



**EVALUATING THE IMPACT OF ARTIFICIAL INTELLIGENCE ON
TEACHING AND LEARNING MATHEMATICS: A CASE STUDY OF
SELECTED SECONDARY SCHOOL TEACHERS IN TORORO DISTRICT
AND STUDENTS AT BUSITEMA UNIVERSITY, NAGONGERA CAMPUS.**

BY

CHELANGAT MARK

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**A RESEARCH REPORT SUBMITTED TO THE DEPARTMENT OF
MATHEMATICS IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE AWARD OF A DEGREE OF BACHELOR OF
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DECLARATION

I, CHELANGAT MARK, hereby declare that this research report is my original work and has not been submitted to any institution of higher learning for the award of any academic qualification to any other university.

Signature  Date 17th AUGUST, 2026

Chelangat Mark

BU/UP/2023/1641

APPROVAL

This research report has been submitted for examination with the approval of my university supervisor.

Signature 

Date : 17th August, 2026

Dr. Kadedesya Stephen

DEDICATION

This work is dedicated to my beloved parents Mr. Michael Kiteywo and Mrs. Joseline Chesang, family members, lecturers, and friends whose encouragement, support and guidance enabled me to complete my studies successfully. I also dedicate this work to all mathematics teachers and students who strive to improve teaching and learning through the effective use of technology.

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I would like to express my sincere gratitude to Almighty God for granting me life, strength, wisdom, and good health throughout the course of this study.

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Abstract.

This study examined the influence of Artificial Intelligence (AI) on mathematics teaching and learning among 15 secondary school teachers in Tororo District and 60 university students at Busitema University, Nagongera Campus. A mixed-methods design was employed, using questionnaires, and interviews.

Findings revealed that 73% of teachers and 93% of students used AI tools, while 70% of students reported that AI helped them understand concepts and 90% supported AI integration in university learning, most remained neutral about whether AI improved their actual academic performance. Teachers acknowledged that AI saved time (80%) and speed up assessment (67%), but only 20% believed it enhanced students' conceptual understanding. Major challenges included inaccurate AI responses, poor internet, limited lecturer guidance, power disruptions, and high data costs.

The study concludes that AI is widely adopted for routine support but its impact on deep mathematical comprehension remains limited. Teachers' doubtfulness highlights a gap between perceived usefulness and pedagogical effectiveness. Recommendations include improving infrastructure, training teachers, and conducting experimental studies on AI's causal effects on learning outcomes.

1.0 CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

Mathematics represents a field of study centered on solving problems, applying logical reasoning, recognizing patterns, and representing real-life situations through abstract models. This subject provides essential competencies for everyday living and academic development, enabling individuals to think quantitatively and address complex challenges (Egara, 2024)

Globally, educational systems have been experiencing a technology-driven shift fueled by the Fourth Industrial Revolution. Various digital innovations including distributed computing, large-scale data analysis, automated learning systems, and Artificial Intelligence (AI) have been reshaping the methods through which educational content is delivered, accessed, and evaluated within schools and higher education institutions (Lara et al., 2025). According to (Mishra et al., 2025) teaching and learning approaches in mathematics have experienced substantial changes following the COVID-19 pandemic due to the integration of AI-based tools.

Artificial Intelligence refers to computational systems designed to execute functions that ordinarily demand human cognitive abilities, such as acquiring knowledge, logical reasoning, solving problems, making choices, and detecting patterns (Russell, n.d.). From a mathematical perspective, AI depends heavily on logical structures and algorithmic thinking (Link, 2025).

(Gqoli & Baidoo, 2025) described AI's role in education as a major shift in teaching methodologies, bringing both significant possibilities and difficulties for instructors, educational leaders, and those who shape academic policy. Within educational contexts, AI has facilitated the examination of student behavior, customization of teaching approaches, and delivery of immediate responses to learners (Holmes et al., 2019; Opesemowo & Ndlovu, 2024).

This study focused on two distinct but related populations, secondary school mathematics teachers who used AI solutions to enhance their teaching practices, and university students who used AI tools to support their mathematics learning. By examining both groups, the research provided a comprehensive understanding of how AI affects mathematics instruction from the educator's perspective and mathematics learning from the learner's perspective.

1.2 Problem Statement

Mathematics constitutes a foundational subject within education because it underpins logical thinking, scientific reasoning, and technological progress. At the secondary school level, mathematics remains compulsory within the curriculum and serves as a prerequisite for numerous science-oriented professions at the university level. However, a large number of students have been performing poorly in mathematics and developing negative perceptions toward the subject.

Traditional teaching approaches frequently emphasized memorizing procedures rather than fostering conceptual comprehension. Secondary school educators often managed large classes, which made delivering personalized attention to each learner challenging. According to (Egara, 2024), learners experienced difficulties with mathematics because of inadequate foundational knowledge, ineffective instructional methods, and anxiety related to mathematics.

Despite the promising solutions offered by AI, how effectively Artificial Intelligence functioned within actual classroom and university settings remained uncertain across many Ugandan institutions. Therefore, this study sought to determine whether employing Artificial Intelligence enhanced secondary school teachers' mathematics instruction effectiveness and university students' academic achievement.

1.3 Objectives of the Study

1.3.1 General Objective

To evaluate the impact of Artificial intelligence on teaching and learning mathematics among teachers and students.

