

# Exploring the Potential of Microsoft Copilot in Mathematics Education at Middle Stage

Prachi Khanna<sup>1</sup> and Peeyush Kamal<sup>2</sup>

<sup>1</sup>Research Scholar and <sup>2</sup>Assistant Professor

<sup>1</sup>Department of Teachers' Training and Non-Formal Education, Faculty of Education,  
Jamia Millia Islamia

<sup>2</sup>Educational Survey Division, NIE, NCERT

<sup>1</sup>prachi18091993@gmail.com (Corresponding Author)

Manuscript Submission Date: August 21, 2025  
Manuscript Acceptance Date: December 30, 2025

## Abstract

*This study made an attempt to understand the potential of Microsoft Copilot in teaching as well as learning of mathematics at middle stage, particularly at Grade 7. The researcher examines Microsoft Copilot's assistance for teachers in planning lessons and incorporating innovative instructional strategies using structured prompts as per the grade/age of the students and in mathematical problems by students. This study analysis the responses given by Microsoft Copilot exclusively, to the questions asked from Grade 7 NCERT mathematics textbook (2025) "Ganit Prakash". The findings of the study highlight the distinct features and abilities of Microsoft Copilot which includes generation of content rapidly, scaffolding for conceptual understanding and consistent availability. It also mentions disadvantages associated with its use such as misinterpretation of context, inaccurate mathematical responses, risk of data privacy, etc. This study contributes to foster mindful integration of AI powered tools in the field of mathematics education.*

**Key words:** Copilot, Mathematics, Middle Stage

## Introduction

Technology has the capability to transform the curriculum and give a more dynamic learning experience to students (Pappas and Giannakos, 2021). The incorporating of artificial intelligence and data analytics is changing the nature of education. Contemporary platforms for learning are able to tailor educational content in order to meet the individual needs of students in a class by using historical user data (Hasanov et al., 2019) Artificial Intelligence(AI) plays an important role in devising the new educational practices by fostering individualised as well as flexible learning experiences (Warren and Domingue, 2015) One of the most impactful feature of AI is

personalised learning as systems driven by AI customise the instructions based on needs of individual students. This approach boosts motivation among students, increases their awareness and improves their engagement (Falcao et al., 2017). These systems adjust the process of education in order to meet each learners' unique needs which improves their learning outcomes. The integration of AI in new domains like augmented reality and game design in education, emphasis its role in bringing innovation to education (Jagadeesan et al., 2023) AI is redesigning the teaching-learning process by providing interactive, inclusive, adaptive and contextually aware support within the diverse environment of education system. The use of AI in education focus

on addressing the challenges associated to the classroom pedagogy such as learners deeper level of learning, data accuracy, etc (Bates, 2019) AI fosters a smooth experience for learning by content customisation and giving instant feedback to the abilities, needs, preferences of learners (Jeon and Lee, 2023) One of the engaging features of AI is Natural Language Processing wherein it interacts in natural language to provide continuous guidance and clarify misunderstandings, which creates an engaging, interactive and student-centred environment (VanLehn, 2011) These large language models bring a significant change in the practices and learning experiences in the field of education (Kasneji et al., 2023). Data analytics which is embedded in AI technologies help in making decisions related to instructions by assisting teachers in identifying gaps in knowledge and modify teaching pedagogy accordingly (Lee and Kwan, 2024). This leads to an increase in the motivation level among students and keeps engaged by providing relevant and instant feedback on the basis of their progress (Sahlam, Ciechanover and Grandjean, 2023). These large language models interact with fluency just like humans and provide adaptive support (OpenAI, 2023).

Microsoft Copilot is developed by Open AI in collaboration with Git Hub. It is a tool backed up with AI which works on the completion of code. It helps the developers by giving suggestions based on the awareness of context and completes the segments of code which are based on the huge body of codes available publicly on Git Hub. Copilot is developed on the 'Codex' model which increases the productivity of the developer by using natural language prompts and initiating corresponding segments of code. (Adetayo, Aborisade, and Sanni, 2024). This feature aids the developers to explain the outcome in simple language and get code

suggestions which are relevant focused on the process of development. Copilot also lends support in various tasks such as writing tests, documentation, and automating repetitive coding activities which in turn reduces the load cognitively and saves time (Acharya, 2023). Its collaboration with Microsoft 365 increases its usage in the educational environments that offers transformative approach towards the development of software and digital productivity (Warner, Aquino and Ykema, 2024). These technologies support lifelong learning and professional growth for students as well as teachers. Though AI has promising usage, it also has concerns related to ethics, privacy, biasness and transparency.

## Review of Literature

AI is a powerful tool that can change students learning experiences and also helps teachers in performing tasks related to their job. The following reviews examine its effect on learning and teaching in classrooms.

Shute and Psotka (1996) supports for a philosophical shift in educational technology, stressing on the need to switch from simple one-way instructional devices towards the integration of intelligent systems in order to promote collaborative learning spaces. However, the integration of AI into mainstream educational system is slow and fragmented. Lo, C. K. (2023) conducted a review of literature on 50 articles that were published on or before 28th February, 2023 to understand the impact of ChatGPT on education. It states that ChatGPT has the capability to improve the learning teaching process however its existing data base is not satisfactory in different subject areas. The overall performance of ChatGPT when tested in various subject domains was unsatisfactory in six domains, satisfactory in 2 domains and outstanding in only four

domains. It provides teachers with a point to easily start creating course syllabus, teaching-learning material, assessment techniques. In the review process, it was observed that ChatGPT efficiently acted on the prompts such as translating material into a different language, suggesting teaching aids for students with dyslexia, efficient grading of students, etc. However, there are concerns related to the accuracy of generated content. Yan et al. (2023) systematically reviewed 118 peer reviewed studies which used large learning models to automate learning tasks. It explored the practical and ethical challenges associated with its use. LLMs are in its initial stage to automate educational tasks and there is not much improvement in teaching, learning and administrative processes. Ethical challenges include issues related to transparency, privacy, equality and beneficence. Based on the transparency index, most of the studies show that LLMs have only reached tier 1 out of three tiers of transparency. These models rarely explain their consenting strategies which is a threat to privacy. The language used by most of the models is English which creates an issue of equality for a democratic society. One more challenge highlighted by the study is the threat of beneficence. Studies show that underperforming LLMs could hamper the learning of students. There is a need to check the authenticity of a model before it could be introduced to learners. Pradana et al. (2023) elaborated on AI's capability to deal with tasks that demand knowledge and creative thinking, such as grading of the assignments and providing counselling for students, could change the education system. It reviewed 93 articles related to the use of ChatGPT in education from 2022 till February 2023. It asserted that ChatGPT has the knowledge and creative intelligence to conduct tasks such as grading the assignments, planning of lessons and offering counselling to

students however there are certain challenges with its integration such as precision as well as the reliability of the answers generated by AI. Education must aim to strike a balance between using AI to enhance education and preserve the human touch as well as the interpersonal communication. Blasco and Charisi (2024) undertook experimental research on understanding the influence of large language models in classroom activities. It collected data from 122 school students aged between 14 -16. The findings of the study stated that explanations generated by AI improve students' performance over solutions. The use of Socratic AI fosters engagement and interaction among students however, there was less improvement in students' learning and a lot of students found it less useful. There was less retention of concepts and students were unable to apply their knowledge to new situations. Kim W, 2021 created and used an AI based teaching model for elementary school students. The results depicted higher student engagement and improved understanding of AI. Students were satisfied with AI education. The teachers were efficiently able to embed AI in classroom learning due to proper training and knowledge about the skills to use AI. Liu et al. (2025) employed a quasi-experimental research design to understand the effectiveness of Gen-AI enabled learning environment in developing problem solving strategies among fifth graders. It found that there was a significant improvement in students' achievement, interest and motivation towards mathematics in a ChatGPT-MPS learning environment. It also enhanced their mathematical thinking and engagement in problem solving tasks.

