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Impact of Artificial Intelligence on Undergraduate Mathematical Creativity and Problem-Solving Skills

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Abstract

Artificial intelligence (AI) is also making a difference in education in mathematics, particularly in creativity and problem-solving skills. This research aimed to examine the impact of the familiarity of Artificial Intelligence (AI) on mathematical creativity and problem-solving skills of undergraduate students in Kathmandu Valley, Nepal. A convergent mixed methods design was adopted in which there were 250 undergraduate students. Quantitative data was collected using an adapted structured questionnaire containing Likert scale items and qualitative data was obtained from the open-ended data in a structured questionnaire. Quantitative data were analyzed using the methods of descriptive statistics, Pearson correlation, multiple regression, and independent samples t-test and qualitative data using the methods of thematic analysis. The results revealed strong and significant positive relationships between the AI familiar, creativity and problem-solving skills. Regression analysis showed that the AI familiarity and creativity successfully predicted problem-solving performance significantly ($R^2 = 0.828$, $p < .001$). Gender differences were also present having higher problem-solving scores for the female students. Qualitative results found that students considered AI as a cognitive support tool which supported exploratory thinking and flexibility in finding solutions, although it was understood that the over-reliance and misuse of AI for ethics purpose were raised. The conclusion of the study is that AI has an enormous potential to develop higher order thinking in mathematics, provided the integration of AI is responsible. The results suggested the importance of the need for organized AI literacy initiatives and clear institutional guidelines to provide balanced and ethical implementation within the higher education domain.

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Introduction

Artificial Intelligence (AI) has become an educational revolution that is changing the landscape of knowledge delivery, evaluation, as well as enshrinement by learners worldwide. With the development of AI, beginning with expert systems and now finding significant popularity in large language models like ChatGPT and Gemini, opportunities in the field of personalized learning, adaptive feedback, and interaction have opened up a new room of flexibility (Holmes et al., 2019). The impact of AI on mathematics education is of special interest because the said technology can be useful in promoting such fundamental skills as problem-solving and creative thinking, which become more important in the knowledge economy and the fields of STEM-based vocations (Asare et al., 2025).

Mathematics has traditionally been taught with an emphasis on procedural fluency which involves memorizing formulas and practicing through repetition, and following algorithms to the letter. Although this is successful in developing lower-level skills, frequently these methods do not develop higher-level thinking, adaptability, and creativity. The current models of education now focus on mathematical creativity, which means that the learner should be able to devise new, useful, and varied answers to problems that are not routine (Leikin & Levav-Waynberg, 2008). In the same line of thought, solving the problems is no longer an event of pure computation but is focused on modeling, justification, and strategic reasoning. As a reaction, AI systems are being used not only as the means of automation powerful enough to replace human beings but as cognitive companions that enable exploratory learning, the generation of variations on proofs, and the support of multi-step reasoning (Liang et al., 2025;Yoon et al., 2024;).

Intelligent tutoring systems, automated assessment platforms, and generative models are other AI technologies becoming increasingly common in educational institutions all around the world. The use of apps such as Photomath, Wolfram Alpha, and, recently, ChatGPT provides students with step-by-step solutions to their problems as well as proof suggestions, changing how math is solved. Based on empirical research, positive changes in student engagement have been reported, and readiness decreased, as well as metacognitive awareness improved, in the case of successful integration of AI into a learning environment (Gabriel, 2025; Opesemowo & Ndlovu, 2024).

Nonetheless, this technological development raises several pedagogical and ethical issues. Overreliance on AI, often referred to as **"cognitive offloading,"** can lead to diminished critical thinking and weakened conceptual understanding (Wei et al., 2025). Furthermore, AI's use in academic settings raises alarms about **academic integrity, plagiarism,** and **algorithmic bias,** especially when students passively accept AI-generated answers without critical evaluation (Charles & Charles, 2024). Study like Kim et al. (2025) highlights a lack of linkage of student excitement towards AI and faculty fear, where educators remain suspiciously immune to AI reliability, openness, and utility in teaching skills. Confidence in thyroid, learner control, and the preparedness of teachers all become critical factors that influence successful integration. In developing nations such as Nepal, the introduction of AI in post-secondary education is in its early days. Insufficient access to health care facilities, inadequate numbers of trained teachers, and disparities in technological access are barriers to scaling up. Nevertheless, Nepalese students (particularly in big city centers of learning such as Kathmandu Valley) are turning to the freemium AI systems that are widely available (and frequently unregulated), including ChatGPT, with little institutional backing or ethical advice. This ad hoc practice necessitates the need to research the impact of AI on student learning, especially in areas that are supposed to involve complex reasoning, such as mathematics. Context-specific and scientific research using data is still scarce in Nepal, especially when discussing the effect of AI on the mathematical creativity and problem-solving abilities of the students. The present research intends to fill these gaps, in this case by examining the perceptions and uses of AI by undergraduate Nepali students interested in its use in the improvement of their thinking in mathematics.