1.3.2 Specific Objectives

- a) To identify Artificial Intelligence resources utilized by secondary school mathematics teachers and students at Nagongera campus, Busitema university.
- b) To establish the effect of Artificial Intelligence on university students' academic achievement in mathematics.

- c) To assess university students' attitudes toward mathematics learning supported by Artificial Intelligence.
- d) To identify the challenges encountered by secondary school teachers when integrating Artificial Intelligence into mathematics instruction.

1.4 Research Questions

- a) Which Artificial Intelligence resources are employed by secondary school mathematics teachers and university students?
- b) How does Artificial Intelligence affect university students' performance in mathematics?
- c) What attitudes do university students hold regarding AI-supported mathematics learning?
- d) What challenges do secondary school teachers face when incorporating Artificial Intelligence

1.5 Scope of the Study

This investigation concentrated on the application of Artificial Intelligence in mathematics instruction among secondary school teachers and mathematics learning among students at Busitema University, Nagongera campus. The research involved 15 mathematics teachers from four selected secondary schools and 60 university students from Busitema University, Nagongera Campus.

1.6 Significance of the Study

The outcomes of this research benefit multiple stakeholders including;

University students to understand the potential benefits and challenges of using artificial intelligence in mathematics learning. It may also provide insights into how AI tools can support independent learning, improve understanding of mathematical concepts, provide immediate feedback and the findings may encourage students to use AI responsibly as a learning support tool rather than relying it entirely.

Secondary school teachers, the findings will help teachers of mathematics understand how AI can be effectively integrated into mathematics instruction. The research may provide insights into the benefits of AI-supported teaching, such as lesson planning, assessment, personalized learning. It will also highlight challenged teachers may face when adopting AI.

Administrators, the research will provide administrators with information about the opportunities and challenges associated with integrating AI into mathematics education. This may help help them make informed decisions regarding the provision of ICT infrastructure, internet access, teacher training, etc.

curriculum designers, the research may provide evidence on the skills, knowledge, and competencies the students and teachers need to effectively use AI in mathematics education.

Policy makers, the research will provide evidence on the impact, opportunities, and challenges of using AI in mathematics teaching and learning. This information may support the development of appropriate policies, guidelines, and strategies for the responsible integration of AI into education

Researchers, the study will contribute to the existing body of knowledge on the use of AI in mathematics education. It may serve as a reference for future researchers interested in AI mathematics teaching and learning, and educational technology.

2.0 CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

According to the literature, the integration of Artificial Intelligence into mathematics education drew significant attention from scholars worldwide. This chapter examined existing knowledge on how AI affected mathematics teaching and learning, the theoretical foundations that explained its impact, AI tools being used, challenges of AI adoption, and gaps in the literature.

(Holmes et al., 2019), noted that mathematics learning demanded ongoing practice, timely feedback, and appropriate guidance. In many secondary school classrooms, teachers struggled to provide individual attention due to large class sizes. At the university level, students often lacked immediate assistance when encountering difficult concepts. According to these scholars, AI emerged as a promising solution by offering personalized, responsive learning experiences. (Mishra et al., 2025) added that AI could guide learners through problem-solving, track progress, and provide explanations that supported deeper understanding.

2.2 AI Tools in Mathematics Education

According to (Gqoli & Baidoo, 2025), AI applications in mathematics learning fell into four categories: intelligent tutoring systems, adaptive learning platforms, automated assessment tools, and real-time feedback mechanisms. (Holmes et al., 2019) propose a complementary framework distinguishing learning with AI, learning about AI, and preparing for AI, which helps categorize the tools identified in the present study.

(Wardat, 2023) identified ChatGPT as the most widely used AI tool in mathematics education. It enhanced mathematical skills and contributed to educational success. However, they noted that ChatGPT had limitations in comprehending geometry and correcting misconceptions. Its accuracy varied depending on the complexity of the equation and the specificity of instructions provided.

(Mishra et al., 2025) reported that Photo-math and Symbolab allowed learners to photograph or type problems and receive step-by-step solutions. These tools were particularly helpful for students needing additional support outside class hours.

2.3 Impact of AI on Mathematics Teaching and Learning

(Graesser et al., 2018), found that intelligent tutoring systems delivered step-by-step guidance and hints when learners made errors. Learners who used these systems achieved higher scores because they practiced more extensively and received immediate correction of mistakes.

(Chen & Chen, 2020) reported that adaptive learning platforms analyzed learner responses and presented problems at an appropriate difficulty level. Learners neither felt overwhelmed nor bored, leading to increased participation and consistent learning.

For secondary school teachers, (Holmes et al., 2019) found that AI tools supported classroom management and instructional planning. Teachers could view learner progress summaries and quickly identify struggling students. Instead of spending hours marking exercises manually, teachers focused on providing targeted support. (Egara and Mosimege 2024) discovered that ChatGPT supported lesson planning, allowing teachers to generate practice problems and quizzes efficiently.

For university students, (Mishra et al., 2025) reported that AI applications such as ChatGPT, and Photomath improved problem-solving skills through personalized feedback and step-by-step guidance. These tools helped students understand complex topics in calculus, algebra, and statistics. However, a counter-view is offered by (Ogoke et al., 2025), who found that students taught geometry without AI achieved higher retention scores than those who used AI tools, suggesting that over-reliance may undermine long-term memory formation..(Maulida et al., 2024) added that AI served as a continuous private instructor, assisting with challenging ideas and offering supplementary exercises. According to their findings, AI-powered educational games encouraged motivation and improved learning outcomes (Panaoura, 2025).