There have been a lot of researches which have explored the role of AI in enhancing the teaching-learning process in different educational areas, however there is a notable gap in

examining their impact on mathematics instruction at the school level. This paper takes a foundational step toward investigating how “Microsoft Copilot,” as an intelligent tool, can effectively support mathematics teaching and learning at the middle stage. It aims to explore the potential of Microsoft Copilot in planning lessons, personalising instructions, problem solving and developing deeper mathematical conceptual understanding of among school student

### **Need and significance of the study**

Artificial Intelligence is one of the engaging technologies today. It has the capability to entirely transform the education in India. There have been several studies to understand the impact of artificial intelligence on the learning of students. As per the recommendations of NEP 2020 in para 4.25, “It is recognised that mathematics and mathematical thinking will be very important for India’s future and India’s leadership role in the numerous upcoming fields and professions that will involve artificial intelligence, machine learning, and data science, etc. Thus, mathematics and computational thinking will be given increased emphasis throughout the school years, starting with the foundational stage, through a variety of innovative methods, including the regular use of puzzles and games that make mathematical thinking more enjoyable and engaging. Activities involving coding will be introduced in the Middle Stage.” This research was conducted to provide an insight to teachers and aid the government and educational institutions in suggesting freely available tools and their potentials in learning-teaching process such as Microsoft Copilot which can support teachers in imparting mathematics education through detailed lesson planning and students suggesting various techniques with step-by-step explanation for problem solving. There is active video links attached with each

prompt in order to develop teachers’ confidence in using technology with ease.

### **Statement of the Problem**

According to National Education Policy 2020, the use of modern technologies such as artificial intelligence, machine learning and smart boards in classrooms would not only impact what students learn but also determine how they learn. The use and integration of such technologies would improve various aspects of education. Therefore, it is important for teachers and students to be aware of AI powered tools and their functioning so as to enhance the learning teaching process. The researcher took up the research to explore the potential of Microsoft Copilot as an Artificial intelligence tool in Mathematics Education at Middle Stage.

### **Research Questions**

This study aims to answer the following questions:

1. How does Microsoft Copilot help teachers in generating age and grade appropriate lesson plans for teaching Mathematics to Grade 7?
2. How efficiently does Microsoft Copilot aid students in solving mathematical problems?
3. What are the perceived advantages and challenges associated with the use of Microsoft Copilot by students and teachers?

This study focuses on Microsoft Copilot acts as a supportive AI tool in mathematics education at school level. The study also attempts to analyse the content generated from Microsoft Copilot in order to understand its relevance and applicability for teaching and learning mathematics. It would elaborate on its accuracy, clarity, and pedagogical strategies with reference to the contextual application. Along with

the technical quality, this analysis aims to align with the educational objectives, curriculum and specific needs of students at middle stage. This would enable the readers to understand how Microsoft Copilot could be used as a technological tool as well as a pedagogical innovator for mathematics learning.

## Operational Definitions

- **Microsoft Copilot:** It is an AI powered tool integrated in learning and teaching tools, which generates responses based on prompts instantly using its data base. In this study, the features of Copilot relevant for teaching learning are explored.
- **Mathematics Education:** It is the study related to teaching and learning of mathematical skills and concepts. In this study, three core areas of mathematics namely, Algebra, measurement and geometry are considered as mathematics education.
- **Middle Stage:** This stage includes students from grade 6 to 8 who are aged between 11 to 14 years. The students studying in Grade 7 are selected for this study.

## Research Design

### Methodology

The study used a qualitative exploratory research design to examine the potential of Microsoft Copilot as a supportive AI tool in mathematics education at school level.

### Sample and Sampling Technique

A purposive sampling technique was employed to select three core mathematics areas which are algebra, measurement and geometry from Ganit Prakash, NCERT mathematics

textbook to generate lesson plans. Two questions from each chosen chapters were also purposively selected from the textbook to check and analyse the problem-solving ability of Microsoft Copilot. These topics were chosen due to their foundational and conceptual importance.

### Tool of the study

The researchers used an AI-driven tool known as Microsoft Copilot which was developed by Microsoft to help in lesson planning and to solve mathematics questions from the grade 7 NCERT textbook. It is a model based on prompts and based on these prompts; it generates detailed responses (OpenAI, 2022). The researchers maintained a formal tone throughout the study, using cautious language to maintain objectivity. The responses from Microsoft Copilot were used as data in our analysis.

### Response Collection Procedure

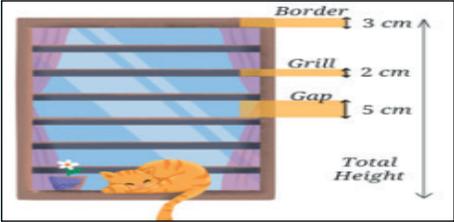
The study involved two primary data sources: AI generated lesson plans for each selected chapter and AI generated solution to the six selected textbook questions. All output generated were documented verbatim for analysis.

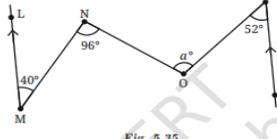
The researcher, in consultation with subject experts, identified specific topics suited for the accomplishment of the research objectives and selected relevant questions. Microsoft Copilot was then asked to create three lesson plans for Grade 7, NCERT text book, each based on different, randomly selected Mathematics topics. Additionally, six questions (two from each topic) were posed to evaluate both the accuracy of its responses and its ability to provide clear explanations. Various features of Copilot, such as Voice instruction, image selection, and attaching documents apart from text instruction, were also explored during the study. The responses

were analysed by four researchers. The analysis was done after timely interactions among the researchers and the data was synthesised on the basis of their evaluations and observations.

The prompt, along with the concept to achieve the corresponding objective, has been shown below:

**Table 1: Process of Response Collection**

Research Question	Topic	Prompt
How does Microsoft Copilot help teachers in generating age and grade appropriate lesson plans for teaching Mathematics to Grade 7?	Arithmetic Expressions (Chapter 2), A peek beyond a point (Chapter 3), and Parallel and Intersecting lines (Chapter 5)	Make a lesson Plan on Topic: Arithmetic expressions (Chapter 2), A peek beyond a point (Chapter 3), and Parallel and Intersecting lines (Chapter 5) from the Grade-7 NCERT Mathematics Textbook.
How efficiently does Microsoft Copilot aid students in solving mathematical problems?	Chapter 2: Arithmetic Expressions	<p>Q 1. "Find the total height of the window by writing an expression describing the relationship among the measurements shown in the picture." (Source: Ganit Prakash (Grade 7) page no. 35, question number 3)</p> <p>Q2. "During the daytime a snail climbs 3 cm up a post, and during the night while asleep, accidentally slips down by 2 cm. The post is 10 cm high, and a delicious treat is on its top. In how many days will the snail get the treat?" (Source: Ganit Prakash (Grade 7) page no. 43, Question number 1)</p> 
	Chapter 3: A Peek beyond the Point	<p>Q3. "Pinto supplies 3.79 L, 4.2 L, and 4.25 L of milk to a milk dairy in the first three days. In 6 days, he supplies 25 litres of milk. Find the total quantity of milk supplied to the dairy in the last three days." (Source: Ganit Prakash (Grade 7) page no. 79, question number 8)</p> <p>Q4.</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p>What will be the sum of <math>15\frac{3}{10}</math> and <math>2\frac{6}{10}</math>?</p> </div> <p>(Source: Ganit Prakash (Grade 7) page no. 56)</p>

Research Question	Topic	Prompt
	Chapter 5: Parallel and Intersecting Lines	<p>Q5. "Draw two lines on a plain sheet of paper so that they intersect. Measure the four angles formed with a protractor. Draw four such pairs of intersecting lines and measure the angles formed at the points of intersection." (Source: Ganit Prakash (Grade 7) page no. 107, Activity 1)</p> <p>Q6.</p> <div style="border: 1px solid black; padding: 5px; margin: 10px 0;"> <p style="text-align: right; font-size: small;">Fig. 5.34</p> <p>6. What is the measure of angle <math>\angle NOP</math> in Fig. 5.35?</p>  <p style="text-align: center; font-size: small;">Fig. 5.35</p> </div> <p>(Source: Ganit Prakash (Grade 7) page no. 125, question number 6)</p>
What are the perceived advantages and challenges associated with the use of Microsoft Copilot by students and teachers?	Through analysing the responses and usage of Copilot	

## Analysis and Interpretation of Responses

A thematic content analysis was employed to analyse AI generated outputs.

