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Bridging the Artificial Intelligence Divide in Higher Education: Digital Literacy, Social Influence, and Ethical AI Adoption among University Students

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ABSTRACT

This study examines the determinants of ethical artificial intelligence (AI) adoption among university students by integrating the Unified Theory of Acceptance and Use of Technology (UTAUT) and Digital Divide Theory. Specifically, this study investigates the effects of digital literacy, social influence, and digital divide on ethical AI adoption, as well as the moderating role of digital divide in the relationships between digital literacy, social influence, and ethical AI adoption. A quantitative survey was conducted involving 408 university students in Indonesia. The data were analyzed using regression analysis, supported by reliability and validity tests, correlation analysis, Gaussian copula endogeneity check, Harman's single-factor test, non-response bias test, and simple slope analysis. The findings show that digital literacy has a positive and significant effect on ethical AI adoption, indicating that students with stronger digital literacy are more likely to use AI critically, responsibly, and in accordance with academic integrity. Social influence also has a positive and significant effect, suggesting that lecturers, peers, academic norms, and institutional guidance play an important role in encouraging responsible AI use. Digital divide-related conditions are also significantly associated with ethical AI adoption, highlighting the importance of access, capability, and digital support in AI-supported learning. However, the moderating effects of digital divide are not statistically supported. These findings suggest that digital divide functions more as a direct contextual factor than as a moderating variable. This study contributes to the literature on AI adoption in higher education by emphasizing that ethical AI adoption is shaped by individual digital competence, social-academic support, and inclusive digital conditions. The findings also imply that universities need to strengthen digital literacy, develop clear AI-use guidelines, and reduce digital access gaps to promote ethical and inclusive AI adoption.

Keywords: Ethical AI Adoption, Digital Literacy, Social Influence, Digital Divide, Higher Education, University Students
JEL Classifications: I23, O33, I24

1. INTRODUCTION

Artificial intelligence (AI) has become one of the most disruptive forces in higher education, reshaping how university students learn, search for academic information, complete assignments, improve writing quality, generate research ideas, and engage with digital knowledge resources (Cui et al., 2025; Humble, 2025; Oubibi et al., 2025). AI-based tools such as chatbots, grammar checkers, paraphrasing applications, translation platforms, reference managers, and AI-supported analytical tools are increasingly embedded in students' everyday academic practices (Delcker et al., 2024; Hua and Cunningham, 2025). This

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development indicates that AI adoption in higher education is not merely a matter of technological use, but a broader transformation in academic behavior, learning culture, and knowledge production (Alshammari et al., 2025; Yurdunkulu et al., 2025). Burke and Crompton (2024) systematic review of AI in higher education shows a substantial growth of studies on AI use between 2016 and 2022, reflecting the increasing relevance of AI in teaching, learning, assessment, student support, and institutional practices. Similarly, UNESCO in 2023 emphasizes that generative AI has major implications for education and research because it can reshape how knowledge is accessed, produced, evaluated, and governed (Bean et al., 2025).

Despite its potential benefits, the increasing use of AI in higher education raises significant academic and ethical concerns (Hirani et al., 2023; Schwendicke et al., 2025; Strayhorn, 2025; Yun et al., 2025). AI can help students improve learning efficiency, language accuracy, information access, and academic productivity (Strayhorn, 2025; Yun et al., 2025). However, AI-generated outputs may contain inaccurate information, fabricated references, biased content, and unverified arguments (Hirani et al., 2023; Schwendicke et al., 2025). Students may also become overly dependent on AI tools, using them as shortcuts to complete assignments rather than as instruments to support learning and critical thinking (Hou et al., 2025; Zhai et al., 2024). These concerns are closely related to academic integrity, originality, transparency, privacy, data protection, and responsible technology use (Güneş and Kaban, 2025). UNESCO's guidance on generative AI in education and research stresses the need for human-centered governance that protects human agency, inclusion, equity, privacy, and ethical responsibility in the use of AI (Giannakos et al., 2025).

Previous studies have examined AI in higher education from several perspectives, including students' awareness, perceptions, readiness, acceptance, and intention to use AI-based tools. These studies generally show that students perceive AI as useful for academic support, particularly in information searching, writing assistance, translation, feedback, and learning personalization (Malik et al., 2023; Strayhorn, 2025). However, much of the existing literature still tends to emphasize general technology acceptance, perceived usefulness, perceived ease of use, or behavioral intention (Iddamalgoda et al., 2026; Wang et al., 2026). This focus is important, but it does not fully explain whether students adopt AI in ways that are ethical, inclusive, and academically responsible. In other words, the fact that students use AI does not necessarily mean that they understand its limitations, verify its outputs, acknowledge its use appropriately, or use it in ways that preserve academic integrity.

Digital literacy is therefore a critical factor in explaining responsible AI adoption among university students. Students need more than technical skills to operate AI tools; they also need the ability to evaluate the credibility of AI-generated content, verify information through academic sources, identify bias, protect personal data, and understand the ethical boundaries of AI use in academic work (Ravi et al., 2025). Without adequate digital literacy, students may passively accept AI outputs, reproduce inaccurate information, or unintentionally engage in academic misconduct (Song, 2024). In this sense, digital literacy functions not only as a technological competence, but also as a critical and ethical capability that enables students to use AI as a learning support rather than as a substitute for academic effort (Ravi et al., 2025).

In addition to digital literacy, social influence plays an important role in shaping students' AI adoption. The Unified Theory of Acceptance and Use of Technology explains that social influence is one of the key determinants of technology acceptance, alongside performance expectancy, effort expectancy, and facilitating conditions (Venkatesh et al., 2003). In higher education, students' AI-related behavior may be shaped by lecturers, peers, academic norms, and institutional policies. Lecturers can influence how students understand acceptable and unacceptable AI use in assignments, academic writing, and research (Misra et al., 2026). Peers can also normalize certain patterns of AI use, either responsibly through collaborative learning or problematically through uncritical dependence (Arango et al., 2024). Therefore, social influence should not be understood merely as interpersonal pressure, but as part of the academic environment that shapes students' ethical orientation toward AI.

The digital divide further complicates AI adoption in higher education. The benefits of AI-supported learning cannot be distributed equally when students have unequal access to digital devices, stable internet connections, paid AI platforms, digital skills, and institutional support (Lin et al., 2024). Students with stronger digital resources may gain greater academic advantages from AI, while those with limited access may be excluded from the benefits of AI-enhanced learning (Gu and Yan, 2025). UNESCO (2024) warns that AI literacy may create a new form of digital divide if access to AI knowledge and skills is not inclusive and accessible to all learners (Bastani et al., 2025). Recent work on AI and the digital divide in education also highlights that AI may produce unequal learning advantages due to disparities in access, language, cultural fit, and algorithmic bias (Assefa, 2025; Bulathwela et al., 2024; Muthukrishna et al., 2025).

This issue creates an urgent need for universities to move beyond the question of whether students use AI and toward the question of how AI can be adopted ethically and inclusively. Higher education institutions cannot simply encourage AI use for academic productivity without providing clear ethical guidelines, adequate digital literacy development, and equal access to supporting infrastructure (Güneş and Kaban, 2025; Song, 2024). Without institutional guidance, AI adoption may intensify academic inequality, weaken academic integrity, and create uncertainty among students and lecturers regarding acceptable AI practices. Therefore, empirical research is needed to identify the factors that shape ethical and inclusive AI adoption among university students (Song, 2024).

This study addresses several gaps in the literature. First, prior studies have largely focused on AI awareness, perceptions, readiness, usefulness, or intention to use (Iddamalgoda et al., 2026; Malik et al., 2023; Strayhorn, 2025; Wang et al., 2026), while fewer studies have examined AI adoption through the combined lens of

ethics and inclusivity. Second, technology acceptance studies often explain adoption through individual perceptions of usefulness and ease of use, but give less attention to students' digital literacy as a critical capability for evaluating and using AI responsibly (Marian et al., 2025; Rogers et al., 2024; Wongyai et al., 2024). Third, social influence is often treated as a general predictor of intention, while its role in shaping ethical academic behavior in AI use remains underexplored. Fourth, the digital divide is frequently discussed as an access issue, but its implications for equitable AI adoption in higher education require further empirical investigation (Goedhart et al., 2022; Korostelina and Barrett, 2023; McNeely, 2024).