2.4 Theoretical Foundations on students' attitudes.

According to (Holmes et al., 2019), constructivist learning theory proposed that learners understood more effectively when they actively engaged with content. Students needed to

attempt problems, make mistakes, and correct them. AI systems supported this process because learners interacted with tasks and received immediate responses. (Luckin, 2018) extends this view by proposing an interwoven intelligence model comprising seven elements, arguing that AI typically supports only academic knowledge (Element 1) but cannot develop metacognitive or self-efficacy elements essential for deep understanding.

(Kulik & Fletcher, 1882) explained that mastery learning theory suggested learning should advance from simple to complex concepts. AI systems adjusted difficulty according to learner performance. A struggling student received additional practice, while an advanced student received more challenging tasks.

(Gqoli & Baidoo, 2025) combined Cognitive Load Theory and the Technology Acceptance Model as complementary frameworks. Cognitive Load Theory maintained that successful learning occurred when cognitive demands remained within manageable limits. The Technology Acceptance Model asserted that perceived usefulness and ease of use predicted whether individuals would adopt a new technology.

(Zhang, 2025) emphasized that motivation theory also played a role. Students performed better when interested and self-assured. Interactive digital learning environments made learning enjoyable and maintained attention, reducing anxiety and increasing engagement.

2.5 Challenges of AI Integration

(Holmes et al., 2019) identified significant challenges that hindered effective AI integration. Many schools lacked adequate computers, reliable electricity, or stable internet connections. Without these basic requirements, AI tools could not be deployed successfully. (Maulida et al., 2024) added that teachers and students also lacked training to use AI tools properly.

According to (Egara and Mosimege 2024), many mathematics teachers possessed limited knowledge of AI-based tools. In their study, only seventeen percent of teachers demonstrated familiarity with ChatGPT. Challenges included technical adaptability, curriculum alignment, and customization for diverse learning styles.

(Mishra et al., 2025) warned that over-reliance on AI posed a risk to student development. When students depended too heavily on AI, they failed to develop fundamental thinking skills and independent problem-solving abilities (Opesemowo & Ndlovu, 2024).

(Almario et al., 2023) observed that the digital divide created unequal access to AI tools. Students from wealthier or urban areas had better access to devices and internet connectivity. They also noted that student attitudes toward AI-supported learning had not been thoroughly examined, and access to AI differed between rural and urban settings (Zulhilmi et al., 2022).

2.6 Research Gap

Despite the vast literature on AI, there is still limited empirical evidence on its impact on the teaching and learning of mathematics, particularly within the Ugandan educational context. Existing studies have mainly focused on the general applications and potential benefits of AI in education, with limited attention to student's attitudes towards AI-supported mathematics learning and challenges secondary school teachers encounter when integrating AI into mathematics instruction. Therefore, this study seeks to address this gap by evaluating the impact of AI on teaching and learning mathematics.

3.0 CHAPTER THREE: METHODOLOGY

3.1 Introduction

This chapter describes the systematic procedures that were followed to carry out the study. It covers the research design, study population, sampling methods (including random and purposive sampling), sample size, data types and sources, data collection methods (questionnaires and interview guide), and data processing and analysis.

3.2 Research Design

The study employed a mixed-methods research design, which combined quantitative and qualitative approaches. The quantitative component involved the collection of numerical data through achievement tests and structured questionnaires to measure students' mathematics performance and the frequency of AI tool usage. The qualitative component involved the collection of narrative data through semi-structured interviews to gather in-depth opinions and experiences from teachers and students regarding the benefits and challenges of using AI in mathematics education.

3.3 Study Population

The study population consisted of two distinct groups. The first group was secondary school mathematics teachers working in four selected schools, namely Great Aubrey Memorial College, Petta community Secondary School, Kisoko high school and Rubongi Army Secondary School. This is because these are the schools with good ICT facilities in Tororo district.

The mentioned schools were considered relevant to the study and provided an appropriate representation of the target population. The schools were also selected based on their accessibility to the researcher, availability of mathematics teachers as respondents and their suitability for providing the information required to address the objectives of the study. Although

other schools could have been included, the selection of these schools was considered appropriate given the scope, time, and resources available for the study.

The second group was university students enrolled in mathematics courses at Busitema University, Nagongera Campus. These frequently use AI in their mathematical work.

3.4 Sampling Methods

In this study, two sampling methods were applied: Random sampling and Purposive sampling. Random sampling was used to select students because it gave each student an equal or known chance of being selected to participate in the study. This help reduce selection bias and ensured that the students selected were reasonably representative of the wider student population. Purposive sampling was used to select secondary school mathematics teachers because they possess specific knowledge and experience relevant to the study on integration of AI in teaching mathematics. Each method was chosen based on the nature of the participant group and the objectives of the study.

3.4.1 Random Sampling

This method was used to select the 60 university students. Specifically, stratified random sampling was applied, where the student population was first divided according to their year of study (Year 1, Year 2, and Year 3). Students were then selected randomly using a simple random sampling procedure. This ensured that all year levels were fairly represented in the final sample.