Lesson Planning by Microsoft Copilot: Microsoft Copilot was asked to make lesson plans for three topics namely: Arithmetic Expressions (Chapter 2), A Peek Beyond a Point (Chapter 3), and Parallel and Intersecting lines (Chapter 5) from NCERT Mathematics Text book (2025) *Ganit Prakash* Grade 7.

### Chapter 2: Arithmetic expressions

The Microsoft Copilot selected topics from the chapter on its own based on the prompt. It gave detailed activities

which could be incorporated in the classroom to teach these mathematical concepts along with assessment criteria. It divided the lesson plan into parts stating the objective of each lesson, Warm-up, Core concepts and closure. Though it suggested few worksheets and questions that could be incorporated however; it did not follow the actual lesson plan format. It was effective in giving an overview of the lesson through a table. The link for the prompt and responses by Microsoft Copilot has been attached: [https://drive.google.com/file/d/1dw8R9hVZtZAYLJm4hgY2k1\\_KbISi2IDu/view?usp=sharing](https://drive.google.com/file/d/1dw8R9hVZtZAYLJm4hgY2k1_KbISi2IDu/view?usp=sharing)

### Chapter 3: A peek beyond a point

It was observed that the Copilot gave

responses by relating the concept to the textbook in just a few seconds. The chapter from the book catered to three concepts which are measurement, mixed fractions and decimals. The AI agent created a lesson plan only for two concepts: measurement and decimals. It only catered to one concept per day as it was asked to make a lesson plan only for 2 days. Microsoft Copilot also generated ready to use worksheets/questions for students. The link for the prompt and responses by Microsoft Copilot can be accessed here: [https://drive.google.com/file/d/1OomZeamthjxk\\_jG4vzrbMg5uUsghcyk\\_/view?usp=sharing](https://drive.google.com/file/d/1OomZeamthjxk_jG4vzrbMg5uUsghcyk_/view?usp=sharing)

### Chapter 5 Parallel and intersecting lines

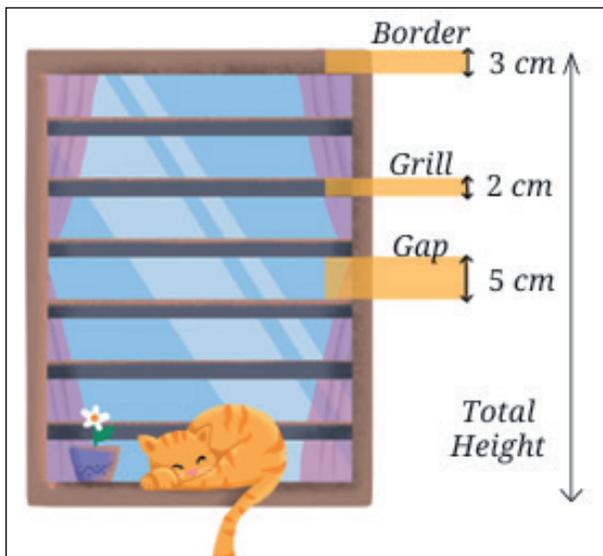
The lesson plan was generated using a file upload. Microsoft Copilot was easily able to present the lesson plan however; it required further

instructions for modification. In one of the prompts, it was asked to use a proper format, so it also gave the material required for each activity. The same prompt was given in the previous lesson plan however; it didn't provide the "Material Required" in that lesson plan. It added printable worksheets as asked within a few seconds. The link for the prompt and responses by Microsoft Copilot has been attached for your reference: [https://drive.google.com/file/d/1OomZeamthjxk\\_jG4vzrbMg5uUsghcyk\\_/view?usp=sharing](https://drive.google.com/file/d/1OomZeamthjxk_jG4vzrbMg5uUsghcyk_/view?usp=sharing)

Copilot's Responses as per Mathematical Question Asked

### Chapter 2: Arithmetic Expressions

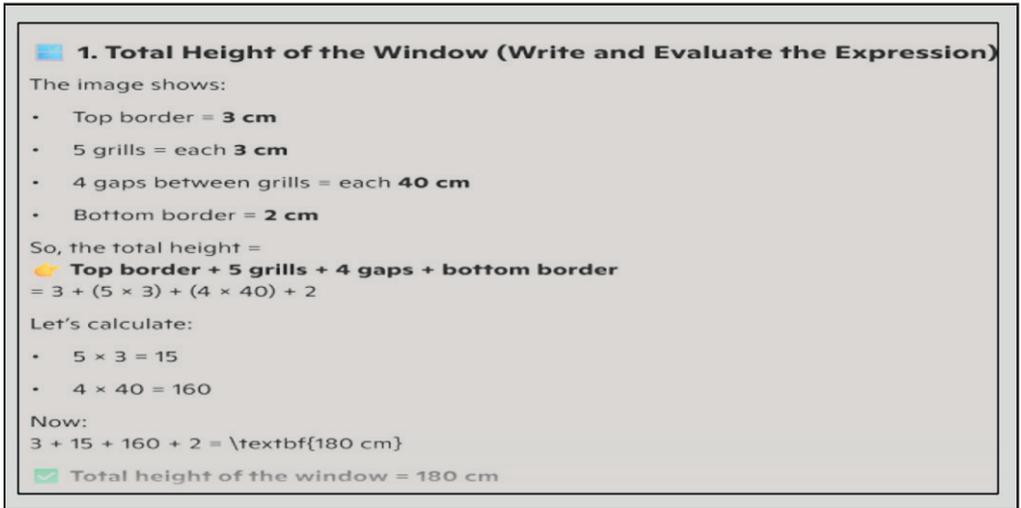
Q1. "Find the total height of the window by writing an expression describing the relationship among the measurements



shown in the picture." (Source: *Ganit Prakash* (Grade 7) page no. 35, Question number 3)

# Prompt 1: Researcher explored “Screenshot” feature of Copilot

## Response 1



**1. Total Height of the Window (Write and Evaluate the Expression)**

The image shows:

- Top border = **3 cm**
- 5 grills = each **3 cm**
- 4 gaps between grills = each **40 cm**
- Bottom border = **2 cm**

So, the total height =  
👉 **Top border + 5 grills + 4 gaps + bottom border**  
 $= 3 + (5 \times 3) + (4 \times 40) + 2$

Let's calculate:

- $5 \times 3 = 15$
- $4 \times 40 = 160$

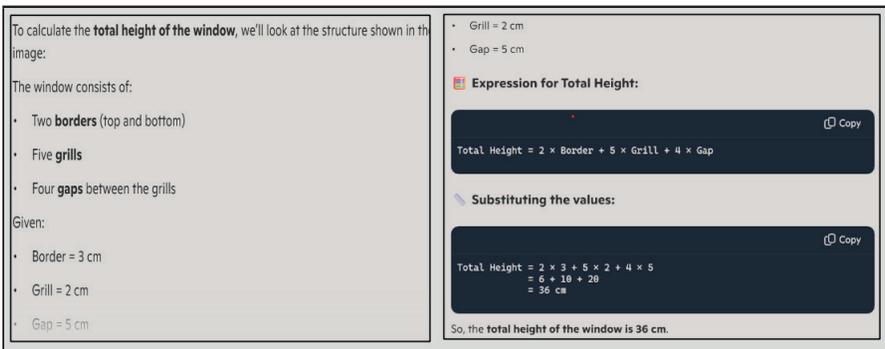
Now:  
 $3 + 15 + 160 + 2 = \text{\textbf{180 cm}}$

✅ Total height of the window = 180 cm

(Fig.1)

## Prompt 2: “Can you explain it again?”

## Response 2



To calculate the **total height of the window**, we'll look at the structure shown in the image:

The window consists of:

- Two **borders** (top and bottom)
- Five **grills**
- Four **gaps** between the grills

Given:

- Border = 3 cm
- Grill = 2 cm
- Gap = 5 cm

- Grill = 2 cm
- Gap = 5 cm

**Expression for Total Height:**

```
Total Height = 2 × Border + 5 × Grill + 4 × Gap
```

**Substituting the values:**

```
Total Height = 2 × 3 + 5 × 2 + 4 × 5  
              = 6 + 10 + 20  
              = 36 cm
```

So, the **total height of the window** is 36 cm.