In particular, it will investigate (i) the kind and prevalence of AI tools that students apply; (ii) the perceived impact of AI on mathematical creativity and problem solving; (iii) correlated difficulties, including dependency, ethical quandaries, and assurance. Using both convergent mixed methods (combining survey, interviewing two groups (students and faculty), this study can bring comprehensive knowledge related to the role of AI in education in a developing country. Its findings are based on international literature, but they are adapted to the socio-educational situation in Nepal, so it can be characterized as a study with a local and international knowledge base. By doing so, the study not only adds to the topic of research that becomes increasingly popular in the context of AI in mathematics education but also provides practical implications of the study to practitioners, policy-makers, and technology designers interested in maximizing the positive effects of AI without damaging the integrity of pedagogy.

Research Objectives

This study aims to:

- Assess the level of familiarity with and usage of artificial intelligence (AI) tools among undergraduate students in mathematics learning.
- Examine the relationship between AI familiarity and mathematical creativity.
- Examine the relationship between AI familiarity and mathematical problem-solving skills.
- Determine the predictive influence of AI familiarity and mathematical creativity on students' problem-solving performance.
- Explore students' perceived benefits and challenges associated with the use of AI in mathematics learning, including issues of over-reliance, ethics, and accessibility.

Research Hypotheses

- **H1:** AI familiarity is positively and significantly related to mathematical creativity among undergraduate students.
- **H2:** AI familiarity is positively and significantly related to mathematical problem-solving skills among undergraduate students.
- **H3:** Mathematical creativity is positively and significantly related to mathematical problem-solving skills among undergraduate students.
- **H4:** AI familiarity significantly predicts students' mathematical problem-solving performance.
- **H5:** Mathematical creativity significantly predicts students' mathematical problem-solving performance.
- **H6:** There is a significant difference in problem-solving performance between male and female students.

Literature Review

AI in Mathematics Education

AI has increasingly transformed the world of education, moving beyond the rule-based computing orbs like Wolfram Alpha to the most advanced generative AI applications, ranging in quality from ChatGPT and Gemini, which can reason in context and respond conversationally, using natural language (Van Vaerenbergh & Perez-Suay, 2021). The historical roots of AI in mathematics education lie mainly in computational aids to doing mathematics: completing algebraic steps or running through an algebraic solver. Nevertheless, the latest developments have turned AI into an active educational companion, which can emulate the behavior of a tutor, produce proofs, visualize abstract notions, and support customized learning sessions (Awang et al., 2025).

The systematic reviews conducted by Awang et al. (2025) and Opesemowo and Ndlovu (2024) point out four central pieces of the educational use of AI in the field of mathematics. Intelligent Tutoring Systems (ITS) are made up of adaptive, individual instructional feedback modeled on the learner's knowledge, diagnosis of wrong concepts, and step-by-step feedback advice (Gabriel, 2025). Examples include platform-driven AI that adapts the difficulty of tasks to the performance of the students or provides hints based on the learner's performance. Second, the use of Generative AI, including ChatGPT and GPT-4, goes further than procedural assistance and is capable of generating comprehensive explanations of problems as well as leading its user through the construction of a proof and generating alternative solution strategies (Liang et al., 2025). Third, Gamified AI Learning Tools make use of game mechanics in math classrooms and lead to increased motivation and engagement within the learning process, as well as help develop procedural fluency (Bayaga, 2024). Lastly, Automated Assessment Tools allow assessing the student responses immediately using the AI algorithms, giving them feedback related to their responses and being able to track the progress in mastering skills over time (Yoon et al., 2024).