3.4.2 Purposive Sampling

This method was used to select the 15 secondary school mathematics teachers. Only teachers who had experience using Artificial Intelligence tools such as ChatGPT, Photomath, or adaptive learning platforms were included. Purposive sampling was appropriate because the study required individuals who could provide rich and relevant information about AI integration in mathematics instruction.

3.5 Sample Size

Category	Sample size	Sampling technique
Teachers	15	Purposive sampling
Students	60	Random sampling
Total	75	

Table 1 sample size considered

The total sample size for this study was 75 participants, comprising 15 secondary school mathematics teachers and 60 Busitema University, Nagongera students. This number was considered adequate for a mixed-methods study because it allowed for meaningful quantitative analysis while also enabling the researcher to conduct in-depth qualitative interviews with a subset of the participants.

3.6 Data Types and Sources

Data are classified into two types based on their source: primary data and secondary data. In this study, both types were used to ensure comprehensive information gathering.

3.6.1 Primary data

The primary data for this study came from the responses to the structured questionnaires, the scores from the mathematics achievement tests, and the verbatim transcripts of the semi-structured interviews. These data formed the main basis for answering the research questions.

3.6.2 Secondary Data

In this study, secondary data were obtained from books, academic journals, previous research studies on AI in education, school and university academic records, government education policy documents, and online scholarly databases. Secondary data were primarily used to support the literature review and to provide context for the findings.

3.7 Data Collection Methods

This study used three main methods: questionnaires, an interview guide, and an achievement test. Each method was designed to capture specific types of data aligned with the research objectives.

3.7.1 Questionnaires

Two structured questionnaires were administered: one for teachers and one for students. The teacher questionnaire collected demographic information (gender, age, teaching experience, qualification), AI usage patterns (which tools and how often), perceptions of AI impact, and challenges faced. The student questionnaire collected demographic information (gender, class level), AI usage, and attitudes toward AI-supported learning using a five-point Likert scale ranging from Strongly Agree to Strongly Disagree. All 75 participants completed the questionnaires in person, and the forms were collected immediately to ensure a high response rate.

3.7.2 Interview Guide

A semi-structured interview guide was developed to collect qualitative data from a subset of 10 teachers and 15 students who had agreed to participate further. The questions focused on participants' personal experiences, perceived benefits, challenges encountered, and suggestions for improving AI integration in mathematics teaching and learning.

3.7.3 Data Processing and Analysis

The data collected from the respondents were processed and analyzed to generate meaningful findings in line with the objectives of the study. The data were checked for completeness, entered, organized, and analyzed using appropriate statistical techniques. Quantitative data were analyzed using descriptive statistics, including frequencies and percentages, and presented using tables and charts. Qualitative responses were analyzed thematically by identifying common themes and patterns related to the use of artificial intelligence in mathematics teaching and learning.

3.7.4 Quantitative data

Numerical information from the questionnaires and achievement tests were processed by checking for completeness, coding the responses, and entering them into Microsoft Excel. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were

computed to summarize the participants' demographic characteristics, AI usage patterns, attitude scores, and achievement test results.

3.7.5 Qualitative data.

The transcripts were read multiple times to gain familiarity with the content. Thematic analysis was then performed, which involved identifying key statements, grouping similar ideas into categories, and developing themes that corresponded to the research questions. Direct quotations from participants were selected to illustrate each theme. Finally, the quantitative and qualitative results were integrated during the interpretation stage, allowing the researcher to compare numerical findings with participants' personal accounts and to draw meaningful conclusions.

3.7.6 Limitations and Solutions of the study

The study faced several limitations. Time was limited because data collection had to be completed within four weeks due to the academic calendar, which reduced the number of classroom observations and interviews. To address this, the researcher prioritized key activities and conducted a pilot test to refine instruments.

Limited literature on AI integration in mathematics education within the Ugandan context made it difficult to compare findings with local studies. To overcome this, the researcher drew from regional and international studies and focused on generating context-specific evidence.

Insufficient funds restricted the purchase of internet data bundles for participants and the printing of questionnaires. To mitigate this, the researcher used free AI tools where possible and leveraged institutional support for printing.

Other limitations included unstable internet connectivity (addressed by using offline tools), a small sample size of 75 participants (mitigated by mixed-methods design), self-reported data (reduced through confidentiality and triangulation), and varying AI experience among participants (addressed through screening questions). Supervised test conditions prevented student over-reliance on AI during the achievement test. Future research could adopt Zhang et al.'s (2025) approach of measuring institutional AI readiness as a moderating variable to examine how infrastructure affects teaching effectiveness.

4.0 CHAPTER FOUR: DATA PRESENTATION, ANALYSIS AND INTERPRETATION

4.1.0 Introduction

This chapter presents, analyzes, and interprets the data collected during the study. The findings are presented using tables, graphs, and charts where appropriate. The analysis is based on the research objectives and research questions of the study. The purpose of this chapter is to organize the collected data into meaningful information, interpret the findings, and draw conclusions that address the problem under investigation.