(Fig.2)

Prompt and Response 3: The same question was asked again by changing the option from “Quick Response” to “Think Deeper”, “Smart” and “Deep Research”. The third option of Deep Research is not available for free. Copilot gave different solution for the same problem every time it was asked to it.

Link: <https://drive.google.com/file/d/1t>

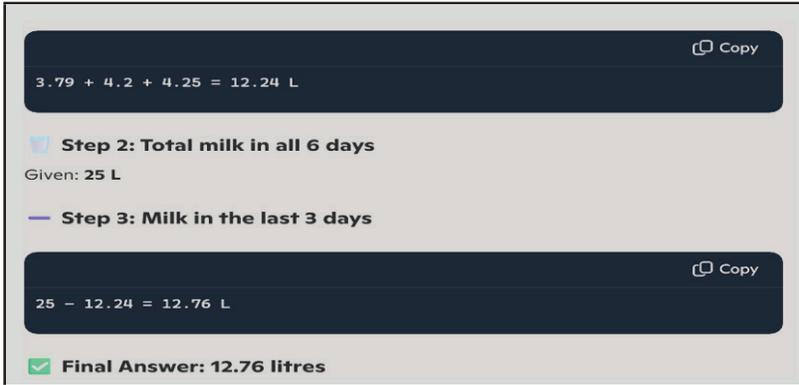
269Ds5E8a9qRaMAVsvXgbMbj2ifhkW3/view?usp=sharing

Q2. “During the daytime, a snail climbs 3 cm up a post, and during the night while asleep, accidentally slips down by 2 cm. The post is 10 cm high, and a delicious treat is on its top. In how many days will the snail get the treat?” (Source: *Ganit Prakash* (Grade 7) page no. 43, Question number 1)

“Talk to Copilot” feature was used for this question. The Copilot explained the problem verbally step-by-step. However, it wasn’t able to give visual or text explanation simultaneously. Link: <https://drive.google.com/file/d/1DEEEVzjy34xUsllkksyOtjMBydFEb96/view?usp=sharing>

### Chapter 3: A Peek beyond the Point

Q3. “Pinto supplies 3.79 L, 4.2 L, and 4.25 L of milk to a milk dairy in the first three days. In 6 days, he supplies 25 litres of milk. Find the total quantity of milk supplied to the dairy in the last three days.” (Source: *Ganit Prakash* (Grade 7) page no. 79, Question number 8)



(Fig. 3)

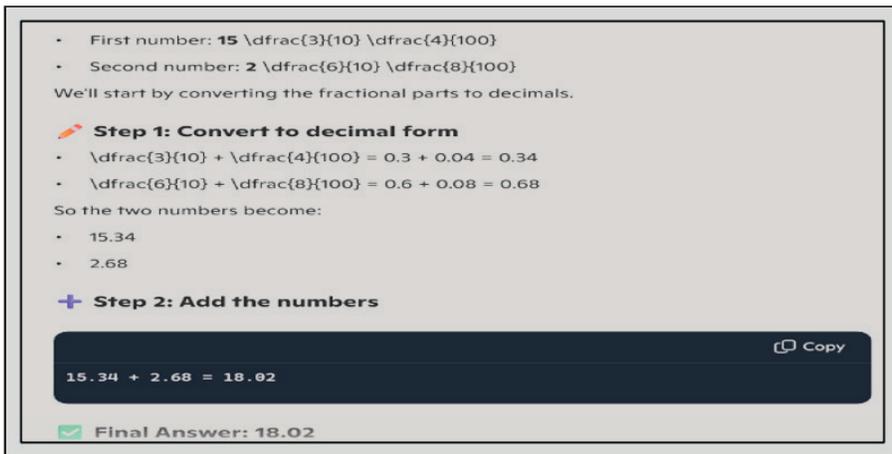
Q4.

What will be the sum of  $15 \frac{3}{10} \frac{4}{100}$  and  $2 \frac{6}{10} \frac{8}{100}$ ?

(Source: *Ganit Prakash* (Grade 7) page no. 56)

**Prompt 1: “Screenshot” feature was used for this question.**

**Response 1**



(Fig. 4)

**Prompt 2: "Give answers in fractions"**

**Response 2**

<p><b>Step 1: Convert fractional parts to the same denominator</b></p> <p>First number:</p> <ul style="list-style-type: none"> <li><math>\frac{3}{10} = \frac{30}{100}</math></li> <li><math>\frac{30}{100} + \frac{4}{100} = \frac{34}{100}</math></li> <li>So: <math>15 \frac{3}{10} + \frac{4}{100} = 15 \frac{34}{100}</math></li> </ul> <p>Second number:</p> <ul style="list-style-type: none"> <li><math>\frac{6}{10} = \frac{60}{100}</math></li> <li><math>\frac{60}{100} + \frac{8}{100} = \frac{68}{100}</math></li> <li>So: <math>2 \frac{6}{10} + \frac{8}{100} = 2 \frac{68}{100}</math></li> </ul> <p><b>Step 2: Add the two mixed numbers</b></p> <p>Now add:</p> <ul style="list-style-type: none"> <li><math>15 \frac{34}{100} + 2 \frac{68}{100}</math></li> </ul> <p><b>Whole parts:</b></p> <ul style="list-style-type: none"> <li><math>15 + 2 = 17</math></li> </ul> <p><b>Fractional parts:</b></p> <ul style="list-style-type: none"> <li><math>\frac{34}{100} + \frac{68}{100} = \frac{102}{100} = 1 \frac{2}{100}</math></li> </ul> <p>So:</p> <ul style="list-style-type: none"> <li><math>17 + 1 \frac{2}{100} = 18 \frac{2}{100} = 18 \frac{1}{50}</math></li> </ul> <p><b>Final Answer: <math>18 \frac{1}{50}</math></b></p>	<ul style="list-style-type: none"> <li>So: <math>2 \frac{6}{10} + \frac{8}{100} = 2 \frac{68}{100}</math></li> </ul> <p><b>Step 2: Add the two mixed numbers</b></p> <p>Now add:</p> <ul style="list-style-type: none"> <li><math>15 \frac{34}{100} + 2 \frac{68}{100}</math></li> </ul> <p><b>Whole parts:</b></p> <ul style="list-style-type: none"> <li><math>15 + 2 = 17</math></li> </ul> <p><b>Fractional parts:</b></p> <ul style="list-style-type: none"> <li><math>\frac{34}{100} + \frac{68}{100} = \frac{102}{100} = 1 \frac{2}{100}</math></li> </ul> <p>So:</p> <ul style="list-style-type: none"> <li><math>17 + 1 \frac{2}{100} = 18 \frac{2}{100} = 18 \frac{1}{50}</math></li> </ul> <p><b>Final Answer: <math>18 \frac{1}{50}</math></b></p>
---	--

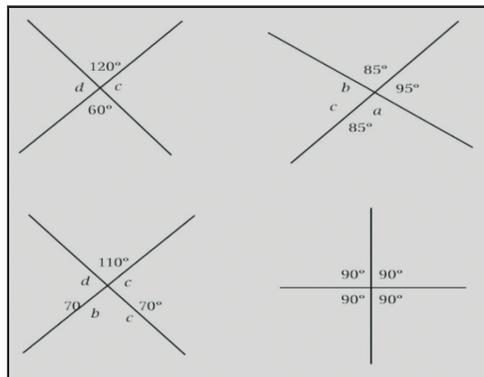
(Fig. 5)

**Chapter 5: Parallel and intersecting lines**

Q5. "Draw two lines on a plain sheet of paper so that they intersect. Measure the four angles formed with a protractor. Draw four such pairs of intersecting lines and measure the angles formed at

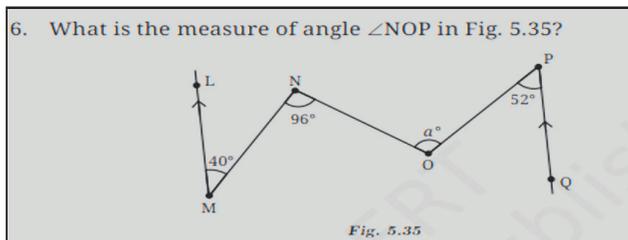
the points of intersection.