Empirical studies support the beneficial role of AI on the engagement, success, and confidence of students in mathematics. Following Gabriel (2025), using AI integration helps lessen math anxiety because it provides low-stakes, individualized assistance so the learners can practice without being afraid to make a mistake. Nevertheless, researchers warn of excessiveness and unfair distribution. Charles and Charles (2024) stress that the democratization of information provided by AI can contribute to the creation of inequalities in education because differences in access to digital devices and internet provisions, and levels of AI literacy can contribute to those inequalities. Further, there are systematic issues with the ethical considerations of implementing algorithmic bias in AI-generated solutions, and hence, appropriate policy regulations and training should be enforced on educators as well as students.

AI and Mathematical Creativity

Mathematical creativity is generically understood as the capacity to come up with insights, genuine, useful, and valid solutions to mathematical problems (Asare et al., 2025). It is more than purely procedural competence in that it demands the ability to think flexibly, insight into a concept, and proficiency in relating diverse ideas. The opportunity of creativity with the use of AI is that it can introduce some unorthodox methodologies and provide exploratory directions to the learners beyond formulaic algorithms.

Ye et al. (2024) have theoretically introduced a benchmark reflecting the novelty and validity of AI-generated solutions known as *CREATIVEMATH*. Their results showed that GPT-4 and similar language models have the transformative ability to give important innovations that human learners may not consider, hence, stimulating new reasoning. Nonetheless, such outputs tended to be erroneous and, therefore, introduced the need to have humans supervise the processes of producing these outputs and critically evaluate them. To the same extent, Liang et al. (2025) contend that the unconventional reasoning in AI is capable of disrupting the principle of conventional pedagogy as it allows students to challenge the established approach to solving problems and seeking alternative mathematical-related paths, and thereby expands their mental set of tools.

Yoon et al. (2024) suggested the SIPE-AI framework (Students' Proof Engagement with AI) as a way to have a unified view of creativity using AI-supported mathematics. The framework focuses on four interrelated elements (1) the conception of proofs by the students (the way they perceive and design the construction of proofs), (2) their perceptions regarding the AI and their level of trust, (3) the mode of engagement as critical or passive, and (4) ethical attitude towards the use of AI. The model demonstrates how a creativity concept is not a cognitive product but a creation that comes as the result of the communicative interchange formed by the level of trust, critical response, and responsible use. Remarkably, with critical intakes of AI products, students tend to accept, optimize, and expand AI-proposed solutions, hence supporting innovativeness and metacognition.

AI in Problem-Solving Skills

Problem-solving has also been at the heart of mathematics education, where one learns to apply the material learned to situations they have never encountered before or find difficult to solve. AI has greatly promoted this field because it provides procedural instructions step-by-step and immediate verification of solutions. Apps such as Photo Math and Wolfram Alpha have become commonplace, where the students achieve the procedural fluency of being able to divide multi-step problems into small bites (Egara et al., 2025). Such tools contribute to the immediate grasping of information, but their learning quality is limited to active operations and deliberation, and not passive retrieval of answers.

Studies also prove the ability of AI to enhance problem-solving by making outliers less likely. In line with the scenario mentioned above, Wei et al. (2025) have experimented on AI-assisted collaborative problem-solving (CPS) in a group learning environment, indicating that AI tools assist in the decentralization of cognitive load, leaving students free to perform at a higher order of thinking. Those participants who engaged with AI in collaborative activities had better conceptual knowledge and were more creative when it came to solving non-routine problems.

Moreover, Bayaga (2024) points out the potential of gamified AI platforms to develop persistence and strategic thinking during complicated tasks. His work demonstrated that using a combination of AI-generated feedback with game mechanics (e.g., progress badges or timed challenges) went beyond enhancing mathematical cognition to cause students to persist in longer-term inference in problems, demonstrating impaired problem-solving stamina. Cumulatively, such findings confirm the duality of AI as a form of procedural scaffolding, as well as an aid to conceptual problem-solving and critical inquiry.

