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Understanding students' intentions to use ai tools in mathematics learning: a theory of planned behavior approach

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Abstract. *This study explores students' intentions to use Artificial Intelligence (AI) tools in mathematics learning through the lens of the Theory of Planned Behavior (TPB). The growing presence of AI applications in education offers new opportunities to enhance mathematical understanding, but students' willingness to adopt such tools is influenced by psychological and contextual factors. The study aims to identify how attitude toward behavior, subjective norms, and perceived behavioral control shape students' intentions to use AI tools in mathematics learning. Using a qualitative descriptive design, data were collected from twenty mathematics education students who are prospective teachers from Universitas Madura and Universitas Islam Negeri Mataram. Semi structured interviews and reflective journals were employed as instruments, and the data were analyzed thematically to identify emerging belief patterns and behavioral tendencies. The results show that positive attitudes toward AI arise from perceptions of its usefulness for problem solving and conceptual understanding. Subjective norms from peers and lecturers encourage experimentation, while perceived behavioral control such as access to technology and confidence in using AI strongly influences intention. The study concludes that students' behavioral intentions toward AI use are context dependent and require institutional and pedagogical support for effective implementation in mathematics education.*

Keywords: *Theory of Planned Behavior; AI tools; mathematics education; behavioral intention; qualitative study.*

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Introduction

In the current era of digital transformation, the integration of Artificial Intelligence (AI) tools into mathematics education offers new opportunities to enhance students' conceptual understanding, problem solving, and self regulated learning. AI technologies such as ChatGPT, Photomath, and WolframAlpha have increasingly been adopted as cognitive support tools that assist students in exploring complex mathematical ideas and reasoning processes (Drushlyak et al., 2025; Minh Dung et al., 2024; Wijaya et al., 2025). However, despite their potential, the willingness of students to adopt AI tools in mathematics learning remains inconsistent and is strongly influenced by individual beliefs, social expectations, and perceived ease of use (Lin et

al., 2025). Understanding these behavioral determinants is essential, particularly among pre service mathematics teachers who will become future facilitators of technology integrated instruction.

The Theory of Planned Behavior (TPB) proposed by Ajzen (1991) provides a comprehensive framework for analyzing intentional behavior in educational settings. According to this theory, intention, the most immediate predictor of behavior, is shaped by three psychological constructs: attitude toward the behavior, subjective norms, and perceived behavioral control. Attitude refers to an individual's positive or negative evaluation of using AI in mathematics learning; subjective norms represent perceived social pressure from significant others such as peers or lecturers; and perceived behavioral control reflects the individual's belief in their capability and access to resources necessary for performing the behavior (Minh Dung et al., 2024). Previous studies have demonstrated that these three components predict students' engagement in mathematics learning and technology adoption. For example, London et al. (2023) found that students' mathematical attitudes and subjective norms significantly influenced their engagement and achievement in mathematics, while Conard (2006) showed that perceived behavioral control was a strong determinant of teachers' intention to participate in online mathematics learning communities.

Despite growing attention to AI integration in mathematics education, limited research has qualitatively examined students' intentions to use AI tools from the perspective of the Theory of Planned Behavior, especially in the context of teacher education in Indonesia. Most previous studies have focused on quantitative relationships between attitudes and learning outcomes, neglecting the nuanced sociocultural and pedagogical factors that shape intention formation (Akinbadewa & Sofowora, 2020; Alharthi, 2020; Dowker, 2019; Gürbüz & Kıran, 2018; Julian, 2017; Öztürk, 2020; Rohman & Muhtamiroh, 2022; Skagerlund, 2018). This gap is particularly relevant for mathematics education students from Universitas Madura and Universitas Islam Negeri Mataram, who are trained in environments that emphasize both technological literacy and the integration of Islamic educational values. Their perspectives provide a distinctive context for understanding how belief systems, social influences, and perceived control interact in forming behavioral intentions toward AI use.

Therefore, this study aims to explore how pre service mathematics teachers construct their intentions to use AI tools in mathematics learning through the lens of the Theory of Planned Behavior. It seeks to describe how their attitudes, subjective norms, and perceived behavioral control shape their readiness to adopt AI as a learning aid. By uncovering these interrelated factors, the study contributes to a deeper understanding of students' belief structures and behavioral motivations, offering practical insights for curriculum designers and policymakers to

develop AI integrated mathematics learning environments that are pedagogically sound, culturally responsive, and contextually grounded.

Method

This study employed a qualitative descriptive design to explore students' intentions to use Artificial Intelligence (AI) tools in mathematics learning based on the Theory of Planned Behavior (TPB) (Ajzen, 1991). The qualitative approach was selected because it enables a deep understanding of participants' beliefs, experiences, and contextual meanings related to their intention to adopt AI in mathematics education (Creswell & Guetterman, 2019). The research was conducted collaboratively at Universitas Madura and Universitas Islam Negeri Mataram, two Indonesian universities that emphasize the integration of technological literacy and Islamic educational values in teacher education.