First, it broke the question in parts and explaining step-by-step through text. Further when it was asked to draw and explain, it generated an image in Figure 7." (Source: Ganit Prakash (Grade 7) page no. 107, Activity 1)



(Fig. 6)

Q6.



(Source: Ganit Prakash (Grade 7) page no. 125, question number 6)

In this question, image recognition was used wherein Microsoft Copilot was used to take the screen shot of the question from text book and generate answers. It identified the source from which the screen shot was taken. It was easily able to recognize and give solution to the problem by proper explanation. It also asked if the user wants it to explain the same question in a different way. Towards the end it was also asked to create the image of the solution. The link of the Copilot response is attached here: [https://drive.google.com/file/d/1K8xxtl5kXmj\\_1CQAV7BKfOzjUskT4O1o/view?usp=sharing](https://drive.google.com/file/d/1K8xxtl5kXmj_1CQAV7BKfOzjUskT4O1o/view?usp=sharing)

## Findings of the Study

### RQ 1: How does Microsoft Copilot help teachers in generating age and grade appropriate lesson plans for teaching Mathematics to Grade 7?

Copilot, an AI powered tool is able to generate content on the basis of the given prompt. It easily generates lesson plans, incorporating specific details mentioned in the prompt. It also efficiently generates supportive material such as worksheets, quiz, etc instantly. Bakers et al. (2019) asserts that the extensive use of AI majorly benefits three primary stakeholders which are learners, teachers and educational administrators. Effective planning of lessons requires the teachers to incorporate differential instructions, engaging learning aids, technology integrated activities that engage all the students. This study on using Copilot for lesson planning presents the design of instruction when posed with detailed prompt. It generates lesson plans that include hands-on activities and experiential experiences for learners. It gives responses that are aligned with contemporary pedagogical frameworks within few seconds. (Siiman, 2024). But, its relevance to the pedagogy was understood to heavily depend up on

the specificises of the prompt. It tends to choose topics and objectives on its own which may or may not align with the intended goals (Adetayo, Aborisade, and Sanni, 2024). The researcher used "Document Upload" feature to ask Copilot to generate lesson plan. It was able to track the source of the document easily. The researcher also uploaded the text from NCERT textbook for giving a contextual background to the assistant, Copilot scanned the document accurately to generate ready to use worksheets as well as reinforcement exercises instantly. In a research based on mixed method approach on pre-service teachers, the participants rated the efficiency of Microsoft Copilot as the highest in creating lesson plans, tasks for assessment and differentiate instructions for different learners (Siiman, 2024). This shows that Copilot has the capability to aid in the instructional process however, the desired results are produced only if the prompt given contains specific details such as the level of students, objectives, type of activities, etc. The study conducted by Pradana et al. (2023) as mentioned above also supports the fact that AI tools such as ChatGPT, a similar version of Copilot acts as a supportive agent in planning meaningful and age-appropriate lessons for learners. It was also observed that Copilot responds on the basis of previous conversations. It integrated Art with lesson plans as it was a part of the researchers' previous conversations with the assistant. It also has the ability to suggest strategies for students with specific learning needs or styles. For example, when Copilot was asked to give pedagogical strategies to teach measurement to a student with dyslexia, it suggested to highlight units with different colours, use measuring cups to bring real-life context, etc. This shows that AI provides the technical aid along with pedagogical decision maker to improve learner coherence (Novita, 2025) t. While generating lesson

plans, it doesn't follow a particular format to generate lesson plans. In some plans, it generated plans with three sections: warm-up, main activity and winding up along with assessment activities. However, in the other plan it just suggested a list of activities for reinforcement without a fixed structure. It depends on the teachers' efficiency to get the desired material from AI. AI tools help teachers' kindergarten with majorly two aspects; one is expanding learners' linguistic skills by generating vocabulary lists and secondly by planning tailored lesson plans (Al Ali and Al-Barakat, 2023) AI driven Copilot can also be used for mathematical teaching as it provides teachers with optimal pedagogical practices for ensuring deeper understanding among learners.

## **RQ2. How efficiently does Microsoft Copilot aids students in solving mathematical problems?**

Microsoft Copilot is an important tool to guide the learning teaching process in classroom. It supports students to check their answers and develop an understanding of the concepts they might have missed in the class or to reinforce their knowledge. This tool has the power to enhance conceptual understanding of students by personalising their learning experience. It uses natural language to interact with the users which helps them easily solve their problem. The tool also generates step by step explanation of concepts and readily gives alternate strategies to solve those problems when required. This enhances their conceptual knowledge and engagement with the subject (Microsoft, 2023). Copilot alters the content as per the needs of individual students and gives instant feedback that aligns with constructive pedagogies and promotes inclusive education (UNESCO, 2021). This tool helps in bridging the gap in comprehension of mathematical concepts and encourage equity in outcomes of learning (OECD,

2022). Though Copilot is a promising tool for learning teaching process, but it sometimes produces incorrect responses. Students should be access under the supervision of an adult. The researcher tried to use and analyse all its major features which have been described below:

- **Text-to-text:** One of the features is text-to-text interaction wherein the input is given in the form of a text and the output generated by copilot is also in textual form. It aids the learning and understanding of mathematical concepts by providing step by step solutions to the given problem. This scaffolds the task for learners and reduce their cognitive load (Sweller, 1988). It also encourages learners to think about their reasoning ability by sequentially facilitating them through every part of the problem. It provides answers to questions through graphs, geometric figures, etc which enhances conceptual clarity and caters to diverse needs of all the students (Mayer, 2005). Copilot is efficient with this feature however; it lacks the ability to generate explanations based on videos as seen in Question 3 of Chapter 3.
- **Screenshot:** Copilot works on "Optical Character Recognition" which is used to interpret images that contain text. That's why it is able to extract information from those images as it can apply and use its reasoning ability to respond to the text. However, Copilot's performance becomes nearly inconsistent when it faces image-based questions that do not contain any textual cues, especially those requiring deeper visual. It could be seen in Question 1 from Chapter 2 where Copilot was asked a question related to the image. It generated different responses every time the

same question was posed to it. Also, when the mode of answering was changed from “Quick Response” to “Smart” and “Deep thinking” alternatively, it gave different answers with different response time in each case. This is primarily because Copilot is not yet optimized for holistic visual analysis. Copilot responded accurately when the images included readable text which could be seen from question 6 of Chapter 5.

- **Document Upload:** When a document was uploaded, Copilot quickly identified its source in real time and generated content aligned with it. It demonstrates strong capabilities in analysing document, particularly when with educational or policy texts. It could easily identify the source and generate content that aligns with its themes, terminology, and objectives on uploading a document. This kind of responsiveness is important in academic and pedagogical contexts as it gives real-time analysis and relevant contextual details which are required for an efficient teaching learning process. It has the ability to adapt to the structure as well as the depth based on the type of the document which makes it an effective tool for educators and researchers who want to combine theory with practice. It was observed that Copilot mentioned the source of the document along with its response to the prompt when one of the chapters from NCERT Grade 7 Mathematics textbook was uploaded to generate lesson plan. (Lesson Plan: Chapter 5: Parallel and Intersecting Lines)
- **Talk to Copilot:** “Talk to Copilot” mode in Copilot gives a conversation-like experience that is much similar to human interaction, which allows users to ask questions

verbally and receive responses instantly. This feature fosters the curiosity of the user and makes it easy for them to get responses for the given prompt. It is beneficial for learners who prefer learning using auditory inputs or interacting verbally, thus increases accessibility and engagement for learners. But it is unable to deliver both a verbal solution and a written explanation simultaneously. This shows that while the user is conversing with Copilot to get answers for the asked questions, they won't be able to get a written explanation of the same which could hamper the deeper conceptual understanding. This limitation can affect the ability of the learner to revisit and reflect upon any query related to the same problem later. In question 2 from chapter 2, this mode was explored in which the user asked the question verbally and Copilot responded in the same manner which appeared like a real conversation. Though the response was quick, however it was unable to give verbatim simultaneously. It gave the written explanation once the conversation ended.

