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Assessing the Impact of ChatGPT and Google Gemini on University Students' Learning Outcomes: An Empirical Study at Institut Bakti Nusantara

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Abstract
The integration of generative artificial intelligence (AI) into higher education offers opportunities to enhance learning effectiveness and academic engagement. However, empirical evidence connecting students' acceptance of ChatGPT and Google Gemini with learning outcomes remains limited, particularly in Research Methodology courses. This study investigates technology acceptance, actual AI usage, and their relationships with students' perceived learning outcomes at Institut Bakti Nusantara, Indonesia. A quantitative approach was employed involving 32 students selected from a population of 50. Data were collected using four-point Likert-scale questionnaires and analyzed through Partial Least Squares Structural Equation Modeling (PLS-SEM), Pearson correlation, and linear regression. The findings revealed positive relationships between perceived ease of use and behavioral intention (β = 0.480), perceived usefulness and behavioral intention (β = 0.350), and behavioral intention and actual use (β = 0.540). The model explained 55% of behavioral intention and 29% of actual usage variance. Furthermore, AI usage was positively associated with perceived learning outcomes (r = 0.672; R^2 = 0.452). The study's novelty lies in integrating TAM-based acceptance pathways with learning-outcome assessment within a specific methodological learning context involving two generative AI platforms. These findings highlight the educational relevance of responsible AI integration while acknowledging limitations concerning sample size and causal inference.

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I. INTRODUCTION

The rapid development of generative artificial intelligence (AI) has significantly transformed higher education, particularly in how university students access information,

understand academic materials, and complete learning activities. ChatGPT, developed by OpenAI and introduced in November 2022, became one of the fastest-growing technological applications, reaching an estimated 100 million monthly active users within two months of its launch. This development reflects the increasing public interest in AI-based technologies and their potential applications in various fields, including education. Alongside ChatGPT, Google Gemini has emerged as another generative AI platform that provides interactive learning support through text-based communication and multimodal capabilities. Both applications enable students to obtain explanations, summarize academic literature, explore theoretical concepts, and receive immediate responses to academic questions. These capabilities offer new opportunities for students to learn independently and access educational resources more efficiently. However, the growing use of generative AI also raises concerns about its actual contribution to academic achievement. Although AI applications can simplify learning activities, their effectiveness in improving students' understanding and learning outcomes remains an important issue that requires empirical investigation.

The increasing adoption of generative AI among university students has become a global educational phenomenon. The Digital Education Council Global AI Student Survey 2024, involving 3,839 students from 16 countries, reported that approximately 86% of respondents used AI tools in their academic activities, while 54% used these technologies at least once a week. The survey also indicated that ChatGPT was among the most widely used generative AI applications, with approximately 66% of respondents reporting its use. These findings demonstrate that AI technologies have become increasingly integrated into students' daily learning activities. Students commonly use AI to search for information, understand difficult concepts, generate ideas, and complete academic assignments. Nevertheless, the widespread adoption of these applications does not necessarily indicate that students achieve better academic performance. Some students may use AI as a supporting tool to strengthen their understanding, while others may depend on AI-generated answers without developing sufficient analytical and independent thinking skills. This condition creates a challenge for higher education institutions in determining how AI should be integrated into learning activities. Therefore, understanding the relationship between the use of ChatGPT and Gemini and students' learning outcomes is essential to ensure that technological development contributes to meaningful educational improvement.

Research Methodology is one of the important courses in higher education because it provides students with the fundamental knowledge and practical skills required to conduct scientific research. Through this course, students are expected to identify research problems, formulate research questions, develop theoretical frameworks, determine research variables, select appropriate research methods, and interpret research findings. These learning activities require analytical thinking, conceptual understanding, and the ability to connect theoretical knowledge with practical research problems. However, students often experience difficulties in understanding research concepts, particularly when distinguishing between qualitative and quantitative approaches, determining appropriate sampling techniques, developing research instruments, and selecting suitable data analysis methods. The availability of ChatGPT and Gemini offers opportunities to address these learning difficulties by providing explanations, examples, and interactive discussions. Students can ask questions repeatedly, compare different research approaches, and obtain additional explanations according to their individual learning needs. Despite these advantages, AI-generated information may contain inaccuracies, incomplete explanations, or inappropriate methodological recommendations. Excessive reliance on AI may also reduce students' opportunities to develop independent reasoning and critical thinking. Consequently, the effectiveness of generative AI in supporting Research

Methodology learning needs to be evaluated through students' academic achievement and their understanding of research concepts.

Previous research has highlighted the potential benefits and challenges of generative AI in educational environments. Kasneci et al. (2023) explained that large language models, including ChatGPT, offer opportunities to support personalized learning, facilitate access to educational information, and provide interactive academic assistance. Their study also emphasized that AI-generated content should be critically evaluated because the technology may produce inaccurate information and encourage excessive dependence on automated responses[1]. Furthermore, Chen and Cheung (2025), through a systematic review and meta-analysis of 57 studies involving 97 effect-size estimates, reported that generative AI had a positive overall effect on university students' learning outcomes, with an estimated effect size of 0.804. Their findings suggested that generative AI could support academic achievement and higher-order thinking skills, although its contribution to metacognitive development was not statistically significant[2]. These findings indicate that generative AI has considerable potential to improve learning performance, but its effectiveness may vary according to educational contexts, student characteristics, and learning activities. Therefore, the positive findings reported in previous studies cannot automatically be generalized to every academic subject. Further empirical investigation is necessary to determine how generative AI contributes to students' learning outcomes in courses that require complex reasoning, scientific understanding, and independent academic judgment.