The participants consisted of twenty mathematics education students who were in their third and fourth semesters and preparing to become future mathematics teachers. They were selected through purposive sampling to ensure that participants had prior exposure to both mathematics problem solving and AI based learning applications such as ChatGPT, Photomath, and GeoGebra. Prior to data collection, participants were informed of the study's purpose and confidentiality measures, and informed consent was obtained.

Data were collected through semi structured interviews and reflective journals. The interviews focused on three main components of the Theory of Planned Behavior: attitude toward the behavior, subjective norms, and perceived behavioral control. The reflective journals were used to capture participants' ongoing reflections on their experiences and intentions when using AI tools in mathematics learning. All interviews were audio recorded with permission, transcribed verbatim, and verified by participants to ensure accuracy.

Data analysis followed the procedures of thematic analysis. The analysis involved six iterative stages: (a) familiarization with the data, (b) generating initial codes, (c) searching for themes, (d) reviewing themes, (e) defining and naming themes, and (f) producing the final report (Ahmed, 2024; Campbell et al., 2021; Kornbluh, 2015; Moeini et al., 2022; Morgan, 2024; Sun et al., 2025). The coding process was guided by the constructs of TPB while allowing new themes to emerge inductively from the data. To enhance the trustworthiness of the findings, researcher triangulation and member checking were applied throughout the analytic process.

The study adhered to ethical research principles and institutional regulations, ensuring that all participants voluntarily took part in the study and that their identities remained confidential. The results of this analysis provide a detailed understanding of how students' attitudes, subjective

norms, and perceived behavioral control interact to shape their intentions to use AI tools in mathematics education.

Results and Discussion

The findings of this study revealed that students' intentions to use Artificial Intelligence (AI) tools in mathematics learning were shaped by the three main constructs of the Theory of Planned Behavior: attitude toward the behavior, subjective norms, and perceived behavioral control. The interaction among these components formed a complex web of belief systems and social influences that guided students' readiness to integrate AI into their learning practices. The interrelation among attitude, subjective norm, and perceived behavioral control can be illustrated in Figure 1.

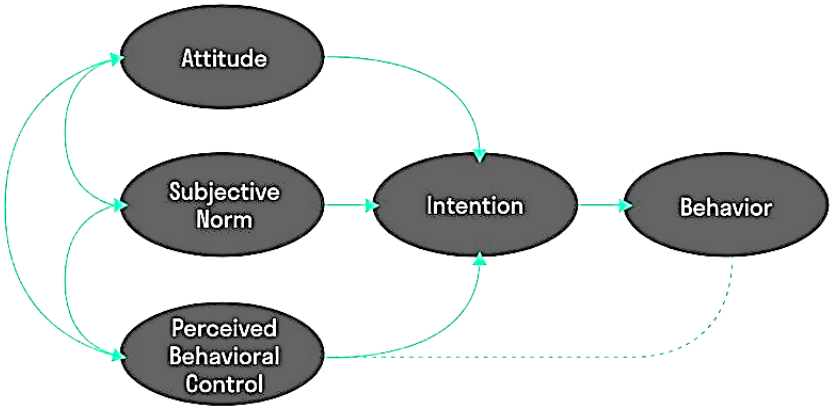

Figure 1. Theory of Planned Behaviour (Ajzen, 1991)

Attitude toward the Behavior

Most participants expressed positive attitudes toward the use of AI tools in mathematics learning. They perceived AI as a supportive learning companion that could help them understand difficult concepts, verify answers, and explore multiple problem solving strategies. Students noted that tools such as ChatGPT and Photomath allowed them to visualize problem solving steps and develop a deeper conceptual grasp of mathematical procedures. These perceptions were consistent with previous research suggesting that favorable attitudes toward technology enhance students' motivation to learn mathematics (Chen, 2019; Fund & Madjar, 2018; Hong, 2020; Locke & Braver, 2008; Miele, 2018; Müller, 2019; Özcan, 2019; Zepeda et al., 2015). However, some participants also expressed caution, emphasizing the risk of overreliance on AI, which might reduce independent reasoning and critical thinking. This ambivalence indicates that attitude formation is influenced not only by perceived usefulness but also by ethical and pedagogical

considerations, aligning with Savitri et al. (2024) who argue that AI adoption requires reflective digital literacy.

Subjective Norms

Subjective norms, or social influences, emerged as a significant factor shaping students' intentions. Peer encouragement and lecturer endorsement played a central role in validating AI use for learning. Many participants stated that they became interested in trying AI tools after seeing their classmates successfully use them in assignments or after lecturers recommended exploring AI for deeper understanding. Family perspectives also influenced acceptance, especially in the context of Islamic universities where technological use is often interpreted through moral and ethical lenses. Similar findings were reported by Zhang et al. (2023), who found that supportive communities and institutional norms increased teachers' willingness to participate in digital learning environments. These results suggest that collective encouragement from peers and instructors can serve as a motivational force in shaping students' behavioral intentions.