Different from previous studies, this study conceptualizes AI adoption as an ethical, social, and institutional phenomenon. It does not only ask whether students use AI, but whether they adopt AI in ways that are responsible, fair, and supportive of academic integrity. By integrating digital literacy, social influence, and the digital divide, this study develops a more comprehensive model of inclusive and ethical AI adoption among university students. This approach extends technology acceptance research by incorporating ethical responsibility and inequality into the analysis of AI adoption.

This study contributes to the literature in three ways. First, it advances AI adoption research by shifting the focus from general acceptance to ethical and inclusive AI adoption in higher education. Second, it extends the application of UTAUT by positioning digital literacy and the digital divide as important factors that shape responsible AI use beyond conventional acceptance determinants. Third, it contributes to higher education policy by providing evidence that can support the development of AI literacy programs, ethical AI guidelines, and inclusive digital learning strategies. These contributions are relevant to universities seeking to promote AI-supported learning while protecting academic integrity, equity, and responsible governance.

In practical terms, the findings of this study are expected to help higher education institutions design fair, transparent, accountable, and inclusive AI policies. Strengthening students' digital literacy, clarifying academic norms around AI use, and reducing unequal access to digital resources are essential steps toward responsible AI integration in higher education. This direction is also aligned with the Sustainable Development Goals, particularly SDG 4 on quality education, SDG 9 on innovation and infrastructure, SDG 10 on reduced inequalities, and SDG 16 on accountable and inclusive institutions. Thus, AI adoption in higher education should be positioned not only as a technological issue, but also as an ethical, social, and institutional agenda for building a more inclusive and responsible academic environment.

2. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

2.1. Unified Theory of Acceptance and Use of Technology/UTAUT

The Unified Theory of Acceptance and Use of Technology (UTAUT) provides a relevant theoretical foundation for explaining students' adoption of artificial intelligence (AI) in higher education (Acosta-Enriquez et al., 2024; Ayyoub et al., 2025; Chatterjee and Bhattacharjee, 2020). UTAUT argues that technology acceptance is shaped by performance expectancy, effort expectancy, social influence, and facilitating conditions (Ali and Warraich, 2024; Kim et al., 2025; Thanthrige et al., 2025). In the context of AI adoption, students are more likely to use AI-based tools when they perceive these tools as useful for improving academic performance, easy to use, socially supported, and supported by adequate infrastructure (Strayhorn, 2025). UTAUT is particularly suitable for this study because AI adoption in higher education is not only determined by individual willingness, but also by social and institutional conditions that enable or constrain technology use (Venkatesh et al., 2003).

In this study, UTAUT is extended by incorporating digital literacy, social influence, and the digital divide as key determinants of ethical AI adoption. Digital literacy reflects students' capability to understand, evaluate, and use AI critically (Ng et al., 2024). Social influence reflects the role of lecturers, peers, academic norms, and institutional expectations in shaping students' AI-related behavior (Korchak et al., 2025). Meanwhile, the digital divide reflects unequal facilitating conditions, such as differences in access to devices, internet connectivity, digital skills, and institutional support (Korostelina and Barrett, 2023). Therefore, AI adoption is conceptualized not only as technology acceptance, but also as a responsible, ethical, and inclusive academic practice.

2.2. Digital Divide Theory

Digital Divide Theory explains that inequality in technology use does not only occur at the level of physical access, but also at the level of skills, usage quality, and outcomes (Goedhart et al., 2022). Earlier digital divide research focused mainly on whether individuals had access to digital technologies (Kumi-Yeboah et al., 2023; Vassilakopoulou and Hustad, 2023). However, more recent perspectives emphasize second-level and third-level digital divides, including differences in digital skills, patterns of use, and the benefits gained from technology. In education, this perspective is important because students may have different levels of access to devices, internet stability, paid AI tools, digital learning resources, and institutional support. These differences may shape whether students can benefit equally from AI-supported learning.

The digital divide is highly relevant to AI adoption in higher education because AI-based learning may create unequal academic advantages (Assefa, 2025). Students with better digital access and stronger technological skills may use AI more effectively for academic writing, information searching, language improvement, and research support (Malik et al., 2023). In contrast, students with limited access or limited digital competence may be excluded from the benefits of AI. UNESCO also warns that AI literacy may create a new form of digital divide if access to AI knowledge and skills is not distributed inclusively (Cheng et al., 2025).

2.3. Ethical AI Adoption

Ethical AI adoption refers to the responsible use of AI tools in academic activities while maintaining integrity, transparency, fairness, and accountability (Güneş and Kaban, 2025). In higher

education, students may use AI to support learning, summarize materials, improve language quality, generate ideas, or assist research processes (Delcker et al., 2024). However, ethical problems arise when students use AI to replace their own academic effort, submit AI-generated work without acknowledgment, rely on unverified outputs, or engage in plagiarism (Song, 2024). Thus, ethical AI adoption requires students not only to use AI effectively, but also to evaluate its outputs, recognize its limitations, and use it in accordance with academic integrity (Ravi et al., 2025).

The ethical dimension of AI adoption has become increasingly important because generative AI can produce inaccurate information, fabricated references, biased content, and persuasive but unreliable outputs (Kaebnick et al., 2023). UNESCO emphasizes the need for human-centered governance of generative AI in education and research to ensure that AI supports human agency, equity, inclusion, privacy, and ethical responsibility (Giannakos et al., 2025). Therefore, in this study, ethical AI adoption is positioned as the dependent variable because the key concern is not merely whether students use AI, but whether they use AI responsibly, fairly, and in ways that support academic learning.

2.4. Digital Literacy

Digital literacy refers to students' ability to access, understand, evaluate, and use digital technologies effectively, critically, and responsibly (Vodă et al., 2022). In the context of higher education, digital literacy is no longer limited to technical skills, such as operating devices or accessing online platforms, but also includes the ability to assess digital information, identify unreliable content, protect personal data, and use technology according to ethical and academic standards (Audrin and Audrin, 2022; Baber et al., 2022). As artificial intelligence becomes increasingly integrated into students' academic activities, digital literacy becomes an essential capability that determines whether students can use AI tools meaningfully and responsibly (Hua and Cunningham, 2025).

In AI-supported learning, students are frequently exposed to AI-generated outputs, including summaries, explanations, translations, writing suggestions, research ideas, and analytical assistance (Bašić et al., 2023). However, these outputs may contain inaccuracies, bias, fabricated references, or incomplete explanations. Students with strong digital literacy are more likely to verify AI-generated information, compare it with credible academic sources, and use AI as a supporting tool rather than as a substitute for independent academic work (Strayhorn, 2025). Therefore, digital literacy is positioned in this study as a key individual capability that supports ethical AI adoption among university students.

2.5. Social Influence

Social influence refers to the extent to which students' attitudes and behaviors toward AI are shaped by lecturers, peers, academic norms, and institutional expectations (Korchak et al., 2025; Ngo et al., 2025). In higher education, students do not adopt AI in isolation; their use of AI is often influenced by how lecturers regulate AI use (Misra et al., 2026), how peers normalize AI-supported learning, and how academic environments define acceptable (Arango et al., 2024), and unacceptable technology use. Based on the Unified Theory of Acceptance and Use of Technology, social influence is an important determinant of technology acceptance because individuals tend to adopt technologies that are supported or encouraged by significant others (Kim et al., 2025).

In the context of AI adoption, lecturers may shape students' ethical understanding by providing clear guidance on how AI can be used in assignments, academic writing, and research (Malik et al., 2023). Peer influence may also encourage students to explore AI tools, share usage experiences, and develop new learning practices (Arango et al., 2024). However, social influence may become problematic when AI use is normalized without adequate ethical awareness (Ahmad et al., 2026). Therefore, this study views social influence not merely as encouragement to use AI, but as an academic and social force that can shape students' responsible and ethical AI adoption.

2.6. Digital Divide

Digital divide refers to inequality in access to, use of, and benefits from digital technologies (Bokhari and Awuni, 2024). Earlier discussions of the digital divide mainly focused on access to devices and internet connectivity (El-Bawab, 2021; McNeely, 2024), but recent perspectives emphasize broader inequalities, including digital skills, quality of technology use, access to paid platforms, institutional support, and the ability to gain meaningful outcomes from digital tools (Goedhart et al., 2022; Korostelina and Barrett, 2023). In the context of AI adoption in higher education, the digital divide is highly relevant because students may differ in their access to devices, internet stability, AI tools, digital competence, and academic support.