Several studies conducted in the Indonesian educational context have also explored the use of ChatGPT and Gemini in teaching and learning activities. Research described using qualitative approaches such as interviews and literature reviews, indicated that generative AI applications could support students in understanding learning materials, developing academic ideas, and completing assignments more efficiently[3], [4]. Their findings also highlighted potential challenges, including excessive dependence on AI-generated information and reduced opportunities for independent thinking and creativity. Another study described [5] examined online training for vocational school teachers in utilizing ChatGPT through structured prompting techniques. The evaluation indicated that participants developed a better understanding of how to use AI applications to support educational activities. Although these studies provide useful information about the educational benefits of generative AI, their primary focus was on user perceptions, learning experiences, and training effectiveness. They did not directly establish the relationship between ChatGPT and Gemini usage and measurable academic achievement in a specific university course. In addition, studies focusing on training activities or secondary education may not fully represent the learning characteristics of university students. These limitations indicate the importance of conducting further research using a more focused and measurable approach to evaluate the contribution of generative AI to students' academic performance.

Based on the existing literature, several research gaps can be identified regarding the use of generative AI in higher education. First, previous studies have frequently examined AI applications in general educational contexts, while empirical investigations focusing on specific courses that require analytical and scientific reasoning remain important. Second, many studies have emphasized students' perceptions, attitudes, and experiences in using AI, whereas the relationship between AI usage and objectively measured learning outcomes requires further examination. Third, previous research has not consistently compared the contributions of ChatGPT and Gemini within the same learning environment, particularly in relation to differences in usage intensity, learning purposes, and academic achievement. Furthermore, findings from international studies may not fully reflect the educational conditions and learning practices of students at Indonesian higher

education institutions. These gaps are relevant to Institut Bakti Nusantara, where students taking the Research Methodology course are expected to demonstrate theoretical understanding and practical research skills. Although ChatGPT and Gemini provide accessible learning assistance, empirical evidence is still needed to determine whether their use is associated with better academic performance and stronger conceptual understanding. Therefore, this study addresses these limitations by examining both AI applications within a specific academic setting and connecting students' patterns of AI usage with their learning outcomes.

The main research problem addressed in this study concerns the limited empirical evidence explaining how the use of ChatGPT and Google Gemini relates to students' learning outcomes in the Research Methodology course at Institut Bakti Nusantara. Although these applications provide immediate access to explanations and academic assistance, their actual educational contribution should not be evaluated only through students' perceptions of convenience or usefulness. Instead, it is necessary to examine whether students who use these applications demonstrate differences in academic achievement and conceptual understanding. Accordingly, this study investigates the frequency, intensity, and purposes of ChatGPT and Gemini usage among students, examines the relationship between the use of these applications and students' learning outcomes, and evaluates their effectiveness in supporting the understanding of Research Methodology concepts. The proposed novelty of this research lies in its comparative examination of two generative AI platforms within a course-specific educational context, integrating AI usage patterns with academic achievement and conceptual understanding. Unlike studies that primarily describe the general benefits of AI adoption, this research seeks to provide empirical evidence concerning the distinct contributions of ChatGPT and Gemini to student learning. This approach is expected to offer a more comprehensive understanding of how generative AI can support academic activities that require analytical thinking, scientific reasoning, and independent learning.

This study aims to analyze the relationship between the use of ChatGPT and Google Gemini and students' learning outcomes in the Research Methodology course at Institut Bakti Nusantara, Indonesia. Specifically, the research seeks to identify the intensity and patterns of AI usage, examine the relationship between each application and students' academic achievement, and evaluate how these technologies support students' understanding of research concepts. Furthermore, the study aims to compare the contributions of ChatGPT and Gemini to determine whether differences in their usage are associated with differences in learning outcomes. From a theoretical perspective, the findings are expected to enrich the literature on generative AI in higher education by providing empirical evidence from a specific academic discipline and an Indonesian university context. From a practical perspective, this research is expected to provide useful information for lecturers in designing effective AI-assisted learning strategies and developing learning activities that encourage students to use AI critically and responsibly. The findings may also support higher education institutions in establishing appropriate guidelines for integrating generative AI into academic activities without reducing students' independence, creativity, and critical thinking abilities. Ultimately, this study is expected to contribute to a better understanding of the educational value of ChatGPT and Gemini and provide evidence-based recommendations for improving learning quality in higher education.

II. LITERATURE REVIEW

2.1. Theoretical

Generative artificial intelligence refers to computational systems capable of producing new content, including text, images, explanations, and analytical responses, based on

patterns learned from large datasets. In educational environments, generative AI has introduced new opportunities for personalized learning, interactive academic assistance, and independent knowledge exploration. Kasneci et al. (2023) explained that large language models can support educational activities by providing explanations, generating learning materials, and facilitating interaction between students and digital learning resources[1], [6]. Similarly, Lo (2023) identified several educational applications of ChatGPT, including academic writing, personalized feedback, and learning support, while emphasizing the importance of addressing accuracy, academic integrity, and overreliance on AI-generated content. These findings are relevant to the present study because ChatGPT and Gemini offer students immediate access to information that may support their understanding of Research Methodology concepts[7][3]. However, the availability of information does not automatically guarantee learning improvement. Students must actively evaluate, interpret, and apply AI-generated information to achieve meaningful academic outcomes.

The Technology Acceptance Model, originally developed by Davis (1989), serves as the primary theoretical foundation of this study. TAM explains technology adoption through two major constructs: perceived usefulness and perceived ease of use. Perceived usefulness refers to the extent to which individuals believe that using a technology will improve their performance, while perceived ease of use describes the degree to which individuals believe that using the technology requires minimal effort. These perceptions influence attitudes and behavioral intentions, which subsequently contribute to actual technology usage. In the context of generative AI, students may perceive ChatGPT and Gemini as useful when the applications help them understand difficult concepts, prepare academic assignments, or solve research-related problems. Students may also consider these applications easy to use because they provide conversational interfaces and immediate responses. Consequently, TAM offers a logical explanation of how students' perceptions of AI technologies may influence their intention to use them and their actual learning behavior. Nevertheless, TAM primarily explains technology acceptance rather than academic achievement. Therefore, this study extends the application of TAM by examining the relationship between actual AI usage and students' learning outcomes[8], [9], [10].