Perceived Behavioral Control

Perceived behavioral control was found to be the most decisive factor influencing actual behavioral intention. Students who had strong confidence in their ability to operate AI tools and reliable access to technological resources were more likely to integrate AI into their mathematics learning routines. Conversely, those with limited access to stable internet connections or insufficient technological competence demonstrated lower intention to use AI tools. Participants from Universitas Islam Negeri Mataram, who reported more institutional support and digital infrastructure, showed higher confidence compared to some participants from Universitas Madura, who faced connectivity and device limitations. This finding aligns with Ajzen (1991) theoretical claim that perceived control determines not only intention but also behavioral enactment. It also echoes the observations of Özcan (2019), who emphasized that digital accessibility and self efficacy are key enablers for meaningful AI use in educational contexts.

Interrelation of Attitude, Norms, and Control

The qualitative synthesis of the data indicates that attitude, subjective norms, and perceived behavioral control operate interdependently rather than independently. A positive attitude toward AI use was often reinforced by supportive norms and adequate control beliefs, leading to strong behavioral intention. Conversely, when one component was weak, such as

limited perceived control, even positive attitudes failed to translate into actual intention. This interdependence highlights the dynamic interaction between individual cognition and sociocultural context in shaping technology adoption behaviors.

Overall, the findings demonstrate that students' intentions to use AI tools in mathematics learning are not solely determined by technological functionality but are deeply rooted in their pedagogical beliefs, social interactions, and access to institutional support. This reinforces the argument that integrating AI into mathematics education requires a holistic approach that balances cognitive, affective, and contextual dimensions. These insights are consistent with Ajzen (2020) refinement of TPB and contribute to expanding its applicability in contemporary digital learning contexts.

To provide a clearer overview of how each construct of the Theory of Planned Behavior contributes to students' intentions to use Artificial Intelligence tools in mathematics learning, the main findings are summarized in Table 1. This summary highlights the relative strength and interaction among the three constructs: attitude toward the behavior, subjective norms, and perceived behavioral control, within the research context. While all components collectively shape behavioral intention, the analysis indicates that perceived behavioral control stands out as the most influential aspect, illustrating its dominance in determining students' readiness to adopt AI in mathematics education.

Table 1. Summary of Findings Based on the Theory of Planned Behavior

Component	Key Findings	Evidence from Participants	Interpretation	Dominance
Attitude toward the Behavior	Students generally showed positive attitudes toward AI use in mathematics learning. They viewed AI as a helpful tool for exploring concepts, solving problems, and checking answers. However, some expressed caution about overdependence.	Students stated that AI tools such as ChatGPT and Photomath made learning easier and more engaging, but they also noted the risk of reduced independent reasoning.	Attitude formation was shaped by both perceived usefulness and ethical considerations.	Moderate
Subjective Norms	Social influences such as peer support and lecturer recommendations strongly encouraged AI adoption. Cultural and moral expectations, especially in Islamic universities, also shaped acceptance.	Students reported becoming interested in AI after seeing classmates or lecturers use it effectively in tasks or discussions.	Social endorsement functioned as motivation to explore AI tools, showing the power of communal learning environments.	Moderate
Perceived Behavioral Control	Confidence in using AI tools and access to digital infrastructure were the most decisive factors	Participants from Universitas Islam Negeri Mataram, with better access	Perceived control determined both intention and behavior,	**High (Dominant)**

	influencing behavioral intention. Students with higher technological competence and institutional support were more consistent in adopting AI.	to technology, showed higher confidence and more frequent AI use than those from Universitas Madura.	validating Ajzen's theoretical model.

Conclusion

This study explored pre service mathematics teachers' intentions to use Artificial Intelligence (AI) tools in mathematics learning through the lens of the Theory of Planned Behavior (TPB). The findings revealed that students' behavioral intentions are shaped by an interplay of three major psychological constructs: attitude toward the behavior, subjective norms, and perceived behavioral control. Students demonstrated generally positive attitudes toward AI, perceiving it as a useful learning aid that enhances problem solving and conceptual understanding. Social influences, especially from peers and lecturers, played a vital role in encouraging students to explore AI applications. Moreover, perceived behavioral control, represented by students' confidence and access to technological resources, emerged as the strongest predictor of actual intention to adopt AI tools in mathematics learning.

The interaction among these three components illustrates that intention formation is a dynamic and context dependent process influenced by both internal belief systems and external learning environments. While positive attitudes and supportive norms encourage engagement, insufficient digital literacy or limited access to resources can hinder students' willingness to integrate AI into their learning practices. These results confirm the relevance of TPB in explaining technology adoption in mathematics education and provide empirical evidence from Indonesian teacher education contexts.

The study contributes to both theory and practice. Theoretically, it extends the application of TPB to the emerging domain of AI assisted mathematics learning by highlighting qualitative insights from student narratives. Practically, it offers implications for mathematics teacher education programs and institutional policymakers. Teacher educators are encouraged to design training modules that not only build students' technical competence but also foster reflective and ethical AI use. Institutions should provide supportive digital infrastructure and create a culture that promotes innovation and responsible technology adoption. Future studies could expand this research by involving larger and more diverse populations, exploring longitudinal changes in behavioral intentions, or examining classroom implementation of AI based learning strategies.

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