The digital divide may create unequal academic advantages among students. Students with adequate digital resources may use AI more effectively to search for information, summarize materials, improve writing, translate texts, develop research ideas, and support data analysis (Alam et al., 2023; Fang and Nie, 2025). In contrast, students with limited access or lower digital competence may be less able to benefit from AI-supported learning (Zhang et al., 2026). Therefore, the digital divide is not only a technological access issue, but also an equity issue that may affect whether AI adoption in higher education becomes inclusive and ethical.

2.7. Hypotheses development

2.7.1. Digital literacy and ethical AI adoption

Digital literacy is a critical capability that enables students to access, understand, evaluate, and use digital technologies effectively, critically, and responsibly in academic contexts (Audrin and Audrin, 2022; Vodă et al., 2022). In the context of AI-supported learning, digital literacy is not limited to technical skills, but also includes students' ability to assess the credibility of AI-generated content, identify unreliable information, protect personal data, and use technology according to academic standards (Baber et al., 2022; Ravi et al., 2025). Students with stronger digital literacy are more likely to verify AI-generated outputs, compare them with credible academic sources, and avoid uncritical dependence on AI tools (Hua and Cunningham, 2025; Strayhorn, 2025).

This capability is important because AI-generated outputs may contain inaccuracies, bias, fabricated references, or incomplete explanations that require critical evaluation before being used in academic work (Bašić et al., 2023; Kaebnick et al., 2023). Previous studies show that students use AI to support academic writing, information searching, translation, idea generation, and learning productivity, but responsible use requires awareness of both the benefits and risks of AI tools (Chan and Hu, 2023; Malik et al., 2023). Therefore, students with higher digital literacy are expected to adopt AI more ethically because they are better able to use AI as a learning support tool rather than as a substitute for their own academic effort (Ravi et al., 2025; Song, 2024).

- H_1: Digital literacy has a positive effect on ethical AI adoption among university students.

2.7.2. Social influence and ethical AI adoption

Social influence refers to the extent to which students' attitudes and behaviors toward AI are shaped by lecturers, peers, academic norms, and institutional expectations (Korchak et al., 2025; Ngo et al., 2025). The Unified Theory of Acceptance and Use of Technology explains that social influence is one of the main determinants of technology acceptance because individuals tend to adopt technologies that are supported or encouraged by important others (Kim et al., 2025; Venkatesh et al., 2003). In higher education, lecturers can influence students' AI-related behavior by providing guidance on acceptable and unacceptable AI use in assignments, academic writing, and research activities (Malik et al., 2023; Misra et al., 2026). Peers may also shape AI adoption by normalizing AI-supported learning practices, sharing usage experiences, and influencing students' confidence in using AI tools (Arango et al., 2024; Ngo et al., 2025). However, social influence is not only related to encouragement to use AI, but also to the formation of ethical norms regarding responsible AI use in academic settings (Ahmad et al., 2026; Güneş and Kaban, 2025). When lecturers, peers, and institutions promote transparent and responsible AI use, students are more likely to adopt AI in ways that support academic integrity and ethical learning behavior (Song, 2024; Strayhorn, 2025).

- H_2: Social influence has a positive effect on ethical AI adoption among university students.

2.7.3. Digital divide and ethical AI adoption

Digital divide refers to inequality in access to, use of, and benefits from digital technologies (Bokhari and Awuni, 2024; McNeely, 2024). Digital Divide Theory explains that digital inequality is not limited to physical access to devices and internet connectivity, but also includes differences in digital skills, quality of use, institutional support, and outcomes gained from digital technologies (Goedhart et al., 2022; Korostelina and Barrett, 2023). In the context of AI adoption in higher education, students may differ in their access to digital devices, stable internet connections, AI platforms, digital competence, and academic support (Gu and Yan, 2025; Lin et al., 2024). These differences can determine whether students are able to use AI tools meaningfully, responsibly, and equally in academic activities (Assefa, 2025; Zhang et al., 2026). Students with limited access or lower digital competence may experience barriers in using AI for information searching, academic writing, translation, research support, and learning productivity (Alam et al., 2023; Fang and Nie, 2025). Therefore, digital divide is expected to reduce students' ability to adopt AI ethically and inclusively because unequal digital conditions may limit their opportunity to benefit from AI-supported learning (Assefa, 2025; Bulathwela et al., 2024).

- H_3: Digital divide has a negative effect on ethical AI adoption among university students.

2.7.4. The moderating role of digital divide in the relationship between digital literacy and ethical AI adoption

Digital literacy is expected to support ethical AI adoption because it enables students to evaluate AI-generated information, verify outputs, recognize bias, and use AI responsibly in academic work (Ravi et al., 2025; Strayhorn, 2025). However, the effect of digital literacy may depend on students' digital access, learning infrastructure, and opportunity to use AI tools effectively (Goedhart et al., 2022; Vassilakopoulou and Hustad, 2023). Digital Divide Theory suggests that unequal access, skills, usage quality, and outcomes may limit the benefits that individuals obtain from digital technologies, even when they have some level of digital competence (Goedhart et al., 2022; Korostelina and Barrett, 2023). In AI-supported learning, students with adequate digital literacy may still face difficulties in applying their skills when they experience unstable internet access, limited devices, restricted access to AI platforms, or weak institutional support (Gu and Yan, 2025; Lin et al., 2024). UNESCO warns that AI literacy may create a new form of digital divide when access to AI-related knowledge and skills is not distributed inclusively among learners (Bastani et al., 2025; Cheng et al., 2025). Therefore, digital divide is expected to weaken the positive relationship between digital literacy and ethical AI adoption because digital barriers may reduce students' ability to translate digital competence into responsible AI use (Assefa, 2025; Zhang et al., 2026).

- H_4: Digital divide weakens the positive relationship between digital literacy and ethical AI adoption among university students.

2.7.5. The moderating role of digital divide in the relationship between social influence and ethical AI adoption

Social influence can encourage students to adopt AI ethically because lecturers, peers, academic norms, and institutional expectations shape students' understanding of acceptable AI use (Korchak et al., 2025; Venkatesh et al., 2003). In higher education, lecturer guidance and peer influence may help students understand how AI can be used responsibly in assignments, academic writing, and research activities (Arango et al., 2024; Misra et al., 2026). However, the effect of social influence may be constrained when students experience digital divide conditions, such as limited device access, unstable internet connections, insufficient digital skills, or lack of institutional support (Korostelina and Barrett, 2023; Lin et al., 2024). UTAUT explains that technology acceptance is influenced not only by social influence, but also by facilitating conditions that enable individuals to use technology effectively (Thanthrige et al., 2025; Venkatesh et al., 2003).

Students with adequate digital resources may be better able to respond to lecturer encouragement and peer support by using AI responsibly in academic activities (Malik et al., 2023; Strayhorn, 2025). In contrast, students facing stronger digital barriers may find it more difficult to translate academic encouragement into actual ethical AI use, even when their lecturers or peers support AI adoption (Assefa, 2025; McNeely, 2024). Therefore, digital divide is expected to weaken the positive relationship between social influence and ethical AI adoption because unequal access and capability may reduce the effectiveness of academic and peer-based encouragement (Goedhart et al., 2022; Lythreatis et al., 2022). Research model is presented in Figure 1.

- H_5: Digital divide weakens the positive relationship between social influence and ethical AI adoption among university students.

2.8. Conceptual Framework

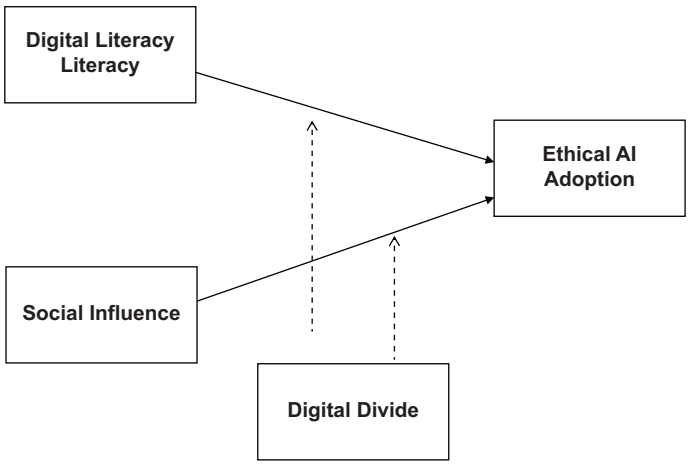
The conceptual framework of this study integrates UTAUT and Digital Divide Theory to explain ethical AI adoption among university students. Digital literacy and social influence are proposed as key determinants of ethical AI adoption, while digital divide is examined both as a direct predictor and as a moderating variable that may weaken the effects of digital literacy and social influence on ethical AI adoption. The proposed relationships are illustrated in Figure 1.