- **Quick Response vs. Deep Thinking:** Copilot has the ability to generate answers within 2-3 seconds which gives a pleasant experience to users. In deep thinking mode, when posed a mathematical problem, it presented the solution with original mathematical notation (slashes for fractions) which aids in maintaining clarity with the output. This is an important aspect in mathematics where minor changes in notations can change the meaning or create confusion. In quick mode, Copilot generated responses with greater speed and gave responses by replacing original symbols with alternate ones such as using

horizontal fraction bars instead of slashes. This gives the correct answers however, it could be disorienting for the learners who rely on visual cues or are used to specific notations. This pattern was observed in Question 3 from Chapter 3. If uniformity is followed in symbolic representations in all modes, it would enhance comprehension.

Yan et al., states that there are challenges related to equality with the use of AI wherein English language is used majorly in many AI-driven tools. This challenge can be addressed by using various features of Copilot wherein even if a person doesn't know English language, he/she can use various other languages such as Hindi, Sanskrit, Spanish, Portuguese and others to gather information about a topic. Overall, Copilot breaks down problems into clear as well as small steps and includes summaries in tables to strengthen comprehension and provides quick overview as well as revision. Its structured approach aids in deeper conceptual understanding, despite occasional errors it commits.

### **RQ3. What are the advantages and challenges associated with the use of Microsoft Copilot by students and teachers?**

Microsoft Copilot provides a lot of advantages related to pedagogy in classroom teaching which uplifts the teaching learning process.

**Scaffolding:** AI helps students in developing their procedural knowledge by providing step-by-step solutions to problems (Jancarik et al., 2022) Copilot breaks the problem in parts and then provides the solution by explaining each step in detail. This helps in scaffolding the task for the learner and encourages independent learning. It can verify answers instantly which

fosters students' ability to self-assess and reflect on their work which also aligns with principles of constructivism in education. For example, when asked Question 3 from chapter 3, Copilot stated all the steps in a sequence for better understanding. It also showed another way to solve the same problem.

**Visual Representation:** The multimedia presentation of problems generated by AI improve conceptual understanding of learners (Hidayat et al., 2022) Copilot generates tables, charts, and diagrams that provide various representations aiding in increased comprehension for visual learners. Students can also ask it to give alternate solution to the same problem for better understanding. It makes learners self-reliant. Copilot generated an image to show the angles within a few seconds (Chapter 3, Question 5)

**Personalised Learning:** There are various AI platforms like ChatGPT which act as effective writing agents in English language education to foster their performance and reduce barriers (Gayed et al.) Similarly, GenAI tools help in mathematical learning. They facilitate as tutors to provide personalised assistance by adapting to the individual needs of students. It understands the academic level of the user during its interaction and alters material as per his/her needs. These tools support the learning process by providing age-appropriate resources which in turn increases the achievement of students.

**Saves Teachers' Time:** According to the AI integration manual by CBSE, AI helps teachers in improving their teaching efficiency and personalise the learning experiences for students which gives them time to invest in their human capabilities, where machine struggle. The efficient use of Copilot helps teachers save time by giving ready to use worksheets, assignments, etc which meets the proficiency level of different

students in class. This benefits teachers by reducing the workload and enriches student learning.

**Lesson Planning:** According to National Education Policy 2020, mathematics and computational thinking should be given increased emphasis during the school years using various innovative methods for teaching, that make learning fun and engaging. Copilot has the ability to generate lesson plans by incorporating innovative teaching strategies and also linking to the real-life experiences of students. It generates differential instruction plans as per the requirements of students and incorporate inclusivity in class.

**Innovative Classrooms:** It is accepted universally that the use of AI-driven innovative technologies would be the source and cause of enhancing the teaching-learning process in classroom (CBSE, 2019) when the teacher bring innovation to the classroom, students tend to engage more with the learning process which improves their achievement. Copilot helps the teachers in using innovative technologies in the classroom by suggesting various other AI powered tools for teaching, playing games with students and teachers collaboratively as well as individually, helping in solving mathematical problems, suggesting art-based ideas for teaching and learning, etc. This keeps students motivated, engaged and develops their love towards the subject like mathematics which is often feared by many learners. While generating lesson plans, it included art-based activities to foster better execution of the concept in classroom.

**Instant Feedback:** One of the AI technologies is GenAI which generates content automatically while responding to the prompts in natural languages while conversing with it (Cardona et al., 2025) Students can use AI tools like Copilot to reinforce their knowledge

and enhance their problem-solving skills with its instant feedback feature as it uses natural language to interact with the user. It gives instant feedback on any piece of work with proper explanation that builds students confidence and brings clarity of concepts. Upon uploading the answer of a question from Chapter 3 (Question 4), it gave instant feedback with details.

**Self-paced Learning:** AI tools help students to learn at their own pace. Microsoft Copilot is easily accessible and most of its features can be used free of cost. This enables the learners to learn as per their level of comfort. This would keep them updated and motivated.

There are many advantages of using Copilot for teaching learning process. Previous studies have shown that AI helps in developing mathematical rigor among learners and boosts their motivation and interest towards mathematics (Liu et al., 2025) however the use of AI has its own challenges.

**Quality of Copilot's Response:** The responses generated by Copilot are directly related to the type of prompts it receives. When the posed query is not clear or contains unstructured data, Copilot may produce misleading or inaccurate information. This is a big challenge for both teachers and students to critically evaluate the received information. This also makes it essential for them to give the prompt in clear language and ensuring that the questions is asked properly.

**No Video Explanations:** Copilot deals with text-based content efficiently and generates responses with at most accuracy however, it cannot generate explanations through videos. Learners with diverse needs do not benefit with its responses. For example, a learner needs both audio and visual to understand a concept may not find this tool useful. It also fails to develop special understanding or geometrical

knowledge among students as it produces answers directly without video explanations.

**Over Reliance on AI powered Technology:** When the users overly rely on these AI powered tools, it negatively affects their skills such as problem solving, critical thinking, collaboration, etc. Students may not develop 21st century skills. Therefore, the usage of AI tools also require intervention from the adults to avoid misconceptions and enhance profound understanding of concepts.

**Issue of Reliability and Accuracy:** Copilot may sometimes respond to problems inaccurately. It may give incorrect or misleading information as it uses the large language models. Its responses are based on interaction with other users and doesn't always refer to verified sources. It is important for teachers and students to cross check its responses with a verified source and incorporate them in learning process.

**Data Privacy and Security:** Yan et al. (2023) stated in his study the challenges associated with privacy of data as AI tools do not maintain their consenting strategies. Copilot is used in different institutions. It processes user data to give responses. There are chances for unauthorised access or leaks in data if proper safety measures are not put in place. It also doesn't explicitly mention its strategy for granting consent from its users. This is crucial in educational environments where student information must be protected under strict privacy regulations. Students may unknowingly grant permission to applications to access their personal information. This may leak their private information and lead to mis-happenings. Therefore, there is a need for imparting information and knowledge about privacy to students and teachers for effective use of technology.

**Biased Content:** Copilot may give biased responses unintentionally that strengthens certain stereotypes or even put down the marginalised voices. The reason for such output is that Copilot used large data bases that depict the existing societal patterns which have been collated due to the interaction with other users. This can also show biases towards a particular group of people, support a section of society and marginalise the other. This may unethically transform the perspectives of the learners as they may rely on the technological use and find it be true in all aspects without crosschecking its data. This requires ethical evaluation of the content and being responsible in the use of AI tools. Both the stakeholders need to be mindful in their usage and review the content generated before using it.