The Unified Theory of Acceptance and Use of Technology, introduced by Venkatesh et al. (2003), provides an additional theoretical perspective on technology adoption. UTAUT identifies performance expectancy, effort expectancy, social influence, and facilitating conditions as important factors influencing behavioral intention and technology usage. These factors are relevant to generative AI adoption because students' decisions to use ChatGPT and Gemini may be influenced by their expectations of academic benefits, perceived simplicity of the applications, recommendations from lecturers or classmates, and access to digital infrastructure. For example, students who believe that generative AI can improve their understanding of research concepts may demonstrate stronger intentions to use these applications. Similarly, adequate internet access and digital literacy may support more effective AI usage. Although UTAUT provides a broader explanation of technology acceptance, the present study retains TAM as its main analytical model to maintain a focused and measurable theoretical structure. UTAUT is therefore used as a supporting theory to explain contextual factors that may influence students' acceptance of generative AI.

Constructivist Learning Theory provides an educational foundation for explaining how generative AI may contribute to students' learning outcomes. Based on the theoretical perspectives of Piaget and Vygotsky, constructivism emphasizes that learning occurs when individuals actively develop knowledge through experience, interaction, reflection, and problem-solving. In this perspective, students are not passive recipients of information but actively construct understanding by connecting new information with existing knowledge.

ChatGPT and Gemini may support this process by providing interactive explanations, alternative examples, and opportunities to explore academic questions. In the Research Methodology course, students can use generative AI to compare research approaches, identify variables, formulate research questions, and examine methodological alternatives. However, meaningful learning requires students to critically evaluate AI-generated information rather than reproduce responses without understanding them. This theoretical perspective complements TAM by explaining the learning processes through which technology usage may contribute to academic achievement. Accordingly, the integration of TAM and constructivist learning principles provides a foundation for investigating both technology acceptance and the educational consequences of generative AI usage.

Recent empirical evidence further supports the relevance of combining technology acceptance with learning outcome measurement. Stroud and Du (2025), in a study involving 687 students across nine institutions, found that perceived usefulness was associated with more positive attitudes toward ChatGPT, stronger behavioral intentions, and greater actual use for academic activities. Bai and Wang (2025) also examined the relationship between generative AI interaction quality, output quality, motivational factors, and university students' learning outcomes. Their work indicates that educational outcomes should be examined through the quality of students' interactions with AI rather than technology adoption alone. In addition, Chen and Cheung (2025), through a meta-analysis of 57 studies, reported an overall positive effect of generative AI on learning outcomes, although the magnitude varied across educational settings. These studies strengthen the argument that technology acceptance and educational achievement are related but distinct research constructs[2], [5], [11].

2.2. Relevance to the Research Problem and Scientific Contribution

The proposed extended TAM framework is directly related to the three research problems identified in this study. The first research problem, concerning the intensity and patterns of ChatGPT and Gemini usage, is addressed through the actual usage construct. The second problem, concerning the relationship between AI usage and academic achievement, is addressed by the proposed relationship between actual usage and learning outcomes. The third problem, concerning the effectiveness of AI in supporting Research Methodology understanding, is examined through conceptual assessment results and students' perceptions of the educational usefulness of these applications. The principal contribution of this framework is the integration of technology acceptance with measurable educational achievement. The literature review supplied for this research identifies earlier studies focusing on bibliometric trends, perceived learning effectiveness, teacher training, and user experience. Those studies provide a foundation for understanding generative AI adoption but do not, on their own, establish its contribution to academic performance in Research Methodology. The proposed model addresses this limitation by connecting students' acceptance and actual use of ChatGPT and Gemini with course-specific learning outcomes. Recent research by Bai and Wang (2025) and Chen and Cheung (2025) further supports the importance of evaluating learning-related outcomes rather than relying exclusively on technology adoption measures. However, the proposed novelty should be framed carefully. Extending TAM to learning outcomes is not entirely new. The more defensible contribution is the course-specific comparison of ChatGPT and Gemini using objective academic indicators within an Indonesian higher education setting. If the research uses cross-sectional survey data, its conclusions should concern statistical associations rather than definitive causal effects. Stronger causal claims would require an experimental or longitudinal research design with appropriate controls for prior academic ability and other relevant factors.

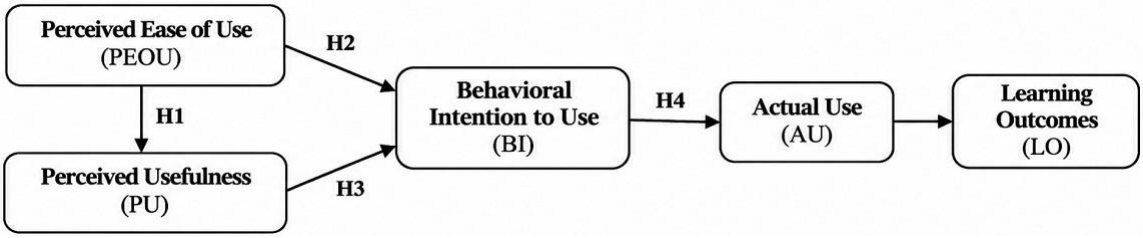


Figure 1. Conceptual framework is based on the Technology Acceptance Model (TAM)[8]

The conceptual framework is based on the Technology Acceptance Model (TAM) developed by Davis (1989), which explains technology acceptance through perceived ease of use, perceived usefulness, behavioral intention, and actual usage. Four hypotheses are proposed.

H1: Perceived Ease of Use positively influences Perceived Usefulness. Students who find ChatGPT and Gemini easy to operate are expected to perceive greater benefits from these applications, particularly when understanding Research Methodology concepts and completing academic assignments.

H2: Perceived Ease of Use positively influences Behavioral Intention to Use. When students experience fewer difficulties in accessing and operating ChatGPT and Gemini, they are expected to demonstrate stronger intentions to use these applications in their learning activities

H3: Perceived Usefulness positively influences Behavioral Intention to Use. Students who believe that ChatGPT and Gemini improve their understanding, academic productivity, and learning efficiency are expected to have stronger intentions to continue using these technologies.

