between teachers' TPACK and their view on whether AI can improve pupils' understanding of mathematics

		On a scale of 1 - 5, how do you rate your understanding of how to align technology with mathematics content?	AI can improve pupils' understanding of mathematics.
On a scale of 1 - 5, how do you rate your understanding of how to align technology with mathematics content?	Pearson Correlation	1	0.109
	Sig. (2-tailed)		0.225
	Sum of Squares and Cross-products	136.159	17.063
	Covariance	1.089	0.137
	N	126	126
AI can improve pupils' understanding of mathematics.	Pearson Correlation	0.109	1
	Sig. (2-tailed)	0.225	
	Sum of Squares and Cross-products	17.063	180.325
	Covariance	0.137	1.443
	N	126	126

In table 1, Pearson correlation is 0.109 which means that there is a very weak positive relationship and p-value is 0.225 which is greater than 0.05 meaning not statistically significant. Therefore, there is a very weak positive and not statistically significant relationship between teachers' TPACK and their belief that AI may improve pupils' understanding of mathematics.

There is no strong evidence to support that teachers' TPACK levels influences their belief whether AI improves pupils' understanding of mathematics.

Table 2

Relationship between teachers' TPACK and their view on whether AI enhances Problem-Solving Skills in mathematics

		On a scale of 1 - 5, how do you rate your understanding of how to align technology with mathematics content?	AI enhances Problem-solving Skills in mathematics..
On a scale of 1 - 5, how do you rate your understanding of how to align technology with mathematics content?	Pearson Correlation	1	-0.028
	Sig. (2-tailed)		0.997
	Sum of Squares and Cross-products	136.159	-0.048
	Covariance	1.089	0.000
	N	126	126
AI enhances Problem-solving Skills in mathematics.	Pearson Correlation	-0.028	1
	Sig. (2-tailed)	0.997	
	Sum of Squares and Cross-products	-0.048	195.654
	Covariance	0.000	1.553
	N	126	127

In table 2, Pearson correlation is -0.028 which means that there is extremely weak (negligible) negative relationship and p-value is 0.997 which is greater than 0.05 meaning not statistically significant. Therefore, there is extremely weak negative (negligible) and not statistically significant relationship between teachers' TPACK and their belief that AI enhances problem-solving skills.

Teachers views on the role of AI in enhancing problem-solving skills does not predict their TPACK levels.

Table 3

Relationship between teachers' TPACK and their thought on the complexity of AI in mathematics classroom

		On a scale of 1 - 5, how do you rate your understanding of how to align technology with mathematics content?	AI tools are too complex for classroom use.
On a scale of 1 - 5, how do you rate your understanding of how to align technology with mathematics content?	Pearson Correlation	1	-0.090
	Sig. (2-tailed)		0.321
	Sum of Squares and Cross-products	136.159	-14.371
	Covariance	1.089	-0.117

	N	126	124
AI tools are too complex for classroom use.	Pearson Correlation	-0.090	1
	Sig. (2-tailed)	0.321	
	Sum of Squares and Cross-products	-14.371	190.800
	Covariance	-0.117	1.539
	N	124	125

In table 3, Pearson correlation is -0.090 which means that there is a very weak negative relationship and p-value is 0.321 which is greater than 0.05 meaning not statistically significant. Therefore, there is a very weak negative and not statistically significant relationship between teachers' TPACK and their belief that AI tools are too complex for classroom use.

Teachers' TPACK does not strongly influence their perception of whether AI tools are too complex for classroom use.

Table 4

Relationship between teachers' TPACK and their view on whether AI could help improve the poor mathematics performance

		On a scale of 1 - 5, how do you rate your understanding of how to align technology with mathematics content?	AI could help improve the poor mathematics performance.
On a scale of 1 - 5, how do you rate your understanding of how to align technology with mathematics content?	Pearson Correlation	1	0.046
	Sig. (2-tailed)		0.609
	Sum of Squares and Cross-products	136.159	7.048
	Covariance	1.089	0.057
	N	126	124
AI could help improve the poor mathematics performance.	Pearson Correlation	0.046	1
	Sig. (2-tailed)	0.609	
	Sum of Squares and Cross-products	7.048	176.672
	Covariance	0.057	1.425
	N	124	125

In table 4, Pearson correlation is 0.046 which means that there is extremely weak (negligible) positive relationship and p-value is 0.609 which is greater than 0.05 meaning not statistically significant. Therefore, there is extremely weak positive (negligible) and not statistically significant relationship between teachers' TPACK and their belief that AI could improve poor mathematics performance.