**Need for Human Intervention:** Cope et al. (2020) states that AI can never replace teachers instead act as a supportive tool for efficient teaching in classroom. Though these tools like copilot seem to be promising for learners as they produce data or information for every input by the user, adult or teacher intervention is quite essential. The authenticity as well as the accuracy of the information must be evaluated. Unsupervised usage of these tools may lead to the development of conceptual misunderstanding or misconceptions. This shows that even if technology performs exorbitantly in every field of education, there will always be need for teachers and it can never replace them.

**Digital Divide:** Digital Divide is a major cause of concern in India where students come from various socio-economic and cultural backgrounds. Learners may or may not have the access to digital resources, internet accessibility or supportive learning environment at home. This hinders their awareness and knowledge of

technological tools that can be used for the learning process. Similarly, teachers may lack the awareness of technological tools that could be used in classrooms due to unavailability of resources. This deepens the inequality of opportunities for learning among students. Thus, there is a need to bridge this gap by giving equal access as well knowledge of technological tools to aid the learning teaching process.

## Conclusion

Microsoft Copilot is a valuable resource in the teaching learning process, especially for a subject like mathematics. Learners engaged in mathematical problem solving may get instant feedback on their work and develop deeper understanding of concepts with the use of Copilot. It has embarked a transformative shift from traditional pedagogy to innovative and inclusive teaching strategies. It follows an approach of scaffolding the concepts by explaining each step meticulously. This fosters and enhances students learning and achievement. This tool encourages learners to learn at their own pace and also personalise the learning process as per each student's needs. This process develops deeper understanding among learners and nurtures their creativity.

Teachers use Copilot for generation of lesson plans which caters to the needs of all the learners thus helps in achieving the objectives of the planned class. It also acts as a supportive agent in classroom teaching. It increases the efficiency of teachers by suggesting varied levels of tasks for learners. For example, it gives easy activities, worksheets, assignments to the average learners, and would give scaffolding

techniques for below average learners. It can also be asked to add differentiation in the activities to make it challenging for advanced learners. This feature makes it an effective tool especially in Indian context where there are around 30 students per teacher and differentiated learning techniques suggested by copilot could help teachers in raising the achievement level of all the students. It often generates ideas that support experiential learning in classroom which are also supported by constructivism. As stated above, these tools can bring a transformative change in classroom learning but relying overly on these tools may hamper the development of 21<sup>st</sup> century skills among learners which are essential for existence in towards world.

Teacher support and supervision is of at most importance when it comes to technological usage in classrooms. Educators must make learners aware of the errors Copilot can make and encourage them to critically evaluate it before using as it could have a negative impact on the conceptual clarity. Thus, Copilot should be used as a tool that complements the learning as well as teaching process instead of substituting the teachers in classroom. Copilot enhance the pedagogical knowledge of teachers and improve learner engagement to a certain extent.

This study contributes to the discussion on use of Artificial Intelligence in education by emphasising how tools like Microsoft Copilot can collaborate with educators to enrich classroom practices, ensuring that technology enhances rather than diminishes the human elements of teaching and learning.

## References

- Acharya, V. V. (2023). The impact of Microsoft 365 Copilot on small and medium-sized businesses. *Journal of Educational Technologies and Innovative Research*, 10(4), 546. <https://www.jetir.org/papers/JETIR2304546.pdf>
- Adetayo, A. J., Aborisade, M. O., & Sanni, B. A. (2024). Microsoft Copilot and Anthropic Claude AI in education and library service. *Library Hi Tech News*. <https://www.emerald.com/insight/content/doi/10.1108/LHTN-01-2024-0002/full/html>
- AlAli, R. M., & Al-Barakat, A. A. (2023). Leveraging the revolutionary potential of ChatGPT to enhance kindergarten teachers' educational performance: A proposed perception. *Eurasian Journal of Educational Research*, 106(106), 67–84. <https://ejer.com.tr/manuscript/index.php/journal/article/view/1374/298>
- Baker, T., Smith, L., & Anissa, N. (2019). Educ-AI-tion Rebooted? Exploring the future of artificial intelligence in schools and colleges. [https://media.nesta.org.uk/documents/Future\\_of\\_AI\\_and\\_education\\_v5\\_WEB.pdf](https://media.nesta.org.uk/documents/Future_of_AI_and_education_v5_WEB.pdf)
- Bates, A.W. (2019). Teaching in a Digital Age – Second Edition. Vancouver, B.C.: Tony Bates Associates Ltd. Retrieved from <https://pressbooks.bccampus.ca/teachinginadigitalagev2/>
- Blasco, A., & Charisi, V. (2024). AI Chatbots in K-12 Education: An Experimental Study of Socratic vs. Non-Socratic Approaches and the Role of Step-by-Step Reasoning *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.5040921>
- Cardona, M. A., Rodríguez, R. J., & Ishmael, K. (2025, December 15). Artificial intelligence and the Future of Teaching and Learning: Insights and recommendations. UNT Digital Library. Retrieved December 21, 2025, from <https://digital.library.unt.edu/ark:/67531/metadc2114121/>
- Central Board of Secondary Education (2020). Artificial intelligence integration across subjects for CBSE curriculum. CBSE Academic. [https://cbseacademic.nic.in/web\\_material/Curriculum20/AI\\_Integration\\_Manual.pdf](https://cbseacademic.nic.in/web_material/Curriculum20/AI_Integration_Manual.pdf)
- Chisaka, B. C., Mamvuto, A., Matiure, S., Mukabeta, M. T., Shumba, T., & Zireva, D. (2013). \*Action research: Some practical ideas for educational practice\*. Save the Children. Retrieved on 20.12.2025 <https://resourcecentre.savethechildren.net/document/action-research-some-practical-ideas-educational-practice/>
- Choi, Y., & McClenen, C. (2020). Development of adaptive formative assessment system using computerized adaptive testing and dynamic Bayesian networks. *Applied Sciences*, 10(22), 8196. <https://doi.org/10.3390/app10228196>
- Cope, B., Kalantzis, M., & Sears, D. (2020). Artificial intelligence for education: Knowledge and its assessment in AI-enabled learning ecologies. *Educational Philosophy and Theory*, 53(12), 1229–1245. <https://doi.org/10.1080/00131857.2020.1728732>
- Corner, E. J., Murray, E. J., & Brett, S. J. (2019). Qualitative, grounded theory exploration of patients' experience of early mobilisation, rehabilitation and recovery after critical illness. *BMJ Open*, 9(2), e026348. <https://doi.org/10.1136/bmjopen-2018-026348>
- Falcão, T. P., De Andrade E Peres, F. M., De Moraes, D. C. S., & Da Silva Oliveira, G. (2017). Participatory methodologies to promote student engagement in the development of educational digital games. *Computers & Education*, 116, 161–175. <https://doi.org/10.1016/j.compedu.2017.09.006>
- Gayed, J. M., Carlon, M. K. J., Oriola, A. M., & Cross, J. S. (2022). Exploring an AI-based writing Assistant's impact on English language learners. *Computers and Education Artificial Intelligence*, 3, 100055. <https://doi.org/10.1016/j.caeai.2022.100055>