3. METHODS

This study employed a quantitative explanatory research design to examine the relationships among digital literacy, social influence, digital divide, and ethical AI adoption among university students. A quantitative approach was considered appropriate because the study aimed to test theoretically developed hypotheses and explain the causal relationships among latent variables. The research design was cross-sectional, as data were collected at a single point in time from university students who had experience with, or awareness of, AI-based tools in academic activities.

Ethical approval for this study was obtained from the Research and Community Service Agency (BPPM), Faculty of Economics and Business, Universitas Brawijaya, under approval number 07051/DST/UN10.F0201/B/PG/2026. Prior to participating in the survey, respondents were provided with information regarding the purpose of the study, voluntary participation, confidentiality of responses, and the right to withdraw at any stage. Informed consent was obtained electronically before respondents proceeded to complete the questionnaire.

Figure 1: Research model



The study was grounded in the Unified Theory of Acceptance and Use of Technology (UTAUT), which explains technology adoption through social influence and facilitating conditions. In this study, digital literacy and social influence were positioned as independent variables, digital divide was positioned as both an independent and moderating variable, and ethical AI adoption was positioned as the dependent variable. This model is consistent with the study's focus on developing an inclusive and ethical AI adoption model by considering students' digital capability, academic-social environment, and digital inequality in higher education.

Data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM). PLS-SEM was selected because the study examines a predictive model involving multiple latent constructs and moderation effects. The analysis consisted of two main stages: Assessment of the measurement model and assessment of the structural model. The measurement model was evaluated using outer loadings, Cronbach's alpha, composite reliability, average variance extracted, and discriminant validity. The structural model was assessed through path coefficients, t-statistics, P-values, R-square, and moderation testing.

3.1. Population and Sample

The population of this study comprised all university students in Indonesia. University students were selected as the population because they are increasingly exposed to AI-based tools in academic activities, including information searching, academic writing, translation, assignment preparation, research idea development, reference management, and data analysis. The focus on university students is also relevant because AI adoption in higher education requires not only technical ability, but also ethical awareness, academic responsibility, and equal access to digital learning resources.

The sample consisted of 408 university students from undergraduate to postgraduate levels, including Bachelor, Master, and Doctoral students. These respondents were considered appropriate because students across these levels are actively involved in academic tasks and may use AI tools for different purposes, ranging from coursework and writing assistance to research support. Including respondents from bachelor to doctoral students also strengthens the variation of the sample because AI adoption may differ across academic levels, learning needs, research exposure, and digital experience.

This study used purposive sampling. This technique was selected because the research required respondents who met specific criteria related to the research context. The criteria for participation were: first, the respondent must be an active university student in

Indonesia; second, the respondent must be enrolled in Bachelor, Master, and Doctoral programs; third, the respondent must have used, known, or been exposed to AI-based tools in academic activities; and fourth, the respondent must be willing to participate voluntarily. Purposive sampling is more appropriate than random sampling in this study because the research focuses on students who are relevant to the phenomenon of AI adoption in higher education, not merely on students in general.

The final sample size of 408 respondents was considered adequate for PLS-SEM analysis. This number exceeds the minimum sample commonly required for models with multiple latent variables and interaction effects. Therefore, the sample provides sufficient statistical power to test the direct effects of digital literacy, social influence, and digital divide on ethical AI adoption, as well as the moderating role of digital divide in the proposed model.

3.2. Data Sources

This study used primary data collected through an online questionnaire. The questionnaire was distributed to university students in Indonesia using a Google Form. The use of an online questionnaire was appropriate because the research topic concerns students' digital behavior and AI adoption, and online distribution allowed the researchers to reach respondents from different universities, academic levels, and geographical areas more efficiently.

The questionnaire consisted of two main sections. The first section collected demographic information, including gender, age, education level, semester, university origin, and consent to participate. The second section measured the main research constructs, namely digital literacy, social influence, digital divide, and ethical AI adoption. The items were designed to capture students' ability to use and evaluate AI, the influence of lecturers and peers, digital access barriers, and responsible AI use in academic activities.

All construct items were measured using a five-point Likert scale, ranging from 1 = strongly disagree to 5 = strongly agree. A Likert scale was used because it is suitable for measuring perceptions, attitudes, and behavioral tendencies related to technology adoption. Before data analysis, the responses were screened to ensure completeness, consistency, and relevance to the study criteria. Incomplete or invalid responses were excluded from the analysis to maintain data quality.

3.3. Operational Definitions

The measurement items were adapted and modified from prior studies and established frameworks to fit the context of AI adoption among university students. Digital literacy items were adapted from digital competence and AI literacy perspectives, focusing on students' ability to use, evaluate, verify, and manage AI-generated information critically and safely. Social influence was adapted from UTAUT, which conceptualizes social influence as the perceived encouragement or expectation from important others to use a technology. Digital divide items were adapted from digital divide literature, which emphasizes disparities in access, skills, use, and outcomes of digital technologies. Ethical AI adoption was operationalized as a multidimensional construct covering AI adoption behavior, ethical AI use, and inclusive AI adoption orientation, adapted from studies on students' generative AI acceptance and use in higher education as well as ethical AI guidance in education. The operational definitions and measurement of the study constructs are summarized in Table 1. The complete measurement items used in this study are presented in Appendix A.

3.4. Digital Literacy

Digital literacy is operationally defined as students' capability to use, evaluate, and manage digital and AI-based tools critically, safely, and responsibly for academic purposes. This construct does not only refer to the technical ability to operate digital applications, but also includes students' ability to search academic information, evaluate the credibility of AI-generated responses, compare AI outputs with valid academic sources, protect personal data, and recognize the risks of misinformation, bias, and inaccuracy produced by AI systems. This definition is adapted from the digital competence framework, which emphasizes the confident, critical, and responsible use of digital technologies for learning, work, and participation in society (Vuorikari et al., 2022). In the context of generative AI, digital literacy is also closely related to students' ability to understand the benefits, limitations, and risks of AI-supported learning (Chan and Hu, 2023).

In this study, digital literacy is measured using eight items that reflect students' ability to use digital applications for academic activities, search academic information through digital platforms, evaluate whether AI-generated information can be trusted, and compare AI responses with more valid academic sources (Chan and Hu, 2023; Vuorikari et al., 2022). The items also capture students' ability to recheck AI outputs before use, use AI according to academic needs, maintain personal data security, and understand the risks of error, bias, or inaccuracy in AI-generated content (Ravi et al., 2025). Higher scores indicate stronger digital literacy in using AI critically and responsibly in academic contexts (Audrin and Audrin, 2022; Baber et al., 2022).

3.5. Social Influence

Social influence is operationally defined as the extent to which students perceive that lecturers, peers, academic environments, and institutional expectations influence their use of AI in academic activities. This definition is adapted from the Unified Theory of Acceptance and Use of Technology, which defines social influence as the degree to which individuals perceive that important others believe they should use a particular technology (Venkatesh et al., 2003). In higher education, social influence is reflected in the role of lecturers, peers, academic norms, and institutional guidance in shaping students' acceptance and use of AI-based tools. Prior studies on students' acceptance of generative AI also show that social and academic environments can shape students' intention and confidence in using AI for learning purposes (Chan and Hu, 2023; Strzelecki, 2024).

In this study, social influence is measured using eight items that assess lecturer encouragement, peer influence, academic environment, and the normalization of AI use among students

(Korchak et al., 2025; Venkatesh et al., 2003). The items also measure program-level guidance, discussions with lecturers or peers, acceptance of AI in academic settings, and support from lecturers and peers in increasing students' confidence to use AI (Arango et al., 2024; Misra et al., 2026). Higher scores indicate stronger social and academic influence that supports students' AI adoption in higher education (Ngo et al., 2025; Strzelecki, 2024).

3.6. Digital Divide

Digital divide is operationally defined as inequality in students' access, skills, usage conditions, and opportunities to benefit from AI-supported digital technologies in academic activities. This construct is adapted from digital divide theory, which explains that digital inequality is not limited to access to devices and internet connectivity, but also includes differences in skills, usage patterns, and outcomes gained from digital technologies (Colom, 2020; Van Dijk, 2005). Lythreatis et al. (2022) further explain that the digital divide includes disparities in access, use, and outcomes, making it relevant for examining unequal opportunities in digital learning environments. In the context of AI-supported learning, the digital divide may determine whether students can access, use, and benefit from AI tools equally (Goedhart et al., 2022; Korostelina and Barrett, 2023).