The way teachers perceive AI in terms of improving the poor mathematics performance does not relate to their understanding of how to align technology with mathematics content.

Table 5

Relationship between teachers' TPACK and their overall perception of AI's role in mathematics education

		On a scale of 1 - 5, how do you rate your understanding of how to align technology with mathematics content?	What is your overall perception of AI's role in mathematics education?
On a scale of 1 - 5, how do you rate your understanding of how to align technology with mathematics content?	Pearson Correlation	1	0.087
	Sig. (2-tailed)		0.331
	Sum of Squares and Cross-products	136.159	7.254
	Covariance	1.089	0.058
	N	126	126
What is your overall perception of AI's role in mathematics education?	Pearson Correlation	0.087	1
	Sig. (2-tailed)	0.331	
	Sum of Squares and Cross-products	7.254	50.706
	Covariance	0.058	0.406
	N	126	126

In table 5, Pearson correlation is 0.087 which means that there is a very weak positive relationship and p-value is 0.331 which is greater than 0.05 meaning not statistically significant. Therefore, there is a very weak positive relationship between teachers' TPACK and their overall perception of AI in mathematics education.

Teachers' overall perception of AI does not really show their level of TPACK

❖ QUALITATIVE ANALYSIS

Teachers' perceptions of AI

Theme 1: AI Relevance in mathematics

Participant 1: Yes, it is relevant and can be used in nearly all mathematical topics. Give it a prompt asking for steps of solving a particular problem where you find challenges

Participant 2: I do not think it is relevant

Participant 3: Yes, I believe it is relevant but I have not used it before in any topic in mathematics.

Participant 4: It is tricky to answer, it both helps and destroys. Therefore, there is need of proper understanding of the tools and how best to use them to the betterment of the learners.

Participant 5: Not so sure for now.

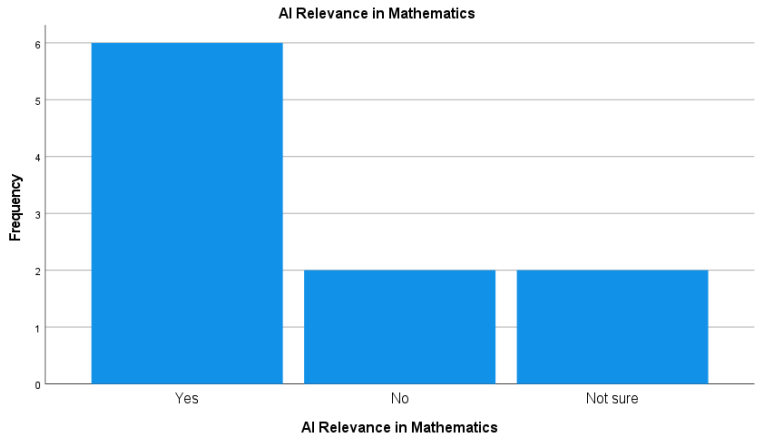
Participant 6: Not sure and I do not trust it that much since sometimes it gives wrong answers.

Participant 7: It is a good thing and I have welcomed it with open hands since it is here to make our work easier.

Participant 8: I believe it is relevant but we need more workshops on how to integrate it to our teaching. All the topics can make use of it.

Participant 9: It is relevant to mathematics in a sense that it gives ideas where one is not very sure of certain mathematical concepts. It able to give answers from diverse range of topics from primary to tertiary education.

Participant 10: it is relevant since it helps where one gets stuck. They can just ask the app where they are not clear and it gives a step by step procedure on how to go about answering a particular problem they wish to solve.



From the interviews, it can be deduced that very few teachers are using AI in mathematics despite the fact that they feel it is relevant in teaching. This is due to not having enough knowledge on how it should be integrated into the classroom.

Theme 2: AI and enhancement of problem-solving skills in mathematics

Participant 1: AI can enhance problem-solving skills but only if it is used properly.

Participant 2: No, AI cannot enhance problem-solving skills. It can even do the opposite

Participant 3: AI can enhance problem-solving skills of learners if used properly with guidance from teachers.

Participant 4: AI can enhance problem-solving skills if used properly.

Participant 5: Not sure if AI can enhance problem-solving skills and need more understanding on how it works.