H4: Behavioral Intention to Use positively influences Actual Use. Students with stronger intentions to adopt ChatGPT and Gemini are expected to use these applications more frequently and consistently during Research Methodology learning activities.

III. RESEARCH METHODS

3.1. Research Design and Approach

This study employs a quantitative research approach with a descriptive and explanatory design to investigate the relationship between the use of generative artificial intelligence and university students' learning outcomes. The research focuses on two AI applications, ChatGPT and Google Gemini, and their use in supporting learning activities in the Research Methodology course at Institut Bakti Nusantara, Indonesia. The quantitative approach is selected because the study aims to measure students' perceptions, technology acceptance, usage behavior, and academic achievement using numerical data. The research adopts an extended Technology Acceptance Model (TAM), originally developed by Davis (1989), to explain how perceived ease of use and perceived usefulness influence students' behavioral intentions and actual use of AI applications. The model is further connected to learning outcomes to examine whether the use of ChatGPT and Gemini is associated with students' academic performance. A cross-sectional survey design is applied, in which information is collected from respondents during a defined research period. This approach enables the identification of relationships among the research variables, although it does not independently establish causal effects.

The research framework integrates five principal constructs: Perceived Ease of Use (PEOU), Perceived Usefulness (PU), Behavioral Intention to Use (BI), Actual Use (AU), and Learning Outcomes (LO). The first four constructs represent the technology acceptance process, while learning outcomes represent the educational performance associated with AI usage. ChatGPT and Gemini are examined as two distinct platforms to identify

similarities and differences in students' technology acceptance and usage patterns. The study proposes four primary TAM hypotheses: the relationship between PEOU and PU, PEOU and BI, PU and BI, and BI and AU. In addition, the relationship between actual AI usage and learning outcomes is examined to address the main research objective. This additional relationship is treated as an exploratory association unless it is formally included as a fifth hypothesis. The integration of TAM and academic achievement measurement provides a structured analytical approach for examining how generative AI is accepted and utilized within the learning environment.

3.2. Population and Sampling Technique

The research population consists of 50 students enrolled in the Metaverse class who participated in the Research Methodology course at Institut Bakti Nusantara. From this population, 32 students were included as research respondents, representing 64% of the total population. The sample size was determined based on the number of students participating in the data collection process. However, the available research information does not specify whether the respondents were selected randomly or through a non-probability sampling procedure. Therefore, the sampling technique should be reported according to the actual recruitment process rather than assumed to be random. If all eligible students were invited and 32 completed the questionnaire, the study can be described as an attempted population survey with a 64% response rate. Because the population is relatively small, the sample may not fully represent the broader student population of Institut Bakti Nusantara. Consequently, the findings should primarily be interpreted within the context of the participating Research Methodology students.

The sample size is an important consideration when selecting the statistical analysis technique. Although 32 respondents can provide preliminary evidence about students' technology acceptance, the sample is relatively limited for estimating a complex structural equation model involving multiple latent variables. Therefore, the analysis should prioritize model simplicity, measurement quality, and transparent reporting of statistical uncertainty. If Partial Least Squares Structural Equation Modeling (PLS-SEM) is applied, its use should be supported by a statistical power assessment rather than relying only on conventional minimum sample rules. A simplified regression or path analysis may be more appropriate if the available sample does not provide sufficient power for the complete extended TAM model. The comparative analysis of ChatGPT and Gemini should also consider whether the same respondents used both applications, as this determines whether paired comparisons or independent-group procedures are appropriate.

3.3. Data Collection Methods

Data collection is conducted through a structured questionnaire and a literature review. The questionnaire serves as the primary instrument for obtaining information about students' perceptions and experiences in using ChatGPT and Google Gemini during Research Methodology learning activities. The instrument uses a four-point Likert scale, ranging from 1 (Strongly Disagree) to 4 (Strongly Agree), to measure perceived ease of use, perceived usefulness, behavioral intention, and perceived effectiveness. A four-point scale is selected to encourage respondents to express a positive or negative evaluation without choosing a neutral midpoint. The questionnaire includes statements about the ease of accessing AI applications, the clarity of generated explanations, the usefulness of AI in completing academic tasks, and students' willingness to continue using these applications. Actual usage is measured through questions about the frequency and purposes of AI use, preferably using behavioral response categories rather than agreement statements. The questionnaire is designed to obtain comparable responses for ChatGPT and Gemini while maintaining the distinction between the two applications.

The literature review is conducted to establish the theoretical foundation and identify relevant findings from previous studies. Scientific publications concerning generative AI, ChatGPT, Gemini, technology acceptance, and student learning outcomes are examined to support the development of research variables and hypotheses. Particular attention is given to the Technology Acceptance Model proposed by Davis (1989), the Unified Theory of Acceptance and Use of Technology introduced by Venkatesh et al. (2003), and recent empirical research on generative AI in higher education. Previous findings are used to identify the limitations of studies focusing primarily on AI adoption, user satisfaction, and perceived learning effectiveness. The literature review also supports the selection of indicators and the interpretation of the relationship between AI usage and academic achievement. In addition to questionnaire responses, students' Research Methodology examination scores or final course grades should be collected, subject to institutional permission and participant consent, to provide an objective measure of learning outcomes. If academic scores are unavailable, the study must distinguish perceived learning improvement from actual academic achievement.

3.4. Research Variables and Operational Definitions

The research variables are developed from the extended TAM framework and the educational objectives of the Research Methodology course. Perceived Ease of Use represents students' perceptions of how easily they can operate ChatGPT and Gemini. Perceived Usefulness reflects their beliefs about the educational benefits of these applications. Behavioral Intention to Use measures students' willingness to continue using generative AI for academic purposes, while Actual Use represents their reported frequency and patterns of technology usage. Learning Outcomes refer to students' academic achievement and conceptual understanding in Research Methodology. The study examines the TAM constructs separately for ChatGPT and Gemini to enable platform-specific analysis. Academic performance is treated as the principal outcome variable, while technology acceptance and usage constructs serve as explanatory variables.