In this study, digital divide is measured using eight items that capture students' access to adequate digital devices, stable internet connection, technological capability, and ease of access to AI applications (Gu and Yan, 2025; Lin et al., 2024). The items also assess barriers caused by limited devices, barriers caused by limited internet access, unequal opportunities to use AI, and differences in digital ability among students (Assefa, 2025; Zhang et al., 2026). Because some items are positively worded as access or capability, while others are negatively worded as barriers, reverse coding should be applied where necessary so that the final construct consistently reflects the intended meaning of digital divide (Lythreatis et al., 2022; Vassilakopoulou and Hustad, 2023).

3.7. Ethical AI Adoption

Ethical AI adoption is operationally defined as students' responsible, transparent, inclusive, and academically appropriate use of AI to support learning and academic work while maintaining integrity, originality, fairness, and accountability. This construct is adapted from studies on students' acceptance and use of generative AI in higher education, which explain that students use AI for learning support, information searching, writing assistance, idea generation, feedback, and academic productivity, while also facing concerns related to accuracy, privacy, ethics, and academic integrity (Chan and Hu, 2023; Strzelecki, 2024). The ethical dimension is also informed by UNESCO's guidance on generative AI in education, which emphasizes human agency, transparency, equity, inclusion, privacy protection, and responsible use of AI in teaching, learning, and research

In this study, ethical AI adoption is treated as a multidimensional dependent construct that combines three related dimensions: AI adoption behavior, ethical AI use, and inclusive AI adoption orientation (Chan and Hu, 2023). AI adoption behavior is measured through students' use of AI for learning, searching academic information, understanding course materials, developing ideas or assignment outlines, improving learning effectiveness, increasing academic productivity, continuing future use, and perceiving AI as an important learning tool (Malik et al., 2023; Strayhorn, 2025). Ethical AI use is measured through academic honesty, plagiarism avoidance, output verification, transparency or acknowledgment of AI use when required, understanding that AI should not replace students' own thinking, using AI as an assistive tool, awareness of academic integrity risks, and the perceived need for ethical AI guidelines (Güneş and Kaban, 2025; Song, 2024). Inclusive AI adoption orientation is measured through equal access to AI, the need for AI training, prevention of wider inequality, support for students with limited technological access, fairness of access, consideration of differences in digital ability, campus digital facilities, and the integration of technology, ethics, and equal access in AI adoption (Assefa, 2025; Bulathwela et al., 2024).

3.8. Research Models

This study develops a research model to explain ethical AI adoption among university students by integrating the Unified Theory of Acceptance and Use of Technology (UTAUT) and Digital Divide Theory. The model positions digital literacy and social influence as the main antecedents of ethical AI adoption. Digital literacy reflects students' capability to use, evaluate, and manage AI-based tools critically and responsibly in academic activities. Students with higher digital literacy are expected to be more capable of verifying AI-generated information, recognizing possible bias or inaccuracy, protecting personal data, and using AI as an assistive tool rather than as a substitute for their own academic effort. Meanwhile, social influence captures the role of lecturers, peers, academic norms, and institutional expectations in shaping students' AI-related behavior. Supportive academic environments are expected to encourage students to use AI in ways that are responsible, transparent, and aligned with academic integrity.

The model also incorporates digital divide as both a direct predictor and a moderating variable. As a direct predictor, digital divide is expected to negatively influence ethical AI adoption because unequal access to devices, internet connection, AI tools, digital skills, and institutional support may limit students' ability to use AI effectively and responsibly. As a moderating variable, digital divide is expected to weaken the positive relationship between digital literacy and ethical AI adoption, as students with adequate digital knowledge may still face barriers if they lack access to supporting infrastructure. Digital divide is also expected to weaken the relationship between social influence and ethical AI adoption, because encouragement from lecturers, peers, or academic institutions may be less effective when students experience limited digital access or capability. Therefore, the proposed model emphasizes that ethical AI adoption is shaped not only by individual competence and social encouragement, but also by the extent to which students have equal access and opportunity to benefit from AI-supported learning.

4. RESULTS

Table 2 presents the demographic profile of the 408 respondents. The majority of respondents were female, with 289 students or

Table 1: Operational definitions and measurement indicators

Variable	Operational Definition	Measurement Indicators	Adapted From
Digital Literacy	Students' capability to use, evaluate, and manage digital and AI-based tools critically, safely, and responsibly for academic purposes.	Use of digital applications, academic information searching, evaluation of AI responses, comparison with academic sources, rechecking AI outputs, appropriate AI use, personal data protection, awareness of AI bias and inaccuracy.	Chan and Hu (2023); Vuorikari et al. (2022)
Social Influence	The extent to which lecturers, peers, academic environments, and institutional expectations influence students' AI use.	Lecturer encouragement, peer influence, academic environment, normalization of AI use, program guidance, discussion with lecturers/peers, academic acceptance of AI, support from lecturers and peers.	Chan and Hu (2023); Strzelecki, (2024); Venkatesh et al. (2003)
Digital Divide	Inequality in students' access, skills, usage conditions, and opportunities to benefit from AI-supported digital technologies.	Device access, internet stability, technological capability, ease of AI access, device barriers, internet barriers, unequal opportunities, differences in digital ability.	Colom (2020); Lythreatis et al. (2022); Van Dijk (2005)
Ethical AI Adoption	Students' responsible, transparent, inclusive, and academically appropriate use of AI while maintaining integrity, fairness, and accountability.	AI use for learning, information search, material understanding, idea development, productivity, continued use, academic honesty, plagiarism avoidance, output verification, AI acknowledgment, AI as support tool, equal access, training, campus support, fairness, and AI guidelines.	Chan and Hu (2023); Strzelecki (2024)

Table 2: Demographic profile

Characteristic	Category	Frequency	Percentage
Gender	Female	289	70.8
	Male	119	29.2
Age	<18	2	0.5
	18-20	234	57.4
	21-23	111	27.2
	>23	61	15.0
Education Level	Diploma	18	4.4
	Bachelor/S1	351	86.0
	Master/S2	27	6.6
	Doctor/S3	12	2.9
Current Semester	Semester 1-2	126	30.9
	Semester 3-4	150	36.8
	Semester 5-6	66	16.2
	Up to Semester 7	66	16.2

70.8%, while male respondents accounted for 119 students or 29.2%. Based on age, most respondents were between 18 and 20 years old, representing 57.4% of the sample, followed by respondents aged 21-23 years at 27.2%. In terms of education level, most respondents were undergraduate students, accounting for 86.0% of the total sample. Based on current semester, the largest group was students in semester 3-4, representing 36.8%, followed by semester 1-2 at 30.9%. Overall, the sample was dominated by female undergraduate students in the early to middle stages of study.

Table 3 presents the correlation matrix among the main variables. The results show that all variables are positively correlated with one another. Digital literacy has a positive correlation with ethical AI adoption, with a coefficient of 0.830, indicating that students with higher digital literacy tend to demonstrate stronger ethical AI adoption. Social influence is also positively associated with ethical AI adoption, with a correlation coefficient of 0.738, suggesting that support from lecturers, peers, and the academic environment is related to students' responsible use of AI. The results also show that digital divide has a strong positive correlation with ethical AI adoption, with a coefficient of 0.836. This finding indicates that the digital divide construct in this study should be interpreted carefully because it captures not only barriers, but also perceived access, capability, and digital conditions related to AI use. Overall, the significant correlations among the variables provide initial evidence that digital literacy, social influence, and digital divide-related conditions are associated with ethical AI adoption among university students.

Table 4 presents the reliability and convergent validity test results. The Cronbach's Alpha values for all constructs range from 0.904 to 0.964, which are above the recommended threshold of 0.70. This indicates that all constructs have strong internal consistency. The Composite Reliability values also exceed 0.70, ranging from 0.925 to 0.967, confirming that the indicators used in each construct are reliable. The Average Variance Extracted values are also above the minimum threshold of 0.50. Digital literacy has an AVE of 0.645, social influence has an AVE of 0.610, digital divide has an AVE of 0.611, and ethical AI adoption has an AVE of 0.551. These results indicate that each construct explains more than half of the variance of its indicators. Therefore, all constructs meet the requirements for reliability and convergent validity and can be considered acceptable for further analysis.