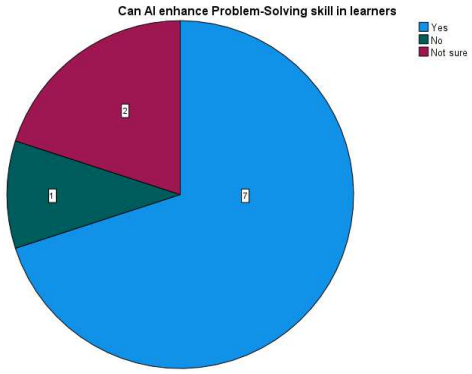
Participant 6: Not sure if AI can enhance problem-solving skills in learners.

Participant 7: I believe AI can enhance problem-solving skills in learners though more trainings are needed especially to us who are not conversant on how to use it.

Participant 8: AI can enhance problem-solving skills but only if proper guidelines are put in place.

Participant 9: AI can enhance problem-solving skills but it is entirely dependent on how a learner is using the tool because to some it can even affect their critical thinking negatively.

Participant 10: Yes, AI can enhance problem-solving skills in learners with guidance from teachers.



Inasmuch as 70% (7 out of 10) of teachers believe that AI can enhance problem-solving skills in mathematics, they additionally believe that more understanding on the right use is needed from both the teachers and learners.

Relationship between mathematics teachers' TPACK and AI adoption

PARTICIPANT	CONFIDENCE	USE TECHNOLOGY	RELATIONSHIP
1	Confident	Occasionally	Yes
2	Somewhat confident	Occasionally	Yes and No
3	Somewhat confident	Occasionally	Yes
4	Confident	Occasionally	Yes and No
5	Confident	Occasionally	Yes and No
6	Somewhat confident	Occasionally	Yes
7	Not confident	No	Yes
8	Confident	Occasionally	Yes and No
9	Confident	Occasionally	Yes
10	Confident	Occasionally	Yes

Of the ten (10) teachers who were interviewed, six (6) said that they were confident in integrating technology in their mathematics classrooms. From these, three (3) agreed that having a strong TPACK makes it easier for teachers to adopt AI in mathematics. Nevertheless, the other three (3), believe that TPACK is not always a factor in a sense that a teacher may be good in using technology in their teaching but they can never adopt AI if they believe it to be not helpful. The following is sample of the two opinions to the relationship between TPACK and AI adoption in classrooms:

Participant 3: Yes, when you are conversant with how to use digital tools and educational software in teaching, it becomes easier even to adopt AI tools.

Participant 2: Yes, and No. There may be teachers who are very good in using technology in their teaching but they may believe AI to be a danger to humankind. The two are not related though AI is part of technology as well but serves a different purpose to that of ordinary technology.

Integration of Quantitative Analysis and Qualitative Analysis

How AI is perceived by Mathematics teachers

a. **Enhancement of Problem-Solving Skills**

Quantitative finding

57.6% of teachers think that AI can improve the poor mathematics performance. Additionally, 59.06% think it can enhance problem-solving skills in learners.

Qualitative finding

7 out of 10 teachers agreed that AI can enhance problem-solving skills in mathematics but this can only be achieved if proper guidance is provided from both the teachers and learners.

Integrated finding

It is commonly quoted that knowledge is power and that people perish due to the lack of it. Therefore, AI has the potential to enhance problem-solving skills in learners if they have proper information on how to use it.

b. **AI and reduction of teachers' workload**

Quantitative Finding

Teachers believe that AI can reduce their workload but however, this can also negatively affect teacher-pupil interaction.

Qualitative Finding

Very few teachers are using AI in mathematics. Nevertheless, those who are not using it is because they have little knowledge on how it should be integrated into the classroom. However, a good number still believe that it is relevant to be adopted in education.

Integrated Finding

AI can reduce the workload of teachers but more information is needed on the use to strike a balance so that it does not affect teacher-pupil interaction negatively.

How Related is Teachers' TPACK and their Attitude Towards AI

Quantitative finding

Teachers believe that having a strong TPACK makes it easier to adopt AI in teaching. While a statistical correlational analysis revealed that teachers with higher levels of TPACK feel slightly comfortable to use AI-driven platforms to teach mathematics. Also and more importantly, the analysis revealed that teachers' perception of AI does not relate to their TPACK levels in mathematics.

Qualitative finding

There is a balanced view amongst the teachers on whether having a strong TPACK may make it easier to adopt AI in mathematics. Some said it can and others said it depends on the belief an individual has of AI despite their TPACK levels.