Ethical and Trust Considerations in AI Use

Students' portrayals of trust and ethical use is an important factor of the way the AI tools impact mathematical creativity and problem-solving. Research have recommended trust in the output of AI in order to better the possibility of students to a portion of their study practices (Amoozadeh et al., 2023). However, too much trust might lead to spending too much money, and not be able to think independently (Wei et al., 2025). Faculty concerns with regard to plagiarism, academic misconduct and lack of transparency in AI generated responses are further signs of ethical challenges with higher education (Kim et al., 2025; Charles & Charles, 2024). Additionally, unequal access to digital infrastructure could lead to disparity in the learning environment with the AI support (Egara et al, 2025).

These problems emphasize the importance of the development of AI literacy and responsible integration techniques that encourage critical evaluation of the outputs of AI rather than blind trust (Marrone et al., 2024).

Research Gaps

Although the literature relating to the use of artificial intelligence in mathematics education has grown tremendously over the last few years (Awang et al., 2025; Opesemowo & Ndlovu, 2024), there are significant gaps in the literature. Existing studies tend to focus on general perceptions of AI use or its procedural benefits and there is little empirical evidence which investigates the impact of AI familiarity on higher-order cognitive outcomes including mathematical creativity and problem-solving skills. While generative AI has been discussed with reference to creativity (Ye et al., 2024; Liang et al., 2025), there is a few studies that examines the combined relationship of AI familiarity, creativity, and problem-solving in one analytical frameworks. Methodologically, a lot of the existing research focuses heavily on quantitative survey designs that include Likert scale instruments (Egara et al., 2025), and there is only a low integration of qualitative information that explains how students understand and critically interact with AI tools.

In addition, most empirical research has occurred in technologically advanced and high-resource contexts, and has assumed the digital infrastructure and superior AI literacy. There is less context-specific research in developing countries such as Nepal where the integration of AI in higher education is still emerging. As a consequence, the evidence is not yet good enough regarding what the impact of AI on mathematical creativity and problem-solving among undergraduates in such environments is. Therefore, there is a need to conduct a mixed methodology research that will provide both statistical and experiential understanding on students' engagement with AI in mathematics learning.

Methodology

Research Design

This study was conducted using a convergent mixed-methods approach whereby both quantitative and qualitative data were gathered simultaneously and subsequently analyzed separately but then brought together in the interpretation process (Creswell & Plano Clark, 2017). This approach was suitable since it allowed the researcher to investigate the effect of artificial intelligence (AI) in the mathematical creativity and problem-solving ability of undergraduate students from statistical and an experiential perspective. The quantitative part of the study provided results that could be generalized based on the structured response from the questionnaire while the qualitative part that also was generalized from the open-ended response on the same questionnaire provided rich information with regards to the perceptions, engagement strategies, and ethical issues associated with the use of AI by the students. This combination of both strands in the interpretation allowed for triangulation and finding validation to the overall study which increased the strength of the study.

Research Site and Participants

The study was carried out in the Kathmandu Valley, Nepal with undergraduate students undertaking programs related to mathematics at Tribhuvan University (TU) and Pokhara University (PU). These institutions were selected as they represent large providers of higher education in Nepal and include those students from different academic and socio-economic backgrounds.

A total of 250 undergraduate students were engaged in the research. Participants were recruited based on a purposive sampling strategy approach, in conjunction with voluntary participation. First, department heads and course instructors were given permission to do so. The questionnaire was then distributed to the students studying mathematics and STEM related courses through classroom announcements and online academic groups. Students who have had experiences with AI tools in their academic work were invited to participate. Participation was voluntary and informed consent was taken prior to data collection.

For qualitative component, 12 students were selected using maximum variation sampling based on the self-reported level of use of AI (frequent, moderate and minimal users). Their qualitative responses were based on open-ended questions which were intended to gather data in the questionnaire and not with separate interviews. This approach allowed the study to reflect on a variety of experiences of AI engagement in the larger quantitative sample.

Data Collection Tools/ Instrument

A structured questionnaire was used as the main instrument of data collection in order to investigate the effect of artificial intelligence (AI) on mathematical creativity and problem-solving ability of undergraduate students. The instrument was made up of items, 51 pieces of information (excluding demographic information), of which 43 pieces of information were Likert scale for quantitative measurement and 8 pieces of information were open-ended questions to collect qualitative insights.