Table 5 presents the discriminant validity test using the Fornell-Larcker criterion. The diagonal values represent the square root of AVE for each construct, while the off-diagonal values represent the correlations among constructs. The square root of AVE values are 0.803 for digital literacy, 0.781 for social influence, 0.782 for digital divide, and 0.742 for ethical AI adoption. Based on the Fornell-Larcker criterion, discriminant validity is expected to be achieved when the square root of AVE for each construct is higher than its correlations with other constructs. The results show that social influence meets this criterion because its diagonal value is higher than its correlations with other constructs. However, digital literacy, digital divide, and ethical AI adoption show several correlations that are higher than their diagonal values. For example, the correlation between ethical AI adoption and digital literacy is 0.830, and the correlation between ethical AI adoption and digital divide is 0.836, both of which are higher than the square root of AVE for ethical AI adoption.

Table 6 presents the regression results examining the effects of digital literacy, social influence, digital divide, and their interaction terms on ethical AI adoption. The results show that digital literacy

Table 3: Correlation matrix test

Variable	Digital literacy	Social influence	Digital divide	Ethical AI adoption
Digital Literacy	1.000	0.621***	0.746***	0.830***
Social Influence	0.621***	1.000	0.702***	0.738***
Digital Divide	0.746***	0.702***	1.000	0.836***
Ethical AI Adoption	0.830***	0.738***	0.836***	1.000

Table 4: Reliability and validity test

Construct	Cronbach's alpha	Composite reliability (CR)	Average variance extracted (AVE)	Decision
Digital Literacy	0.921	0.935	0.645	Acceptable
Social Influence	0.906	0.926	0.610	Acceptable
Digital Divide	0.904	0.925	0.611	Acceptable
Ethical AI Adoption	0.964	0.967	0.551	Acceptable

Table 5: Fornell Larcker test

Construct	Digital literacy	Social influence	Digital divide	Ethical AI adoption
Digital Literacy	0.803	0.621	0.746	0.830
Social Influence	0.621	0.781	0.702	0.738
Digital Divide	0.746	0.702	0.782	0.836
Ethical AI Adoption	0.830	0.738	0.836	0.742

Table 6: Model regression test

Variable	Coefficient	Robust SE	z-value	P-value	95% CI Lower	95% CI Upper	Decision
Constant	4.051	0.015	266.612	0.000	4.021	4.081	Significant
Digital Literacy	0.379	0.038	10.005	0.000	0.304	0.453	Significant
Social Influence	0.199	0.032	6.301	0.000	0.137	0.261	Significant
Digital Divide	0.351	0.039	8.993	0.000	0.274	0.427	Significant
Digital Literacy×Digital Divide	−0.019	0.040	−0.478	0.633	−0.098	0.060	Not significant
Social Influence×Digital Divide	−0.041	0.042	-0.985	0.324	−0.123	0.041	Not significant

Table 7: Gaussian copula test

Variable	Coefficient	Robust SE	z-value	P-value	Decision
GC Digital Literacy	0.000	0.137	0.003	0.998	No endogeneity indicated
GC Social Influence	−0.216	0.148	−1.454	0.146	No endogeneity indicated
GC Digital Divide	0.148	0.163	0.905	0.365	No endogeneity indicated

has a positive and significant effect on ethical AI adoption, with a coefficient of 0.379 and a P = 0.000. This indicates that students with higher digital literacy are more likely to adopt AI ethically in academic activities. Social influence also has a positive and significant effect on ethical AI adoption, with a coefficient of 0.199 and a P = 0.000. This result suggests that support from lecturers, peers, academic environments, and institutional guidance contributes to students' ethical use of AI. Digital divide also shows a positive and significant effect on ethical AI adoption, with a coefficient of 0.351 and a P = 0.000. However, this finding should be interpreted carefully because the digital divide construct in this study includes indicators of access, capability, and barriers. Thus, the positive coefficient may reflect students' perceived digital access and AI-related conditions rather than digital exclusion alone.

The interaction between digital literacy and digital divide is negative but not significant, with a coefficient of −0.019 and a P = 0.633. Similarly, the interaction between social influence and digital divide is also negative but not significant, with a coefficient of −0.041 and a P = 0.324. These results indicate that digital divide does not significantly moderate the relationships between digital literacy and ethical AI adoption or between social influence and ethical AI adoption. Overall, the regression results support the direct effects of digital literacy, social influence, and digital divide on ethical AI adoption. However, the moderating role of digital divide is not supported. Therefore, the findings suggest that ethical AI adoption among university students is mainly explained by students' digital capability, social-academic support, and digital access-related conditions, rather than by the interaction effects of digital divide.

Table 7 presents the Gaussian copula test used to examine potential endogeneity in the main predictors. The results show that all Gaussian copula terms are not statistically significant. The Gaussian copula for digital literacy has a coefficient of 0.000 with a P = 0.998, social influence has a coefficient of −0.216 with a P = 0.146, and digital divide has a coefficient of 0.148 with a P = 0.365. Since all P-values are >0.05, the results indicate that there is no evidence of endogeneity in the model. Therefore, digital literacy, social influence, and digital divide can be considered free from serious endogeneity concerns in explaining ethical AI adoption. This supports the robustness of the regression results.

Table 8 presents the result of Harman's single-factor test, which was conducted to assess the potential presence of common method bias. The first factor has an eigenvalue of 23.989 and explains 49.976% of the total variance. Since the variance explained by

the first factor is below the commonly used threshold of 50%, common method bias is not considered dominant in this study. This result suggests that the variance in the data is not mainly explained by a single factor. Therefore, common method bias is unlikely to seriously affect the findings. However, because the percentage is close to the 50% threshold, the result should still be interpreted with caution.

Table 9 presents the non-response bias test by comparing early and late respondents. The early respondents represent the first group of respondents, while the late respondents represent the last group of respondents. This test was conducted to examine whether there were significant differences between the two groups that could indicate potential non-response bias. The results show that there are no significant differences between early and late respondents for all constructs. Digital literacy has a P = 0.181, social influence has a P = 0.953, digital divide has a P = 0.551, and ethical AI adoption has a P = 0.775. Since all P-values are >0.05, the results indicate that the responses of early and late respondents are statistically similar. Therefore, non-response bias is unlikely to be a serious concern in this study.

Table 10 presents the simple slope test used to examine the conditional effect of digital literacy and social influence on ethical AI adoption at different levels of digital divide. The results show that the effect of digital literacy on ethical AI adoption remains positive and significant at low, mean, and high levels of digital divide. At low digital divide, the simple slope is 0.391 with a P = 0.000. At the mean level, the simple slope is 0.379 with a P = 0.000. At high digital divide, the simple slope is 0.366 with a P = 0.000. These findings indicate that digital literacy consistently supports ethical AI adoption across different levels of digital divide.

The results also show that social influence has a positive and significant effect on ethical AI adoption at all levels of digital divide. At low digital divide, the simple slope is 0.227 with a P = 0.000. At the mean level, the simple slope is 0.199 with a P = 0.000. At high digital divide, the simple slope decreases to 0.172 but remains significant with a P = 0.000. This indicates that social influence continues to encourage ethical AI adoption, although its effect becomes slightly weaker when digital divide is higher. Overall, the simple slope results show that digital literacy and social influence remain important predictors of ethical AI adoption at low, medium, and high levels of digital divide. However, because the interaction effects in the regression model were not statistically significant, these results should be interpreted as conditional patterns rather than strong evidence of moderation.

5. DISCUSSION

This study examines the determinants of ethical AI adoption among university students by integrating digital literacy, social influence, and digital divide into a single research model. The findings provide empirical evidence that ethical AI adoption is shaped not only by students' individual digital capability, but also by their academic-social environment and digital access conditions, which is consistent with the integration of UTAUT and Digital Divide Theory (Lythreatis et al., 2022; Van Dijk, 2005; Venkatesh et al., 2003).