4.2.0 Background characteristics of the respondents

Gender	Frequency	Percentage
Male	41	55%
Female	34	45%

Table 2 Gender of the participants/respondents

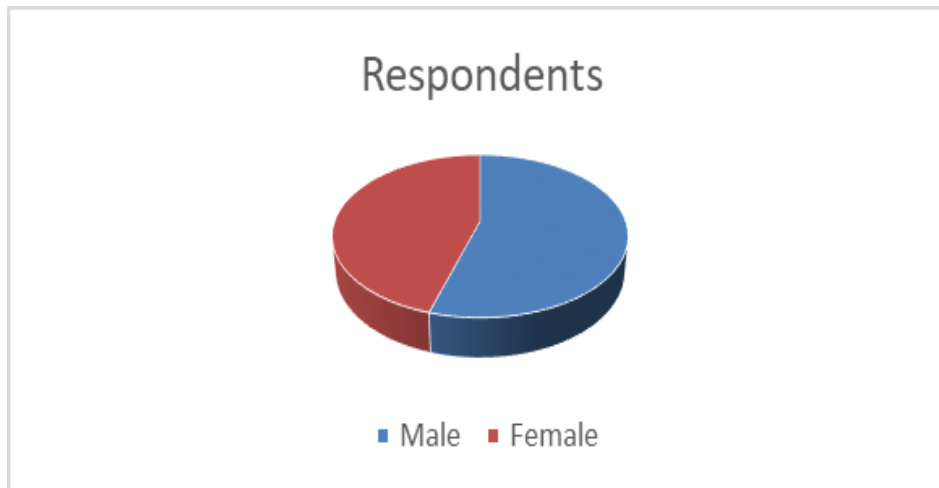


Figure 1: Gender of the respondents

From table 2 above, the study involved a total of 75 respondents, comprising 41 males (55%) and 34 females (45%). The findings indicate that male respondents constituted the majority of the study participants, accounting for 55% of the total sample, while female respondents represented 45%. This shows that both genders were fairly represented in the study, although males were slightly more than females.

4.3.0 Age Distribution of the respondents

Age (years)	Frequency	Percentage (%)
20 and below	04	05
21-23	30	40
24-26	28	37
27-30	08	11
Above 30	05	07

Table 3 Age of the respondents

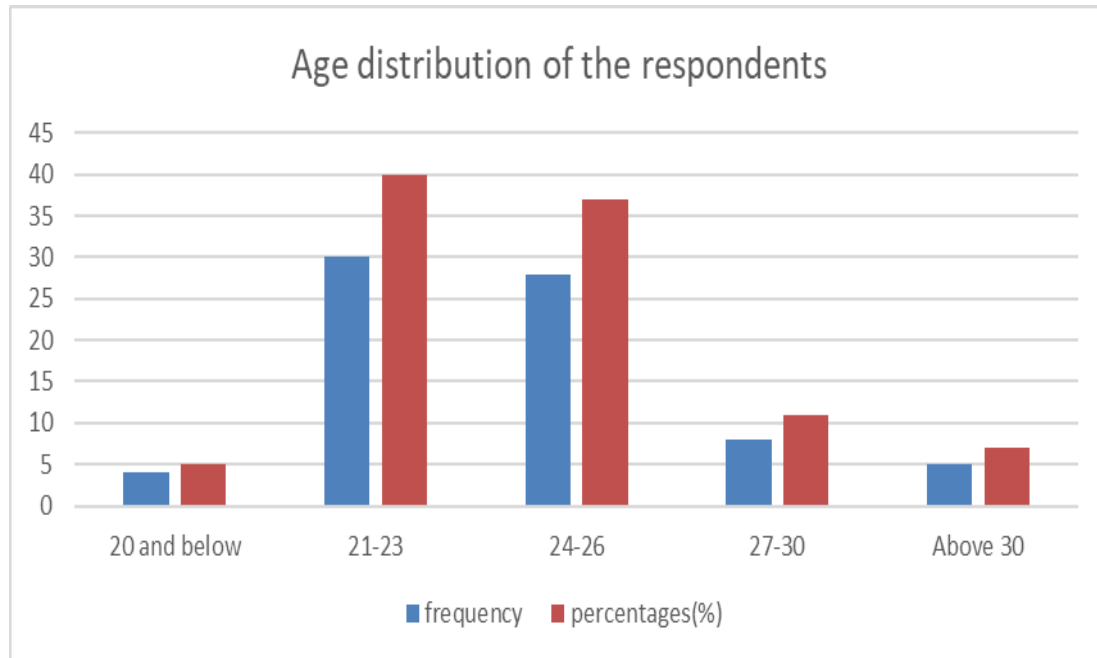


Figure 2: Age distribution of the respondents

The data in Table 3 shows that the largest proportion of respondents falls within the 21–23 age bracket, representing 40% of the sample. This is closely followed by respondents aged 24–26 years, who constitute 37%. Together, these two categories form the overwhelming majority of the study population, accounting for 77% of the participants. Conversely, mature adults aged 27–30 make up 10% while those above 30 years old represent the smallest number at 6%. Very young respondents aged 20 and below account for a minimal 5% of the total sample size

4.4.0 Qualifications

4.4.1 Academic qualifications of the respondents

Qualification	Frequency	Percentage (%)
Diploma	03	04
Undergraduate bachelor's degree holder	58	78
Bachelor's degree	09	12
Master's degree	01	01
Others	04	05
Total	75	100

Table 4 Academic qualifications of the respondents

Table 4 show that majority of the respondents were undergraduate bachelor's degree holders, accounting for 78% of the total sample. This was followed by respondents with a Bachelor's degree at 12%. Cumulatively, these two categories represented 90% of the entire study population. Conversely, Diploma holders constituted a minor 4%, while those with a Master's degree represented the smallest proportion at just 1%. Respondents categorized under "Others" made up the remaining 5% of the sample. The high concentration of respondents holding undergraduate or bachelor's degrees 90% indicated that the sample was highly educated and

possessed the foundational pedagogical knowledge necessary to evaluate technological shifts in education.