- Hasanov, A., Laine, T. H., & Chung, T. S. (2019). A survey of adaptive context-aware learning environments. *Journal of Ambient Intelligence and Smart Environments*, 11(5), 403–428. <https://doi.org/10.3233/AIS-190534>
- Hidayat, R., Mohamed, M. Z. B., Suhaizi, N. N. B., Sabri, N. B. M., Mahmud, M. K. H. B., & Baharuddin, S. N. B. (2022). Artificial intelligence in mathematics education: A systematic literature review. *International Electronic Journal of Mathematics Education*, 17(3), em0694. <https://doi.org/10.29333/iejme/12132>
- Jagadeesan, S., Rao, K. S., Halim, M. S., Otero-Potosi, S., Fuertes-Narváez, E., & Rao, A. L. N. (2023). AI in education: The potential impact of intelligent tutoring systems and personalized learning. *European Chemical Bulletin*, 12, 1964–1975. Retrieved on 10.02.2025 [https://www.researchgate.net/publication/370526386\\_AI\\_In\\_Education\\_The\\_Potential\\_Impact\\_of\\_Intelligent\\_Tutoring\\_Systems\\_and\\_Personalized\\_Learning](https://www.researchgate.net/publication/370526386_AI_In_Education_The_Potential_Impact_of_Intelligent_Tutoring_Systems_and_Personalized_Learning)
- Jancarik, A., Novotna, J., & Michal, J. (2022). Artificial intelligence assistant for mathematics education. *European Conference on e-Learning*, 21(1), 143–148. <https://doi.org/10.34190/ecel.21.1.783>
- Jeon, J., & Lee, S. (2023). Large language models in education: A focus on the complementary relationship between human teachers and ChatGPT. *Education and Information Technologies*, 28, 15873–15892. <https://doi.org/10.1007/s10639-023-11834-1>
- Kasneji, E., Sessler, K., Küchemann, S., Bannert, M., Dementieva, D., Fischer, F., Gasser, U., Groh, G., Günemann, S., Hüllermeier, E., Krusche, S., Kutyniok, G., Michaeli, T., Nerdel, C., Pfeffer, J., Poquet, O., Sailer, M., Schmidt, A., Seidel, T., . . . Kasneji, G. (2023). ChatGPT for good? On opportunities and challenges of large language models for education. *Learning and Individual Differences*, 103, 102274. <https://doi.org/10.1016/j.lindif.2023.102274>
- Kim, W. (2021). A Design-based Research on Application of Artificial Intelligence (AI) Teaching-learning Model in Elementary School. *International Journal of Advanced Smart Convergence*, 10(2), 201–208. <https://doi.org/10.7236/IJASC.2021.10.2.201>
- Lee, S. J., & Kwon, K. (2024). A systematic review of AI education in K–12 classrooms from 2018 to 2023: Topics, strategies, and learning outcomes. *Computers and Education: Artificial Intelligence*, 6, 100211. <https://doi.org/10.1016/j.caeai.2024.100211>
- Lin, C. C., Huang, A. Y. Q., & Lu, O. H. T. (2023). Artificial intelligence in intelligent tutoring systems toward sustainable education: A systematic review. *Smart Learning Environments*, 10(1), Article 41. <https://doi.org/10.1186/s40561-023-00260-y>
- Liu, J., Sun, D., Sun, J., Wang, J., & Yu, P. L. H. (2025). Designing a generative AI enabled learning environment for mathematics word problem solving in primary schools: Learning performance, attitudes and interaction. *Computers and Education Artificial Intelligence*, 9, 100438. <https://doi.org/10.1016/j.caeai.2025.100438>
- Lo, C. K. (2023). What is the impact of ChatGPT on education? A rapid review of the literature. *Education Sciences*, 13(4), 410. <https://doi.org/10.3390/educsci13040410>
- Mayer, R. E. (2005). *The Cambridge handbook of multimedia learning*. Cambridge University Press. <https://www.jsu.edu/online/faculty/MULTIMEDIA%20LEARNING%20by%20Richard%20E.%20Mayer.pdf>
- Ministry of Human Resource Development. (2020). National education policy 2020. Government of India. [https://www.education.gov.in/sites/upload\\_files/mhrd/files/nep\\_update/National\\_Education\\_Policy\\_2020\\_en.pdf](https://www.education.gov.in/sites/upload_files/mhrd/files/nep_update/National_Education_Policy_2020_en.pdf)
- Microsoft. (2023). *Introducing Copilot: Your everyday AI companion*. Microsoft. <https://www.microsoft.com/en-us/copilot> 2025 *Ganit Prakash*, Book 1: Textbook in mathematics for class VII

- Novita, N. R. (2025). AI in lesson planning: Improving teacher efficiency and instructional design. *JOURNAL RISET RUMPUN ILMU PENDIDIKAN*, 4(2), 192–202. <https://doi.org/10.55606/jurripen.v4i2.5560>
- OpenAI. (2023). *Filling crucial language learning gaps: Duolingo and GPT-4*. <https://openai.com/index/duolingo/>
- Organisation for Economic Co-operation and Development (OECD). (2022). *Artificial intelligence in education: Challenges and opportunities*. OECD Publishing. <https://www.oecd.org/education/artificial-intelligence-in-education.html>
- Pappas, I. O., & Giannakos, M. N. (2021). Rethinking learning design in IT education during a pandemic. *Frontiers in Education*, 6, 652856. <https://doi.org/10.3389/feduc.2021.652856>
- Pradana, M., Elisa, H. P., & Syarifuddin, S. (2023). Discussing ChatGPT in education: A literature review and bibliometric analysis. *Cogent Education*, 10(2), 2243134. <https://doi.org/10.1080/2331186X.2023.2243134>
- Sahlman, W. A., Ciechanover, A. M., & Grandjean, E. (2023). Khanmigo: Revolutionizing learning with GenAI (Case No. 9-824-059). *Harvard Business School Publishing*. <https://www.hbs.edu/faculty/Pages/item.aspx?num=64929>
- Sanusi, I. T. (2021). Intercontinental Evidence on learners' differentials in sense-making of machine learning in schools. In *21st Koli Calling International Conference on Computing Education Research*. pp. 1–2. <https://doi.org/10.1145/3488042.3490514>
- Shute, V. J., & Psotka, J. (1994). Intelligent tutoring Systems: past, present, and future. Retrieved from [https://myweb.fsu.edu/vshute/pdf/shute%201996\\_d.pdf](https://myweb.fsu.edu/vshute/pdf/shute%201996_d.pdf)
- Siiman, L. A. (2024). AI in teacher education: An introductory training session for pre-service teachers involving Microsoft Copilot. *Innovative Technologies and Learning*. pp. 231–236. Springer. [https://link.springer.com/chapter/10.1007/978-3-031-65884-6\\_24](https://link.springer.com/chapter/10.1007/978-3-031-65884-6_24)
- Sweller, J. (1988). Cognitive load during problem solving: Effects on learning. *Cognitive Science*, 12(2), 257–285. [https://doi.org/10.1207/s15516709cog1202\\_4](https://doi.org/10.1207/s15516709cog1202_4)
- UNESCO. (2021). *AI and education: Guidance for policy-makers*. United Nations Educational, Scientific and Cultural Organization. <https://unesdoc.unesco.org/ark:/48223/pf0000376709>
- VanLehn, K. (2011). The relative effectiveness of human tutoring, intelligent tutoring systems, and other tutoring systems. *Educational Psychologist*, 46(4), 197–221. <https://doi.org/10.1080/00461520.2011.611369>
- Warner, J., Aquino, N., & Ykema, R. (2024). Copilot use cases for research – Copilot for M365 – Starter Series. Microsoft Tech Community. <https://techcommunity.microsoft.com/blog/healthcareandlifesciencesblog/recording---copilot-use-cases-for-research-%e2%80%93-copilot-for-m365-%e2%80%93-starter-series/4116494>
- Warren, D. H. D., & Domingue, J. (2015). Artificial intelligence in education: Past, present and future. In *Proceedings of the 2015 International Conference on Artificial Intelligence and Education*. pp. 12–24. Springer. [https://doi.org/10.1007/978-3-319-12334-5\\_2](https://doi.org/10.1007/978-3-319-12334-5_2)
- Yan, L., Sha, L., Zhao, L., Li, Y., Martinez-Maldonado, R., Chen, G., Li, X., Jin, Y., & Gašević, D. (2023). Practical and ethical challenges of large language models in education: A systematic scoping review. *British Journal of Educational Technology*, 1–23. <https://doi.org/10.1111/bjet.13370>
- OpenAI. (2023). *Filling crucial language learning gaps: Duolingo and GPT-4*. <https://openai.com/index/duolingo/>

Organisation for Economic Co-operation and Development (OECD). (2022). *Artificial intelligence in education: Challenges and opportunities*. OECD Publishing. <https://www.oecd.org/education/artificial-intelligence-in-education.htm>

Warner, J., Aquino, N., & Ykema, R. (2024). Copilot use cases for research – Copilot for M365 – Starter Series. Microsoft Tech Community. <https://techcommunity.microsoft.com/blog/healthcareandlifesciencesblog/recording---copilot-use-cases-for-research-%e2%80%93-copilot-for-m365-%e2%80%93-starter-series/4116494>