The finding shows that digital literacy has a positive and significant effect on ethical AI adoption. This result indicates that students with higher digital literacy are more likely to use AI responsibly in academic activities because they are better able to evaluate AI-generated information, verify the accuracy of AI outputs, compare AI responses with credible academic sources, and understand the risks of misinformation, bias, and academic misconduct (Ravi et al., 2025; Vuorikari et al., 2022). This finding is consistent with the digital competence perspective, which emphasizes that digital literacy is not limited to technical ability, but also includes critical,

Table 8: Harman test

Test	First factor eigenvalue	Total variance explained by first factor (%)	Threshold	Decision
Harman's Single-Factor Test	23.989	49.976	<50%	Common method bias is not dominant

Table 9: Non response bias test

Construct	Early respondents (n)	Early Mean	Early SD	Late Respondents (n)	Late Mean	Late SD	t-value	P-value	Decision
Digital Literacy	102.000	4.206	0.518	102.000	4.080	0.794	1.344	0.181	No significant difference
Social Influence	102.000	3.746	0.617	102.000	3.752	0.844	−0.059	0.953	No significant difference
Digital Divide	102.000	3.935	0.606	102.000	3.994	0.788	−0.598	0.551	No significant difference
Ethical AI Adoption	102.000	4.101	0.542	102.000	4.073	0.815	0.287	0.775	No significant difference

Table 10: Simple slope test

Predictor	Moderator Level	Digital Divide Value (Centered)	Simple Slope	Robust SE	z-value	P-value	95% CI Lower	95% CI Upper	Decision
Digital Literacy	Low Digital Divide (−1 SD)	−0.667	0.391	0.037	10.666	0.000	0.320	0.463	Significant
Digital Literacy	Mean Digital Divide	0.000	0.379	0.038	10.005	0.000	0.304	0.453	Significant
Digital Literacy	High Digital Divide (+1 SD)	0.667	0.366	0.054	6.723	0.000	0.259	0.472	Significant
Social Influence	Low Digital Divide (−1 SD)	−0.667	0.227	0.044	5.111	0.000	0.140	0.314	Significant
Social Influence	Mean Digital Divide	0.000	0.199	0.032	6.301	0.000	0.137	0.261	Significant
Social Influence	High Digital Divide (+1 SD)	0.667	0.172	0.040	4.332	0.000	0.094	0.250	Significant

safe, and responsible use of digital technologies for learning and participation (Audrin and Audrin, 2022; Vuorikari et al., 2022). In the context of AI-supported learning, students need digital literacy to avoid passive dependence on AI-generated outputs and to use AI as a learning support tool rather than as a substitute for academic effort (Song, 2024; Strayhorn, 2025). The result also supports previous studies on generative AI adoption in higher education. Chan and Hu (2023) found that students perceive generative AI as useful for learning support, idea development, writing assistance, and academic productivity, but they also recognize concerns related to accuracy, privacy, ethics, and academic integrity. In line with this, the present study suggests that students need sufficient digital literacy to transform AI use from merely practical assistance into ethical academic behavior. Thus, digital literacy becomes a key foundation for ethical AI adoption because it helps students use AI critically, transparently, and responsibly rather than passively accepting AI-generated outputs (Güneş and Kaban, 2025; Ravi et al., 2025).

The result also shows that social influence has a positive and significant effect on ethical AI adoption. This finding supports the Unified Theory of Acceptance and Use of Technology, which explains that individuals' technology use is influenced by the expectations, encouragement, and support of important people around them (Kim et al., 2025; Venkatesh et al., 2003). In higher education, lecturers, peers, academic communities, and study program policies can shape students' attitudes toward AI use. When lecturers provide guidance on acceptable and unacceptable AI use, students may better understand the boundary between responsible assistance and academic misconduct (Malik et al., 2023; Misra et al., 2026). This finding is also consistent with Strzelecki (2024), who found that students' acceptance of ChatGPT in higher education can be explained through technology acceptance factors, including social and academic contexts. Similarly, prior studies suggest that peer influence and academic environments can normalize AI-supported learning practices and influence students' confidence in using AI tools (Arango et al., 2024; Ngo et al., 2024). In this study, social influence reflects how lecturer encouragement, peer practices, academic norms, and institutional guidance can encourage students to adopt AI more ethically. Therefore, ethical AI adoption should not be viewed only as an individual decision, but also as a socially constructed academic behavior shaped by expectations, discussions, and norms within higher education institutions (Korchak et al., 2025; Venkatesh et al., 2003).

The finding indicates that digital divide has a positive and significant effect on ethical AI adoption. This result needs to be interpreted carefully because the digital divide construct in this study includes indicators of access, capability, barriers, and unequal opportunities, meaning that the coefficient may reflect students' perceived digital access and AI-related learning conditions rather than digital exclusion alone (Colom, 2020; Lythreatis et al., 2022). The positive coefficient may indicate that students who perceive stronger digital access, sufficient technological capability, and awareness of AI-related inequalities are more likely to adopt AI ethically. In this sense, the result does not imply that inequality increases ethical AI adoption, but rather that AI-related digital conditions are strongly connected to students' ability to use AI responsibly (Goedhart et al., 2022; Korostelina and Barrett, 2023). This finding is relevant to Digital Divide Theory, which explains that digital inequality is not limited to physical access to devices and internet connection, but also includes differences in skills, usage, and outcomes (Colom, 2020; Van Dijk, 2005) Lythreatis et al. (2022) also emphasize that the digital divide involves disparities in access, use, and outcomes of digital technologies, making it relevant for examining unequal opportunities in AI-supported learning. In the context of AI-supported learning, students with better access to devices, stable internet, and sufficient digital capability may have more opportunities to learn how to use AI properly. Therefore, universities need to address digital access and capability as part of ethical AI governance in higher education to ensure that AI adoption supports inclusion rather than widening educational inequality (Assefa, 2025; Gu and Yan, 2025; Zhang et al., 2026).

The interaction between digital literacy and digital divide is negative but not significant. This means that digital divide does not significantly moderate the relationship between digital literacy and ethical AI adoption, although the negative coefficient suggests that digital divide may weaken the positive role of digital literacy (Goedhart et al., 2022; Vassilakopoulou and Hustad, 2023). This result indicates that digital literacy remains a significant predictor of ethical AI adoption regardless of students' digital divide conditions. Students with strong digital literacy may still be able to evaluate AI outputs, recognize ethical risks, and use AI responsibly even when they experience certain access or capability limitations (Ravi et al., 2025; Vuorikari et al., 2022). This finding can be interpreted through the lens of digital competence and Digital Divide Theory. Digital competence enables students to manage digital and AI-based learning environments critically, while Digital Divide Theory explains that unequal access and skills may influence the extent to which students benefit from digital technologies (Colom, 2020; Lythreatis et al., 2022). However, the non-significant moderation suggests that digital divide functions more strongly as a direct contextual factor than as a conditional factor in this model. This result slightly differs from the theoretical expectation that unequal access would weaken the effect of digital literacy, but it remains reasonable because digital literacy itself already reflects students' capability to manage digital information, AI-generated content, and ethical risks in academic settings (Audrin and Audrin, 2022; Song, 2024).

The interaction between social influence and digital divide is also negative but not significant. This indicates that digital divide does not significantly moderate the relationship between social influence and ethical AI adoption, although the coefficient direction suggests that the influence of lecturers, peers, and academic environments may become weaker when digital divide is higher (Korostelina and Barrett, 2023; Venkatesh et al., 2003). This finding suggests that social influence remains relevant in encouraging ethical AI adoption even when students experience different levels of digital access or capability. From the UTAUT perspective, social influence works through perceived expectations and encouragement from important others, such as lecturers, peers, and institutional actors (Kim et al., 2025; Venkatesh et al., 2003). In higher education, this influence may continue to shape

students' ethical awareness through academic guidance, peer discussions, and institutional norms. Lecturers and peers can help students understand appropriate AI use, academic integrity, and responsible learning practices even when students face different digital conditions (Arango et al., 2024; Misra et al., 2026) However, because digital divide does not significantly condition this relationship, universities should treat social support and digital inclusion as complementary strategies rather than assuming that one automatically strengthens or weakens the other. Academic guidance is needed to shape ethical AI behavior, while digital inclusion is needed to ensure that students have fair opportunities to access and benefit from AI-supported learning (Assefa, 2025; Goedhart et al., 2022).

Overall, the results show that ethical AI adoption among university students is directly influenced by digital literacy, social influence, and digital divide-related conditions. These findings support the integration of UTAUT and Digital Divide Theory in explaining AI adoption in higher education. UTAUT helps explain how social and academic environments influence students' acceptance and use of AI, while Digital Divide Theory explains why access, capability, and inequality matter in shaping students' opportunities to use AI responsibly. However, the moderating role of digital divide is not statistically supported. This indicates that digital divide is more relevant as a direct predictor than as a moderator in this study. The findings imply that universities should strengthen students' digital literacy, provide clear academic guidance on AI use, and reduce digital access gaps. These efforts are important to ensure that AI adoption in higher education is not only effective, but also ethical, inclusive, and aligned with academic integrity.