4.5.0 Use of artificial intelligence in teaching and learning mathematics.

This section presents the findings regarding the utilization of Artificial Intelligence (AI) tools in both the instructional and learning phases of mathematics education

4.5.1 Use of Artificial intelligence in teaching

Response	Frequency	Percentage (%)
Yes	11	73
No	04	27
Total	15	100

Table 5 Use of AI in teaching

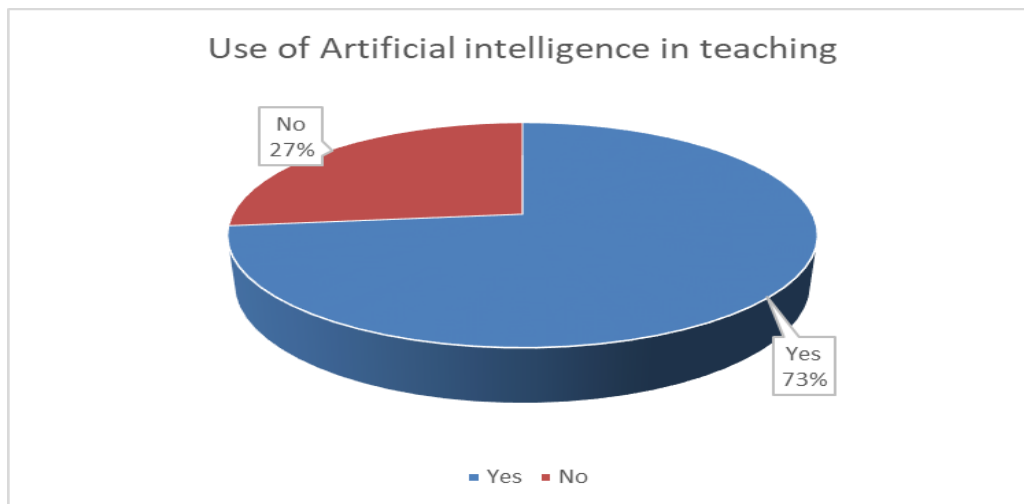


Figure 2 use of Artificial intelligence in teaching

The data in table 5 revealed that a substantial majority of the sampled educators integrated AI into their instructional delivery. Specifically, 11 respondents, representing 73% of the teaching sample, indicated that they utilized Artificial Intelligence in teaching. Conversely, a smaller

proportion consisting of 4 respondents, or 27%, stated that they did not use AI tools for instructional purposes

4.5.2 Use of Artificial intelligence in learning mathematics

Response	Frequency	Percentage (%)
Yes	56	93
No	4	7
Total	60	100

Table 6 Use of AI in learning

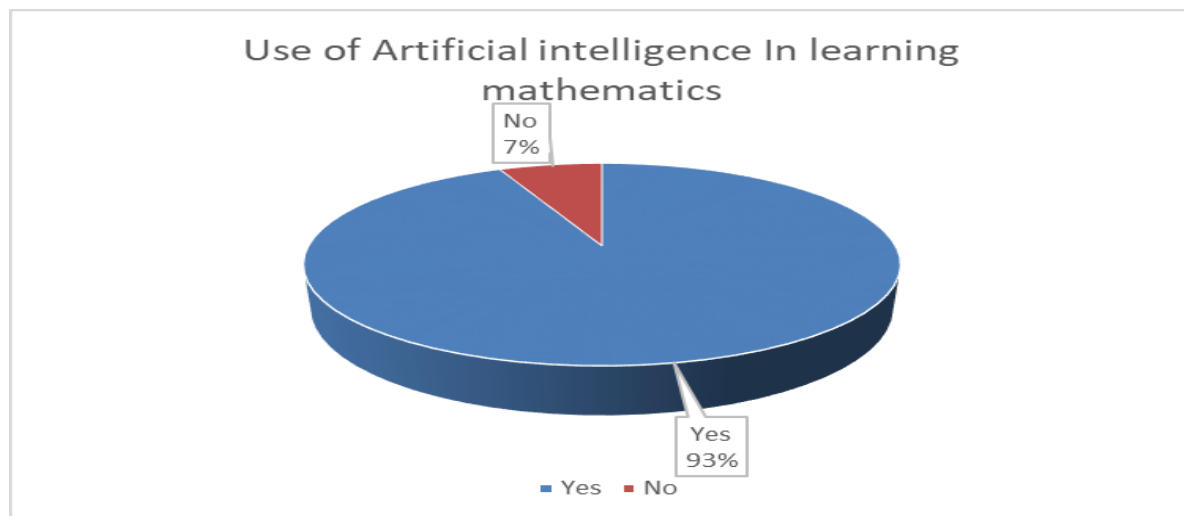


Figure 3 Use of AI in learning

As illustrated in table 6, the majority of the student respondents actively employed AI applications in their mathematics study routines. Out of 60 participants surveyed, 56 individuals (93%) confirmed using AI for learning mathematics. Only a small fraction of the sample, amounting to 4 respondents (7%), reported that they did not utilize AI tools for this purpose. The high percentage observed in this section highlighted a massive reliance on digital and AI-driven platforms among students seeking to understand mathematical concepts.