Table 1. Operational Definitions of Research Variables

Variable	Code	Measurement indicators	Data source
Perceived Ease of Use	PEOU	Ease of access, ease of interaction, clarity of operation	Questionnaire
Perceived Usefulness	PU	Learning assistance, academic productivity, conceptual support	Questionnaire
Behavioral Intention to Use	BI	Intention to continue using AI, willingness to integrate AI into learning	Questionnaire
Actual Use	AU	Frequency of use, learning purposes, consistency of use	Questionnaire
Learning Outcomes	LO	Examination scores, course grades, conceptual understanding	Academic records and assessment

Each TAM construct should be measured using multiple indicators adapted from established instruments and adjusted to the context of generative AI-assisted learning. For example, perceived usefulness can be measured through statements about whether ChatGPT or Gemini helps students understand research methods and complete assignments more effectively. Perceived ease of use can be evaluated through statements concerning the simplicity of interacting with the applications and obtaining relevant explanations. Behavioral intention can be measured through students' plans to continue using AI in future learning activities. Actual usage should be assessed through frequency and duration or other observable indicators of AI-assisted learning. Learning outcomes

should preferably be measured using consistent academic assessments rather than self-reported improvement alone. These operational definitions establish a measurable relationship between the theoretical model and the research questions.

3.5. Research Hypotheses

The hypotheses are formulated based on the Technology Acceptance Model and the proposed relationships among technology acceptance variables. The first hypothesis assumes that students who perceive ChatGPT and Gemini as easy to use are more likely to consider these applications useful for academic learning. The second hypothesis proposes that perceived ease of use positively influences students' intention to use generative AI. The third hypothesis suggests that perceived usefulness positively influences behavioral intention, indicating that students who recognize the educational benefits of AI are more willing to adopt these technologies. The fourth hypothesis proposes that behavioral intention positively influences actual AI usage. These relationships follow the theoretical logic of TAM and provide a foundation for examining the acceptance and adoption of ChatGPT and Gemini in the Research Methodology course.

Table 2. Proposed Research Hypotheses

Hypothesis	Relationship	Expected effect
H1	PEOU → PU	Positive
H2	PEOU → BI	Positive
H3	PU → BI	Positive
H4	BI → AU	Positive

In addition to these four TAM hypotheses, the relationship between Actual Use and Learning Outcomes is examined as an extension of the original model. This relationship is essential because the main objective of the research is to determine whether ChatGPT and Gemini usage is associated with students' academic achievement. The additional analysis evaluates whether differences in AI usage correspond to differences in Research Methodology performance. If this relationship is intended to be tested as a confirmatory hypothesis, it should be formally designated H5 before data analysis. Maintaining this distinction ensures consistency between the conceptual framework, research objectives, and statistical interpretation.

IV. RESULTS

4.1. Results

This section presents the empirical findings concerning the acceptance and use of ChatGPT and Google Gemini and their relationship with students' learning outcomes in the Research Methodology course at Institut Bakti Nusantara. The analysis involved 32 students from a population of 50 students enrolled in the Metaverse class in 2025, representing 64% of the population. The respondents came from Information Systems and Information Management programs, with female students constituting the majority. Data were collected using a structured questionnaire with a four-point Likert scale and analyzed through instrument validity and reliability testing, Technology Acceptance Model (TAM) analysis, Pearson correlation, and simple linear regression. The findings are organized into three tables covering measurement quality, relationships among TAM constructs, and the association between generative AI usage and learning outcomes. The results are interpreted in relation to the theoretical framework and research hypotheses.

The first stage of the analysis evaluated the quality of the research instrument to determine whether the questionnaire indicators were sufficiently valid and internally consistent. The instrument included four TAM constructs, namely Perceived Usefulness (PU), Perceived Ease of Use (PEOU), Behavioral Intention (BI), and Actual Use (AU),

together with the broader variables of AI Usage (X) and Learning Outcomes (Y). Validity testing was conducted using Pearson product-moment correlations between questionnaire items and their respective variable scores. With 32 respondents and a significance level of 0.05, the reported critical correlation value was 0.349. Reliability was evaluated using Cronbach's alpha, with 0.70 adopted as the preferred threshold for acceptable internal consistency. The reported results are summarized in Table 3.

Table 3. Validity and Reliability Assessment of Research Instruments

Construct	Item correlation (r)	Cronbach's α	Assessment
Perceived Usefulness (PU)	0.790–0.820	0.850	Valid and reliable
Perceived Ease of Use (PEOU)	0.800–0.840	0.830	Valid and reliable
Behavioral Intention (BI)	0.880	0.880	Validity supported; reliability requires verification
Actual Use (AU)	0.850	0.860	Validity supported; reliability requires verification
AI Usage (X)	0.638–0.793	0.806	Valid and reliable
Learning Outcomes (Y)	0.613–0.824	0.819	Valid and reliable

The validity results indicate that all reported item correlations exceed the critical value of 0.349. The highest reported correlation among the TAM indicators was obtained for Behavioral Intention (r = 0.880), while the Perceived Usefulness indicators ranged from 0.790 to 0.820. The broader AI Usage variable produced item correlations between 0.638 and 0.793, whereas Learning Outcomes showed correlations between 0.613 and 0.824. These findings provide preliminary evidence that the questionnaire items are associated with their intended constructs. The reported Cronbach's alpha coefficients ranged from 0.806 to 0.880, suggesting acceptable internal consistency for the multi-item scales. However, the available summary does not include the complete item-level data needed to verify reliability calculations or evaluate convergent and discriminant validity. Consequently, the instrument results support the use of the reported composite measures for preliminary analysis but do not constitute a complete SEM measurement-model assessment.