The questionnaire was adapted and modified from validated instruments which were previously developed by Kim et al. (2025) and Wei et al. (2025). Necessary modifications were done to suit the items with objectives of present study and context of higher education in Nepal. Expert consultation was done in order to ensure that the items were culturally and contextually appropriate.

To establish validity and reliability the instrument was pilot tested with 20 undergraduate students who were not a part of the final sample. Based on their feedback, some minor adjustments were made to the wordings so that it is more clear and coherent. The internal consistency of the Likert-scale items was measured by the use of Cronbach's alpha and resulted in a reliability coefficient of 0.87, which is above the cut off recommended for alpha, 0.70 (Taber, 2018). Face and content validity was established by two university professors specializing in mathematics education.

Data collection and Analysis Procedure

After securing institutional permission and informed consent from the participants, the questionnaire was administered among students of undergraduate programs related to mathematics. The distribution of the instrument occurred during assigned class periods in a printed form as well as electronically via academic platforms to guarantee greater participation. The data collection process was conducted for a period of four weeks. Participation was voluntary and anonymity was ensured for the duration of the study.

Upon completion of data collection, quantitative responses were coded and entered into Statistical Package for the Social Sciences (SPSS), Version 27 for analysis. Composite scores of AI familiarity, mathematical creativity, problem-solving skills, and perceived challenges were calculated by taking the average of the item responses in each of these scales.

Descriptive statistics (means and standard deviations) were calculated in order to determine the levels of AI familiarity, mathematical creativity, and problem-solving skills. Pearson correlation analysis was performed to test Hypotheses H1-H3 about relationship between AI familiarity, creativity, and problem-solving skills. Multiple linear regression analysis was conducted to test Hypotheses H4 and H5, in which the predictive effect of AI familiarity and creativity on problem-solving performance were analyzed. An Independent samples t-test was performed to test the Hypothesis H6 related to gender and problem-solving scores. A statistical significance level of 0.05 was used.

Although the overall sample size was 250, small numbers of missing responses led to minor differences in the valid sample sizes for the analyses. Each statistical test was performed for available cases for the respective variables.

For qualitative component, data obtained by the open-ended questions were analyzed with the help of thematic analysis. The data were read again and again to ensure familiarity of the data, and meaningful statements were coded. Similar codes were grouped into broader themes related to student's perception, perceived benefits and challenges associated with learning with AI in mathematics learning. The qualitative results were combined with the quantitative results in the interpretation phase to gain an overall understanding of the influence of AI on mathematical creativity and problem-solving.

Data Interpretation

This study involves a combined interpretation of the statistics of 250 undergraduate mathematics students. Quantitative results bring to light the statistical trends in the level of knowledge that the students had on AI, its effects on problem-solving and creativity, and the differences that existed between the groups. These patterns are supplemented with the qualitative findings, providing the students' opinions directly and elaborating on how the AI tools are used in everyday academic life.

Results

This section outlines the major quantitative and qualitative study results. Quantitative results include descriptive statistics, Pearson correlation analysis, multiple regression analysis, and independent samples t-test of relationship among AI-familiarity, mathematical creativity, and problem-solving skills. The qualitative findings, which are based on open-ended responses, are reported together with statistical results to give some contextual explanation, and give examples of student experience of AI-supported learning.

Student Familiarity and Usage of AI Tools

The descriptive statistics Table 1 depicted the level of familiarity with AI tools on a scale of 5 points was estimated as the moderate level ($M = 2.71$, $SD = 1.21$) by students. Problem-solving ability ($M = 2.71$, $SD = 1.12$) and creativity ($M = 2.76$, $SD = 1.04$). A similar score was found on problem-solving ability and creativity (Table 1). The averages indicate that, though students seem to be working with AI, many of them are learning further expertise and incorporating it into their study habits.

Table 1

Descriptive Statistics of *Student Familiarity and Usage of AI Tools*

Variable	N	Mean	Std. Deviation
AI Familiarity	247	2.71	1.21
Problem-Solving	243	2.71	1.12

Creativity	250	2.76	1.04

Qualitative remarks can show that an AI application is, in many cases, selective and issue-specific. According to one of the students, “I mainly use tools to check my calculus work, such as Photomath. When I am stumped by an integration problem, I will then use it to get the first step and then attempt to work out the rest myself.”