4.5.3 Artificial intelligence tools used in teaching and learning

AI tool	Frequency	Percentage (%)
ChatGPT	48	64
DeepSeek	12	16
PhotoMath	06	08
Other	9	12

Table 7 AI tools used by the respondents

From the data above, Multi-purpose AI programs took up 80% of the total use, with ChatGPT (64%) being the top choice, followed by DeepSeek (16%). On the other hand, apps made specifically for math, like PhotoMath, were used the least at only 8%, while other AI tools made up the remaining 12%.

4.6 Effects of Artificial intelligence in teaching and learning mathematics

The study gathered feedback from 60 university students and 15 mathematics instructors to compare their experiences and perspectives

4.6.0 Student attitude regarding use of Artificial intelligence.

Statement	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Frequency	Mean	Variance/standard deviation
AI helps me understand mathematics concepts	14	29	09	07	01	60	3.81	0.88/0.94
AI makes solving mathematics problems easier	04	36	12	08	00	60	3.74	0.47/0.69
AI increases my academic performance in mathematics	00	20	31	03	06	60	3.09	0.99/0.99
AI support independent learning	10	11	25	12	02	60	3.22	1.12/1.06
AI should be encouraged in university mathematics learning	41	13	05	01	00	60	4.59	0.35/0.59

Table 8 perception of AI in learning mathematics

The data in table 8 shows that students generally welcomed AI tools because they made studying math much less intimidating. About 70% of the students felt that AI helped them understand difficult mathematical concepts, the statement recorded a mean of 3.81 and a standard deviation of 0.94 indicating an overall tendency towards agreement among the respondents. and roughly 67% agreed that it made solving complex problems easier corresponding to a mean of 3.74 and standard deviation of 0.69, the findings indicate that respondents generally agreed that AI makes solving mathematics problems easier, with a relatively low variation in responses. Then 52% of the respondents corresponding to a mean of 3.09 and standard deviation of 0.99 indicate that respondents were generally neutral about whether AI increases their academic performance in mathematics with moderate variation in their responses. However, (Ogoke et al., 2025) caution that perceived helpfulness does not always translate into actual achievement gains; their experimental study found no significant improvement in mathematics performance among AI-using students compared to controls. Because of these practical benefits, an overwhelming 90% of students strongly believed that the university should officially encourage the use of AI in math education having a mean of 4.59 and standard deviation 0.59 strongly agreed with low variation in their responses. However, students also showed an unexpected level of caution. More than half of them remained neutral when asked if AI actually improved their final grades, and many were unsure if it truly helped them learn independently.

4.6.2 Teacher attitude regarding use of Artificial intelligence.

Statement	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	mean	Variance /standard deviation
AI improves students understanding of mathematics	01	02	07	02	03	2.53	1.84/1.36
AI saves teaching time	09	03	02	01	00	4.38	0.76/0.87
AI helps in assessing students quickly	02	08	02	02	01	3.47	1.27/1.13
AI makes mathematics more interesting	00	02	07	04	02	2.47	1.27/1.13

Table 9 perception of AI in teaching

From table 9 above, a large majority of math's teachers (80%) agreed that AI successfully saved them valuable teaching time with a mean of 4.38 and standard deviation 0.87 strongly agreed although responses showed considerable variation. Nearly 67% with mean 3.47 and standard deviation 1.13, teachers were slightly positive about AI helping them assess students much faster. Yet, when it came to actual student learning. Only 20% of the teachers believed that AI genuinely improved a student's understanding of math, and a mere 13.3% felt that it made the subject more interesting. The majority of teachers either disagreed or remained completely neutral on these points.

4.6.3 Relationship between AI improving students understanding of mathematics (X) and AI making mathematics more interesting (Y)

Variables	Pearson correlation	Interpretation
X and Y	0.195	weak positive relationship

The Pearson correlation coefficient ($r=0.195$) indicates a weak positive relationship between teacher's perceptions that AI improves students understanding of mathematics and their perceptions that AI makes mathematics more interesting. This suggests that teachers who tend to perceive AI as improving students understanding also tend, to a smaller extent, to perceive AI as making mathematics more interesting. However, the relationship is weak, indicating that the two perceptions are not strongly associated.

4.7.0 Challenges faced when using Artificial intelligence tools

4.7.1 Challenges faced by the respondents when using Artificial intelligence tools in teaching and learning

Challenge	Frequency	Percentage (%)
Inaccurate answers from AI	55	73
Poor internet connection	30	40
Limited guidance from lecturers	22	29
Power disruptions	20	27
High data costs	15	20
Other	10	13

Table 10 Challenges faced in using Artificial intelligence

The data displayed in table 10 illustrated the various obstacles that respondents faced when integrating AI into mathematics education. The most prominent challenge identified by the participants was the receipt of inaccurate answers from AI tools, which registered the highest

frequency of 55, representing 73% of the total sample (Opesemowo & Ndlovu, 2024). Technical and infrastructural limitations also figured significantly in the findings. Specifically, poor internet connectivity was cited by 30 respondents (40%), while power disruptions were reported by 20 respondents (27%). Institutional support and financial factors presented additional challenges. A lack of adequate guidance from lecturers was experienced by 22 respondents (29%). Furthermore, high data costs were noted as a barrier by 15 participants (20%). Lastly, a small minority of 10 respondents (13%) indicated other unspecified challenges.