The measurement findings are relevant to TAM because the model requires a clear distinction between students' perceptions of usefulness, ease of use, intention, and actual usage. Davis (1989) emphasized the importance of perceived usefulness and perceived ease of use in explaining technology acceptance. In the present study, the reported instrument statistics provide an initial basis for examining these relationships in the context of ChatGPT and Gemini. The Learning Outcomes variable was measured through questionnaire indicators concerning conceptual understanding, research problem formulation, theoretical framework development, methodological selection, and critical thinking. Therefore, this variable represents self-reported learning outcomes, rather than independently verified examination scores or final course grades. This distinction is important when interpreting the educational contribution of generative AI.

4.2. Structural Relationships Based on the Technology Acceptance Model

The second stage examined the relationships among TAM constructs to identify factors associated with students' intention and actual use of generative AI. The structural analysis focused on Perceived Usefulness, Perceived Ease of Use, Behavioral Intention, and Actual Use. According to TAM, students are more likely to adopt a technology when they perceive it as useful and easy to operate. These perceptions are expected to strengthen behavioral intention, which subsequently contributes to actual usage. The supplied SEM results

reported three structural relationships, together with the coefficients of determination for Behavioral Intention and Actual Use. Table 4 presents these findings in relation to the four hypotheses developed in the theoretical framework.

Table 4. Structural Model Evaluation and TAM Hypothesis Testing

Hypothesis	Structural relationship	Path coefficient (β)	t-value	Result
H1	PEOU → PU	—	—	Not reported
H2	PEOU → BI	0.480	3.650	Significant*
H3	PU → BI	0.350	3.200	Significant*
H4	BI → AU	0.540	4.100	Significant*

*The significance assessment is based on the reported t-values, assuming an appropriate two-tailed test at $\alpha = 0.05$. The original p-value entries are malformed and require verification against the statistical output. Reported explanatory power: $R^2(BI) = 0.550$; $R^2(AU) = 0.290$.

The structural results indicate that Perceived Ease of Use has a positive relationship with Behavioral Intention, with a path coefficient of 0.480 and a t-value of 3.650. This finding supports H2 and suggests that students who perceive ChatGPT and Gemini as easier to operate tend to demonstrate stronger intentions to use generative AI for academic activities. Perceived Usefulness also shows a positive relationship with Behavioral Intention, with a coefficient of 0.350 and a t-value of 3.200, supporting H3. These findings are consistent with the central argument of TAM, which identifies perceived ease of use and perceived usefulness as important determinants of technology acceptance. The relatively larger coefficient for Perceived Ease of Use suggests that ease of interaction may be particularly relevant to students' willingness to adopt generative AI in the Research Methodology course. Nevertheless, the difference between these coefficients has not been formally tested, so the results do not establish that ease of use is statistically more influential than usefulness.

The relationship between Behavioral Intention and Actual Use produced a positive coefficient of 0.540 and a t-value of 4.100, supporting H4. This finding suggests that students with stronger intentions to use ChatGPT and Gemini tend to report more frequent or consistent use of these applications. The coefficient of determination indicates that Perceived Usefulness and Perceived Ease of Use jointly explain approximately 55% of the observed variance in Behavioral Intention. Meanwhile, Behavioral Intention explains approximately 29% of the variance in Actual Use. These results suggest that students' technology acceptance is associated with their usage behavior, although other factors not included in the model may also contribute to actual AI usage. Such factors may include digital literacy, academic motivation, access to technology, and lecturers' guidance. The findings are consistent with the theoretical relationship between behavioral intention and technology usage proposed by Davis (1989) and further developed by Venkatesh et al. (2003).

The results also reveal an important limitation in the evaluation of H1. Although the theoretical framework proposes that Perceived Ease of Use positively influences Perceived Usefulness, the supplied SEM results do not report the corresponding path coefficient, t-value, or significance level. Consequently, H1 cannot be accepted or rejected based on the available evidence. This relationship should be estimated before the complete four-hypothesis TAM model is presented as empirically validated. In addition, the structural coefficients were reported for generative AI usage collectively rather than separately for ChatGPT and Gemini. Therefore, the results explain the overall acceptance of the two applications but do not yet establish differences between their respective adoption mechanisms.

4.3. Relationship Between Generative AI Usage and Students' Learning Outcomes

The third stage examined the association between generative AI usage and students' learning outcomes in the Research Methodology course. This analysis was conducted to address the main research objective, which extends beyond technology acceptance to evaluate the educational relevance of ChatGPT and Gemini. The analysis used Pearson correlation and simple linear regression, with AI Usage (X) as the independent variable and Learning Outcomes (Y) as the dependent variable. The supplied statistical results also reported a Shapiro–Wilk residual normality test with a statistic of 0.973 and a p-value of 0.589. Since the reported p-value exceeds 0.05, the test did not provide evidence against residual normality. The principal results are presented in Table 5.

Table 5. Statistical Relationship Between AI Usage and Learning Outcomes

Statistical indicator	Reported result	Interpretation
Pearson correlation (r)	0.672	Positive association
Coefficient of determination (R^2)	0.452	45.2% explained variance
Adjusted R^2	0.434	Adjusted explanatory power
Regression coefficient (B)	0.627	Positive slope
Regression constant	9.208	Estimated intercept
Regression t-value	4.981	Statistically significant
Regression F-value	24.811	Model significance reported
Reported significance	$p < 0.0001$	Requires numerical verification

The Pearson correlation coefficient of 0.672 indicates a positive association between students' reported AI usage and their learning outcomes. This suggests that students who report greater use of ChatGPT and Gemini also tend to report higher levels of understanding and academic learning achievement. The coefficient of determination of 0.452 indicates that approximately 45.2% of the variance in the reported Learning Outcomes score is statistically explained by the AI Usage variable in the simple regression model. The remaining 54.8% is not explained by this model and may reflect other educational factors, measurement error, or unobserved influences. The adjusted R^2 of 0.434 further indicates that the model retains a moderate level of explanatory power after adjustment for the number of predictors and sample size. These findings provide preliminary empirical support for a positive relationship between generative AI usage and students' perceived learning outcomes.