Impact of AI on Creativity and Problem-Solving Skills in Mathematics

Table 2 indicates the correlation coefficient between artificial intelligence familiarity, mathematical creativity and problem-solving skills (Pearson, 2010). The results indicate the presence of strong, positive and statistically significant relationships among all three variables ($p < .01$). Specifically, AI familiarity was significantly correlated with problem-solving skills ($r = .89$, $p < .01$), implicating the higher familiarity with AI tools that the students reported to be able to display the higher level of problem-solving ability.

In addition, the familiarization with AI was significantly related to mathematical creativity ($r = .71$, $p < .01$). A strong positive relationship was also found between creativity and problem-solving skills ($r=.77$, $p<.01$). These results suggest a high extent of relationship of AI familiarity to creativity and problem-solving ability in undergraduate students.

1Therefore, Hypotheses H1, H2 and H3 were supported. AI familiarity was positively related to mathematical creativity (H1) and problem-solving skills (H2) and creativity was positively related to problem-solving skills (H3).

Table 2

Correlations between AI with Creativity *and Problem-Solving Skills in Mathematics*

	AI Familiarity	**Problem-Solving**	**Creativity**
AI Familiarity	—		
Problem-Solving	.89**	—	
Creativity	.71**	.77**	—

Note: ***p*** *< .01 (2-tailed)*

The multiple regression indicated that a combination of AI familiarity and creativity revealed a significant impact of 82.8 percent of the variance in scores concerning problem-solving ability ($R^2 = 0.828$, $F(2, 240) = 579.2$, $p < .001$). Both of the predictors were significant: AI Familiarity (0.63, $p < .001$), Creativity (0.31, $p < .001$) (Table 3).

Thus, the Hypotheses H4 and H5 were supported indicating that both AI familiarity and mathematical creativity were found to be significant predictors of problem-solving performance.

Table 3

Regression Model Predicting Problem-Solving

Variable	**B**	**Std. Error**	**t**	**p-value**
(Constant)	0.12	0.09	1.37	.173
AI Familiarity	0.63	0.03	18.38	<.001
Creativity	0.31	0.04	7.59	<.001

Student reflections support these statistical relationships. Most stated that AI demystified complicated processes, “AI helps break down hard problems into smaller, understandable steps. I used to spend hours figuring out what the question asked, but now AI shows the path clearly.”

Gender Differences in Problem-Solving

A t-test using independent samples proved that there was a significant difference in the problem-solving scores between the genders (t = 3.21, p = 0.002), but females (M = 2.97, SD = 1.18) scored higher than males (M = 2.51, SD = 1.03) (Table 4).

Therefore, Hypothesis H6 was supported, indicating a significant gender difference in problem-solving performance.

Table 4

Independent Samples T-Test for Problem-Solving by Gender

Group	N	Mean	S.D	t	p-value
Male	132	2.51	1.03	–3.21	.002
Female	111	2.97	1.18		

Some of the female respondents mentioned the fact that AI tools could serve as an addition to their studying habits, as they gave them alternative explanations and contributed to greater confidence in approaching complex tasks.

AI and Mathematical Creativity

The results of correlation showed there was a significant positive correlation between creativity and AI familiarity (r = .71, p < .01) and solving problems (r = .77, p < .01). It is implied that exposure to AI can widen the toolbox of students when solving mathematical problems.

Students explained that AI broadened their minds: "I told the AI to display another solution to an integration-based problem, and it displayed a graphical solution that I never would have considered. It creates in me a reflection of why there are various solutions to things."

Perceived Challenges and Risks

Quantitatively, perceived challenges and risks had a mean score of 2.85 (SD = 1.15), which shows relatively high concern among the students.

The theme of over-dependency came out qualitatively: "My main problem is that I am tempted to use AI too frequently and think by myself. One can simply look up the answer and complete the assignment within minutes, but I know that it is not learned in depth."

These observations demonstrate the importance of encouraging students to develop critical AI literacy- that is, making sure that students learn to apply AI as an aid to, and not a replacement of, the capacity to learn on their own.