Thematic analysis

Theme	challenges
AI-related challenges	Inaccurate answers from AI
Infrastructure challenges	Poor internet connection Power disruptions
Institutional/academic challenges	Limited guidance from lecturers
Financial challenges	High data costs
Other challenges	

The findings in the table above indicate that respondents encountered several challenges when using AI in teaching and learning mathematics. Inaccurate answers generated by AI emerged as the most frequently challenge, identified by 55 respondents. This suggests that the reliability and accuracy of AI-generated mathematical information remain significant concerns. Poor internet connectivity was the second most common reported by 30 respondents, highlighting the role of technological infrastructure in limiting effective AI use. Other challenges included limited guidance from lecturers (29%), Power disruptions (27%) and high data costs.

5.0 CHAPTER FIVE: SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

5.1.0 Summary of Findings

The study assessed the influence of Artificial Intelligence on mathematics instruction among secondary school teachers and mathematics learning among university students at Busitema University, Nagongera Campus, and four selected secondary schools.

AI usage indicated that 73% of teachers and 93% of students used AI tools. Regarding the first objective, the findings showed that AI tools were widely used by both teachers and students. ChatGPT emerged as the most frequently used AI application having, followed by DeepSeek and Photo-math

Regarding the second objective, the findings revealed that students generally perceived AI as beneficial in mathematics learning with an average mean of 4.59 and standard deviation 0.59 of students strongly agreed that university should encourage the use of AI in learning mathematics. Most respondents agreed that AI enhanced their understanding of mathematical concepts and simplified problem-solving with 70% and 67% respectively. However, most students remained neutral on whether AI improved their actual academic performance or supported independent learning.

Students demonstrated generally positive attitudes towards AI-supported mathematics learning, with majority supporting the integration of AI into university mathematics education. In contrast,

teachers appreciated AI mainly for improving instructional efficiency, particularly by saving teaching time and facilitating faster assessment, although many remained uncertain about its effectiveness in improving students conceptual understanding.

Regarding the challenges, the findings established that respondents encountered several challenges while using AI tools. The most commonly reported challenges included inaccurate AI-generated responses, poor internet connectivity, limited guidance from lecturers, power disruptions and high data costs. The findings. These findings indicate that despite the potential benefits of AI, infrastructural limitations, financial constraints, and concerns about the reliability of AI-generated information continue to hinder its effective integration into mathematics teaching and learning.

5.2.0 Conclusion

Artificial Intelligence is widely adopted in mathematics education among both secondary teachers and university students in the study area, with ChatGPT being the dominant tool. While AI offers practical benefits such as saving teachers' time, speeding up assessment, and helping students approach mathematical problems with greater ease, its impact on deeper learning outcomes remains questionable. Students strongly support AI integration, yet teachers are skeptical about AI's ability to improve conceptual understanding. Furthermore, serious challenges including inaccurate AI responses, poor infrastructure, and inadequate guidance hinder effective AI use. Therefore, AI currently serves as a useful assistant for routine tasks but has not yet proven to be a reliable tool for enhancing genuine mathematical comprehension or independent learning (Luckin, 2018; Ogoke et al., 2025).

5.3.0 Recommendations

To policy makers: Invest in reliable internet and electricity infrastructure in educational institutions. Develop national guidelines for verifying AI-generated content to address the problem of inaccurate answers. (Holmes et al., 2019) similarly recommend a humanistic approach to AI in higher education, emphasizing open platforms, privacy-sensitive mechanisms, and ethical governance.

To university and school administrators, provide formal training programs for teachers and lecturers on pedagogically sound AI integration, focusing on how to use AI to deepen conceptual understanding, not just save time.

To teachers and lecturers, Use AI as a supplementary tool. Verify AI outputs before presenting them to students. Design assignments that require students to solve problems independently first, then use AI for verification or alternative methods.

To students, avoid over-reliance on AI. Attempt mathematical problems on your own before consulting AI. Cross-check AI-generated answers with textbooks, lecture notes, or teacher feedback due to frequent inaccuracies.

5.4.0 Suggestions for Further Research

Conduct experimental or quasi-experimental studies to measure the causal effect of specific AI tools (e.g., ChatGPT vs Photomath) on students' actual mathematics achievement scores, rather than relying on self-reported perceptions (Ogoke et al., 2025; Zhang, 2025).

Investigate why secondary school teachers remain skeptical about AI's ability to improve conceptual understanding, and explore which professional development models effectively change this perception.

Carry out longitudinal studies tracking the same cohort of students over multiple semesters to determine whether sustained AI use leads to measurable academic improvement.

Compare AI integration in urban versus rural Ugandan schools to better understand and address digital divide issues affecting equitable access to AI tools (Zulhilmi et al., 2022).

Examine the effectiveness of offline AI solutions and solar-powered devices in mitigating infrastructure challenges such as poor internet and power disruptions.

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