The positive regression coefficient indicates that a one-unit increase in the AI Usage score is associated with an estimated increase of 0.627 units in the Learning Outcomes score. This relationship suggests that generative AI may serve as a useful learning support tool, particularly when students use it to understand research concepts, formulate research problems, develop theoretical frameworks, and select appropriate research methods. However, the regression coefficient represents an observed statistical association and should not be interpreted as proof that increasing AI usage will necessarily cause higher academic achievement. The cross-sectional research design does not establish causality, and the dependent variable was measured using self-reported questionnaire indicators. The findings provide an educational extension to the Technology Acceptance Model by connecting technology usage with learning-related outcomes. While the TAM results indicate that perceived usefulness and ease of use are associated with students' intentions and actual AI usage, the regression analysis suggests that greater reported usage is also associated with more favorable perceived learning outcomes. This interpretation is consistent with the broader educational argument presented by Kasneci et al. (2023), who identified the potential of large language models to support personalized learning and academic assistance. It is also broadly aligned with the meta-analytic findings reported by Chen and Cheung (2025), which identified positive effects of generative AI on several

university learning outcomes. Nevertheless, the present results should be distinguished from those of studies using objectively assessed academic performance, because the available Learning Outcomes data reflect students' self-assessments. Taken together, the three analyses provide preliminary evidence supporting the relevance of TAM for examining generative AI adoption in higher education. The instrument assessment indicates acceptable reported internal consistency, the structural analysis supports H2, H3, and H4, and the regression analysis identifies a positive association between AI usage and self-reported learning outcomes. However, H1 remains untested in the supplied results, and the comparison between ChatGPT and Gemini has not been statistically established. The study therefore contributes initial evidence about generative AI acceptance and learning-related perceptions among Research Methodology students at Institut Bakti Nusantara, while further analysis is needed to substantiate platform-specific differences and objective academic achievement effects.

4.4. Discussion

This section discusses the relationships among the Technology Acceptance Model (TAM) constructs and their implications for the use of ChatGPT and Google Gemini in the Research Methodology course at Institut Bakti Nusantara. The discussion integrates the empirical findings from 32 student respondents with the theoretical foundations of Davis (1989), Venkatesh et al. (2003), and relevant research on generative artificial intelligence in higher education. Four hypotheses are examined, covering the relationships between Perceived Ease of Use (PEOU), Perceived Usefulness (PU), Behavioral Intention (BI), and Actual Use (AU). The discussion also considers the relationship between generative AI usage and students' learning outcomes to address the main research objective. The interpretation emphasizes the magnitude and direction of the reported relationships while recognizing the limitations of the available statistical evidence.

H1: The Relationship Between Perceived Ease of Use and Perceived Usefulness

The first hypothesis proposes that Perceived Ease of Use positively influences Perceived Usefulness in the adoption of ChatGPT and Google Gemini. According to the Technology Acceptance Model developed by Davis (1989), individuals are more likely to perceive a technology as useful when it is easy to operate and requires relatively little effort. In the context of Research Methodology learning, students who can easily access ChatGPT and Gemini, formulate questions, and understand AI-generated explanations may be more likely to recognize the educational benefits of these applications. The measurement results indicate that Perceived Ease of Use and Perceived Usefulness have reported Cronbach's alpha values of 0.830 and 0.850, respectively, suggesting acceptable internal consistency. However, the available structural model does not report the path coefficient or statistical significance for the PEOU–PU relationship. Therefore, the empirical evidence is insufficient to determine whether H1 is supported. Although the proposed relationship is theoretically consistent with TAM, its significance must be established through an additional structural path analysis before a definitive conclusion can be drawn.

H2: The Relationship Between Perceived Ease of Use and Behavioral Intention

The second hypothesis examines the influence of Perceived Ease of Use on students' Behavioral Intention to use ChatGPT and Google Gemini for academic learning. The structural model results demonstrate a positive relationship between these constructs, with a path coefficient of $\beta = 0.480$ and a t-value of 3.650, supporting H2 at the conventional 5% significance level. This finding indicates that students who perceive generative AI applications as accessible, understandable, and easy to operate are more likely to intend to use them during Research Methodology learning activities. The result is particularly relevant because students can interact with ChatGPT and Gemini through natural language without requiring advanced technical knowledge. Such accessibility may encourage

students to explore research concepts, ask questions about methodological procedures, and obtain explanations independently. The finding is consistent with the original TAM proposed by Davis (1989), which recognizes ease of use as an important determinant of technology acceptance. It is also broadly aligned with the study published in Sustainable Futures (2025), which found that perceived ease of use contributed to students' attitudes toward continued ChatGPT use. However, a study of 411 university students published in Acta Psychologica (2025) found that ease of use influenced intention indirectly through perceived usefulness rather than directly. This difference suggests that the relationship may vary across educational settings and model specifications. In the present study, the positive coefficient indicates that ease of use is an important factor associated with students' intention to adopt generative AI.

H3: The Relationship Between Perceived Usefulness and Behavioral Intention

The third hypothesis evaluates whether Perceived Usefulness positively influences students' Behavioral Intention to use ChatGPT and Google Gemini. The structural analysis produced a positive path coefficient of $\beta = 0.350$ and a t-value of 3.200, supporting H3 at the conventional 5% significance level. This result suggests that students who recognize the educational benefits of generative AI are more likely to intend to use these applications in their academic activities. In the Research Methodology course, perceived usefulness may arise when students find that ChatGPT and Gemini help them understand theoretical concepts, formulate research questions, identify research variables, and select appropriate methodological approaches. The result supports the central proposition of TAM that perceived usefulness is an important determinant of technology adoption. Similar findings were reported by Stroud and Du (2025), who examined ChatGPT acceptance among 687 students from nine higher education institutions and found that perceived usefulness was associated with positive attitudes, stronger behavioral intentions, and greater actual use for academic tasks. Furthermore, the 2025 study published in Acta Psychologica identified perceived usefulness as a significant direct predictor of students' intention to use ChatGPT, with the proposed model explaining approximately 51% of the variance in usage intention. These findings reinforce the importance of perceived educational value in students' decisions to adopt generative AI. The present study extends this discussion to the combined use of ChatGPT and Gemini in Research Methodology learning.