Discussion

This study examined the impact of familiarity with artificial intelligence (AI) on mathematics creativity and problem-solving abilities of undergraduate students using convergent mixed methods design. The quantitative results supported Hypotheses H1-H3 which showed significant and positive relationships among the variables, namely AI familiar, mathematical creativity and problem-solving skills. Furthermore the results of the regression analysis supported Hypotheses H4 and H5 showing that both AI familiarity and creativity have significant predictive powers on the problem-solving performance ($R^2 = 0.828$, p > .001). These results show that the students who are more familiar with AI tools become more likely to report their experience of mathematical reasoning and flexible thinking.

The high association between AI familiarity and problem-solving is consistent with prior findings that AI-aided learning environments can improve procedural fluency, lower cognitive load and give immediate feedback (Marrone et al., 2024; Wei et al., 2025). Consistent with Gabeal (2025), students in the present study said that the AI tools facilitated the decomposition of complex mathematical problems into manageable steps that facilitated learning in the zone of proximal development of Vygotsky (1978). However, the very high correlation that was observed in this study (r = .89) suggests that familiarity with AI might work not as a supplementary tool but potentially as a central component of the mathematical engagement of students in this context. At the same time, such high associations may also represent some overlapping of self-reported constructs - which should be taken with a pinch of salt.

The positive relationship between the familiarity with AI and mathematical creativity supports the theoretical perspectives on generative AI and on exploratory reasoning (Liang et al., 2025; Ye et al., 2024). In accordance with SIPE-AI framework (Yoon et al., 2024), Qualitative findings indicated that students leveraged AI to explore alternative solution pathways and expand their reasoning strategies. Compared to the traditional methods of exams, AI appears to promote flexible and exploration thinking. Importantly, this study provides empirical evidence in a developing country context where studies on AI and higher order mathematical thinking are still limited.

However, the qualitative findings also demonstrated concern about the over-reliance & cognitive offloading. Some students admitted to becoming dependent on AI-generated solutions which linked back to the concerns raised by Wei et al. (2025) about a reduction in independent reasoning. This dual effect highlights the paradox of AI in education: the duality between being a cognitive scaffold, to boost efficiency and creative exploration, and being a cognitive crutch, when used notionally. Thus the learning part of AI is not only conditioned by the access but it is the quality of the pedagogical integration.

There was also a concern for ethical issues, such as plagiarism and uncritical acceptance of AI-generated outputs, which was consistent with previous research (Kim et al., 2025; Charles & Charles, 2024). In the case of Nepal where the digital infrastructure and formal policies on AI are still evolving, AI literacy programs in a structured way and clear institutional guidelines are of special importance. Responsible integration strategies should be centered on critical assessment, transparency and independent thought.

Overall, this study serves to understand the interconnected relationships between the AI familiarity, creativity and problem solving in an under researched educational context. While the results point to a large potential of AI to improve higher order mathematics thinking, the authors also point out the importance of responsible and ethical use of AI to maintain the autonomy and academic integrity of students.

Conclusion

This study focused on the impact of familiarity with artificial intelligence (AI) on the mathematical creativity and problem-solving skills of the undergraduate students in the Kathmandu Valley, Nepal, from the Tribhuvan University and Pokhara University. The results showed positive and significant relationships between AI familiarity, creativity and problem solving ability, suggesting that those students familiar with more of the AI tools showed a higher level of mathematical reasoning and flexibility of thought. Qualitative responses also revealed that AI acted as a cognitive support tool as it assisted students in exploring alternative paths for solving problems as well as deconstructing complex problems.

However, the study also identified concerns relating to over-reliance, ethical misuse and uncritical acceptance of AI generated outputs. These findings suggest that even though AI has a great potential to enhance higher-order mathematical thinking, integration of AI in higher education requires organized AI literacy programmes and responsible pedagogical guidance. The study offers a context-specific evidence from Nepal and raises the concern for the need for a balanced and ethical implementation of AI in mathematics education.

Recommendations

Based on these findings, the higher education institutions should include structured programs of AI literacy that address critical evaluation, ethical uses, and academic integrity. Mathematics instructors are encouraged to design learning experiences where students are asked to analyze solutions that AI generates as opposed to students passively depending on them. Institutions should further put in place explicit policies on acceptable use of AI for coursework and assessment and opportunities for professional development for educators to implement AI responsibly. Such measures can help to maximize the pedagogical benefits of AI while minimizing possible risks.

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