Integrated finding

Teachers' perception of AI does not relate to their TPACK levels in mathematics

DISCUSSION OF RESULTS

Complexity of AI Tools for Classroom Use

Results showed that slightly over half of the sample of the population of this study, believe AI to be complex for classroom use. Manuel and Valderama (2025) in their study advised that teachers of mathematics must be engaged in CPDs for them to be equipped with the necessary skills aligned with the use of AI. This is because technical issues, curriculum misalignment, ethical concerns and cultural barriers like difficulties in adapting AI-generated content to local contexts are one of the notably challenges which may be there in the integration of Artificial Intelligence in mathematics education (Filiz et al., 2025).

Findings from the interviews interestingly showed that a good number of teachers claim to be confident in using technology but they do not use it that often in classrooms. The reason to this may be what Chama and Subaveerapandiyan (2023) points out that most teachers have access to digital devices and possess moderate to high levels of digital skills but they only lack alignment into education. Egara and Mosimege (2024) also points out that there is need of customizing of these tools to accommodate diverse learning styles. Therefore, mathematics educators must learn how to give correct prompts to the tools in order for them to get intended feedback they are looking for. Besides, they should also be equipped with content knowledge so that they can also evaluate the solutions given by AI since it is prone to error (Cheng, 2025).

The Role of AI in Workload of Mathematics Teachers

Interestingly, the findings of this study indicates that AI can reduce workload of mathematics teachers and there is a balanced view on whether it can affect teacher-pupil interaction negatively. This is in concurrence with the findings of Celik et al. (2022) who noted that AI helps teachers in planning, implementation and assessment work by identifying students' needs to come up with the most suitable learning contents and activities for them. On the contrary, Wardat et al. (2024) discovered that there is need to exert more effort in AI-based teaching than in traditional method especially when using different AI systems and applications. This pressure placed on them may be the reason for resistance in adoption. On the other hand, studies such as Wang et al. (2024) and Delello et al. (2025) believe that AI saves time as well as reduces stress through automation. Nevertheless, Wang et al. (2024) emphasized on the potential threat on process, using AI may lead

to bypassing problem solving skills of both teachers and learners. While, Delello et al. (2025) believe it may lead to social isolation due to reduced interpersonal interactions.

However, AI is capable of significantly enhances instructional planning which in the long run can directly improves students' performance (Alwakid et al., 2025). Chan and Tsi (2023) highlights the need for educators to develop AI literacy as well as to have an understanding of how to work with it in order to deal with practical issues to do with data protection, ethics and privacy.

The Study's Limitations

The study only focused on understanding the relationship of teachers' TPACK levels and their attitude towards adoption of AI in mathematics classroom. It may be also helpful to understand learners' attitude towards AI in mathematics classroom.

SUMMARY, CONCLUSION AND RECOMMENDATION

Summary

Secondary School teachers of Mufulira district of Zambia generally have a positive attitude towards Artificial Intelligence, AI, and they believe it can help them in the reduction of their teaching workload. However, it was noted that more understanding of the tools is needed in order to strike a balance so that it does not eventually affect teacher-pupil interaction negatively.

The first objective of this study was to investigate the perception of secondary school teachers on the integration of AI in mathematics classrooms. Generally, the findings show that secondary school teachers of Mufulira district have a positive perspective of the integration of AI in mathematics classrooms.

The second and last objective was to determine the relationship between teachers' TPACK and their attitude towards AI in mathematics. Teachers' TPACK has little influence on their attitude towards AI in mathematics. Although those teachers with less or zero levels of TPACK are likely to have a negative attitude towards AI in mathematics.

Conclusion

An English common adage say that not all that glitters is gold. By all means, the effectiveness of technology integration in classrooms lies in strong TPACK levels amongst teachers. Nevertheless, teachers TPACK levels has less to do with their attitude or intention towards adoption of AI in teaching and learning of mathematics.

Therefore, this study's contribution to the body of knowledge and literature, is the reaffirmation of the proverbial question of glass being half-full or half-empty. It is the emphasis of attitude being more important than TPACK in the adoption of AI in mathematics classrooms.

Recommendations

Inasmuch as TPACK is cardinal in the proper implementation of Artificial Intelligence, AI, in mathematics education, policymakers and curriculum developers should pay more attention to address best practices of using AI-based learning tools in order to change the general perspective of those mathematics teachers with a negative attitude towards it. Further, future research should also look at learners' attitude towards generative AI in mathematics classrooms.

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