H4: The Relationship Between Behavioral Intention and Actual Use

The fourth hypothesis examines whether Behavioral Intention positively influences Actual Use of ChatGPT and Google Gemini. The structural model results indicate a positive relationship, with a path coefficient of $\beta = 0.540$ and a t-value of 4.100, supporting H4 at the conventional 5% significance level. The coefficient of determination for Actual Use was $R^2 = 0.290$, indicating that Behavioral Intention explained approximately 29% of the variance in students' reported AI usage. This finding suggests that students who express stronger intentions to use generative AI are more likely to integrate these applications into their learning activities. In the Research Methodology course, actual usage may include searching for explanations, reviewing research concepts, developing initial research ideas, and obtaining assistance with academic assignments. The finding is consistent with the behavioral assumptions of TAM and the Unified Theory of Acceptance and Use of Technology developed by Venkatesh et al. (2003), which identify behavioral intention as an important predictor of technology usage. Stroud and Du (2025) also reported that stronger behavioral intentions were associated with greater ChatGPT use for academic activities. Nevertheless, the R^2 value indicates that intention alone does not fully explain students' actual usage behavior. Other factors, including digital literacy, access to technology, academic motivation, and institutional guidance, may also influence the extent to which students use AI applications. Therefore, the findings suggest that promoting positive

attitudes toward AI should be accompanied by practical learning strategies that support responsible and effective usage.

Beyond the four TAM hypotheses, the study also examined the relationship between generative AI usage and students' learning outcomes. The statistical analysis reported a positive Pearson correlation of $r = 0.672$ and a coefficient of determination of $R^2 = 0.452$, indicating that AI usage was positively associated with students' self-reported learning outcomes and accounted for approximately 45.2% of their observed variance in the simple regression model. The reported regression coefficient of $B = 0.627$ also indicates a positive relationship between the two variables. These findings suggest that students who report greater use of ChatGPT and Gemini tend to report better understanding of Research Methodology concepts, including research problem formulation, theoretical framework development, and methodological selection. This result is consistent with the meta-analysis conducted by Chen and Cheung (2025), which synthesized 57 studies and 97 effect-size estimates and reported an overall positive effect of generative AI on university students' learning outcomes ($g = 0.804$), including academic achievement ($g = 0.633$) and higher-order thinking ($g = 0.580$). Similarly, a 2026 three-level meta-analysis involving 36 empirical studies and 7,229 participants identified a positive overall effect of generative AI on learning outcomes ($g = 0.499$). These studies support the educational potential of generative AI, particularly when it is integrated into appropriate learning activities. However, the present findings are based on self-reported learning measures and cross-sectional data. Therefore, they demonstrate an association rather than establishing that ChatGPT or Gemini directly causes improvements in academic achievement.

The findings provide preliminary empirical support for the relevance of TAM in explaining generative AI adoption among university students. The positive relationships between Perceived Ease of Use and Behavioral Intention, Perceived Usefulness and Behavioral Intention, and Behavioral Intention and Actual Use suggest that students' acceptance of ChatGPT and Gemini is influenced by both their perceptions of the applications and their willingness to incorporate them into academic activities. The model explained 55% of the variance in Behavioral Intention and 29% of the variance in Actual Use, indicating that the TAM constructs contribute to explaining students' technology adoption behavior. However, the absence of the PEOU–PU structural coefficient means that the complete four-hypothesis model has not yet been empirically verified. Furthermore, the available results represent the combined use of ChatGPT and Gemini, so they cannot establish whether one platform has a stronger influence than the other.

From an educational perspective, the positive association between AI usage and perceived learning outcomes suggests that generative AI may provide useful academic support in courses requiring conceptual understanding and analytical reasoning. This interpretation is consistent with Kasneci et al. (2023), who emphasized the potential of large language models to support personalized learning, academic interaction, and access to educational information. Nevertheless, their research also highlighted the importance of critical evaluation, fact-checking, and human supervision when integrating AI into educational activities. Accordingly, the findings of the present study suggest that lecturers should guide students in using ChatGPT and Gemini as supplementary learning tools rather than substitutes for independent reasoning. For Research Methodology learning, students should be encouraged to verify AI-generated explanations, compare methodological recommendations with scientific literature, and demonstrate their understanding through independently completed academic assessments. These practices may help universities benefit from generative AI while maintaining academic integrity and students' critical thinking skills

V. CONCLUSION

This study examined the acceptance and utilization of ChatGPT and Google Gemini and their relationship with students' learning outcomes in the Research Methodology course at Institut Bakti Nusantara, Indonesia. Using the Technology Acceptance Model (TAM), the research analyzed questionnaire responses from 32 students to evaluate the relationships among Perceived Ease of Use (PEOU), Perceived Usefulness (PU), Behavioral Intention (BI), and Actual Use (AU). The findings revealed positive relationships between PEOU and BI ($\beta = 0.480$), PU and BI ($\beta = 0.350$), and BI and AU ($\beta = 0.540$), supporting hypotheses H2, H3, and H4. The structural model explained 55% of the variance in Behavioral Intention and 29% in Actual Use. However, H1, concerning the relationship between PEOU and PU, could not be conclusively evaluated because its structural coefficient was unavailable. Furthermore, AI usage demonstrated a positive correlation with self-reported learning outcomes ($r = 0.672$), with an explanatory power of 45.2%. These findings contribute to the application of TAM in generative AI-assisted higher education by connecting technology acceptance, usage behavior, and perceived educational outcomes. Practically, universities should integrate AI literacy, critical evaluation, and responsible technology utilization into learning strategies to support students' academic development. Nevertheless, the small sample, cross-sectional design, and reliance on self-reported outcomes limit causal interpretation and generalizability. Future research should employ larger samples, objective academic assessments, longitudinal designs, and separate comparisons of ChatGPT and Gemini to establish their respective contributions to learning effectiveness and academic achievement.

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