6. CONCLUSION AND IMPLICATIONS

6.1. Conclusion

This study concludes that ethical AI adoption among university students is significantly influenced by digital literacy, social influence, and digital divide-related conditions. The findings show that students with higher digital literacy are more likely to adopt AI ethically because they are better able to evaluate AI-generated information, verify its accuracy, recognize potential bias, and use AI as a supporting tool rather than as a substitute for academic thinking. This confirms that digital literacy is an essential foundation for responsible AI use in higher education. The study also finds that social influence has a positive and significant effect on ethical AI adoption. This indicates that lecturers, peers, academic norms, and institutional guidance play an important role in shaping students' responsible AI behavior. When students receive clear direction and support from their academic environment, they are more likely to use AI in ways that are transparent, responsible, and aligned with academic integrity. Digital divide also has a significant effect on ethical AI adoption. However, this finding should be interpreted carefully because the digital divide construct in this study includes access, capability, barriers, and unequal opportunities. The result suggests that students' digital conditions, including access to devices, internet stability, and technological capability, are closely related to their ability to use AI ethically and meaningfully. Therefore, ethical AI adoption requires not only individual competence and social support, but also adequate and inclusive digital infrastructure. The moderating role of digital divide is not statistically supported. Although the interaction effects show a negative direction, digital divide does not significantly weaken the relationships between digital literacy and ethical AI adoption or between social influence and ethical AI adoption. This means that digital divide functions more as a direct contextual factor than as a moderator in this study. Overall, the findings highlight the importance of strengthening students' digital literacy, providing academic guidance on responsible AI use, and reducing digital access gaps in higher education. Universities need to develop clear ethical guidelines, provide AI-related training, and ensure equal access to digital facilities so that AI adoption can support learning while maintaining academic integrity, fairness, and inclusiveness.

6.2. Implications

6.2.1. Theoretical implications

This study contributes to the literature on AI adoption in higher education by integrating UTAUT and Digital Divide Theory to explain ethical AI adoption among university students. The findings show that digital literacy and social influence are important predictors of ethical AI adoption, which supports the argument that students' AI use is shaped by both individual capability and social-academic environments. This strengthens the relevance of UTAUT in explaining AI adoption, especially through the role of social influence from lecturers, peers, academic norms, and institutional guidance. The study also extends Digital Divide Theory by showing that digital divide-related conditions are directly associated with ethical AI adoption. This indicates that AI adoption in higher education is not only a matter of willingness to use technology, but also depends on students' access, capability, and opportunity to benefit from digital learning tools. However, the non-significant moderating effect suggests that digital divide may function more strongly as a direct contextual factor than as a condition that changes the effects of digital literacy and social influence. Therefore, future studies may further examine digital divide as a multidimensional construct, including access divide, skills divide, usage divide, and outcome divide.

6.2.2. Practical implications

The findings imply that universities need to strengthen students' digital literacy as a foundation for responsible AI use. Digital literacy training should not only focus on how to use AI tools, but also on how to evaluate AI-generated content, verify information, identify bias, protect personal data, and avoid academic misconduct. This is important because students with stronger digital literacy are more likely to use AI ethically in learning and academic work. The significant role of social influence also suggests that lecturers, study programs, and academic communities should actively guide students in using AI responsibly. Lecturers can provide clear instructions on acceptable and unacceptable AI use in assignments, research, and academic writing. Study programs may also develop academic guidelines so that students understand when AI use is allowed, how AI assistance should be acknowledged, and how to maintain academic integrity.

6.2.3. Institutional and policy implications

Universities should develop clear policies on ethical and inclusive AI adoption. These policies need to cover academic honesty, transparency in AI use, plagiarism prevention, data privacy, and responsible use of AI-generated content. Without clear institutional guidance, students may use AI based only on personal judgment or peer practices, which can increase the risk of unethical use. In addition, universities need to reduce digital access gaps by providing adequate digital infrastructure, stable internet access, AI-related learning facilities, and training for students with different levels of digital ability. Since digital divide-related conditions significantly influence ethical AI adoption, inclusive access should become part of AI governance in higher education. AI adoption should not only improve learning efficiency, but also ensure fairness and equal opportunity for all students.

6.2.4. Limitations and suggestions for further research

This study has several limitations that should be considered when interpreting the findings. First, the study used a cross-sectional survey design, meaning that the data were collected at one point in time. Therefore, the results can explain the relationships among digital literacy, social influence, digital divide, and ethical AI adoption, but they cannot fully confirm causal relationships. Future research may use longitudinal designs to examine how students' ethical AI adoption develops over time, especially as AI tools and university policies continue to evolve. Second, the data were collected using self-reported questionnaire responses. Although this approach is appropriate for measuring students' perceptions, attitudes, and behavioral tendencies, it may be influenced by social desirability bias. Students may report that they use AI ethically because they perceive ethical use as the expected academic behavior. Future studies may combine survey data with interviews, focus group discussions, or behavioral data to gain deeper insight into how students actually use AI in academic tasks.

Third, the digital divide construct in this study includes access, capability, barriers, and inequality-related indicators. Although this reflects the broad nature of digital divide, the results show that the construct needs to be interpreted carefully. Future research may separate digital divide into more specific dimensions, such as device access, internet access, AI access, digital skills, usage intensity, and learning outcomes. This would allow researchers to identify which dimension of digital divide has the strongest effect on ethical AI adoption. Fourth, the moderating role of digital divide was not statistically supported in this study. This suggests that digital divide may function more as a direct predictor than as a moderating variable. Future studies may retest the moderating role of digital divide using different samples, different measurement approaches, or multi-group analysis based on students' access levels, study programs, regions, or education levels. This may provide a more detailed understanding of whether digital inequality changes the effects of digital literacy and social influence on ethical AI adoption. Finally, this study focused on university students as respondents. Future research may extend the model to lecturers, academic administrators, or different types of higher education institutions. Comparative studies across countries, universities, disciplines, or education levels may also provide broader evidence on ethical and inclusive AI adoption in higher education. Such research would help develop more comprehensive policies and guidelines for responsible AI use in academic environments.

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APPENDIX

Appendix A: Research questionnaire items

Construct	Code	Questionnaire Item
AI adoption	AIA1	I use AI-based applications to support my learning activities in higher education.
	AIA2	I use AI to search for academic information or references.
	AIA3	I use AI to help me understand course materials.
	AIA4	I use AI to help develop ideas or outlines for academic assignments.
	AIA5	I feel that using AI makes the learning process more effective.
	AIA6	I feel that using AI helps improve my academic productivity.
	AIA7	I intend to continue using AI to support my academic activities in the future.
	AIA8	I believe that AI has become an important tool in students' learning processes today.
Digital literacy	DL1	I am able to use various digital applications to support my academic activities.
	DL2	I am able to search for academic information effectively through digital platforms.
	DL3	I am able to evaluate whether information provided by AI is trustworthy.
	DL4	I am able to compare AI-generated answers with more valid academic sources.
	DL5	I understand that AI-generated answers need to be rechecked before being used.
	DL6	I am able to use AI appropriately according to my academic needs.
	DL7	I am able to maintain the security of my personal data when using AI-based applications.
	DL8	I understand the risks of errors, bias, or inaccuracies in information generated by AI.
Social influence	SI1	Lecturers encourage students to understand the use of AI in academic activities.
	SI2	Peers influence me to use AI in completing academic assignments.
	SI3	The academic environment on campus makes me more interested in using AI.
	SI4	I use AI because many other students also use it.
	SI5	Policies or guidance from the study program influence how I use AI.
	SI6	Discussions with peers or lecturers help me understand the benefits of AI in learning.
	SI7	I feel that AI use is increasingly accepted in the academic environment.
	SI8	Support from lecturers and peers makes me more confident in using AI.
Digital divide	DD1	I have adequate digital devices to use AI.
	DD2	I have stable internet access to use AI-based applications.
	DD3	I have sufficient technological skills to use AI in learning.
	DD4	I do not experience difficulties in accessing AI applications for academic activities.
	DD5	Limited digital devices can hinder students from using AI.
	DD6	Limited internet access can hinder students from using AI.
	DD7	Not all students have equal opportunities to use AI in learning.
	DD8	Differences in students' digital skills can influence the success of AI use.
Ethical AI use	EAI1	I understand that the use of AI in academic assignments must still consider academic honesty.
	EAI2	I do not use AI to commit plagiarism or copy answers without understanding their content.
	EAI3	I always recheck AI-generated outputs before using them in academic assignments.
	EAI4	I acknowledge or explain the use of AI when required in academic assignments.
	EAI5	I understand that AI should not be used to replace the entire thinking process of students.
	EAI6	I use AI as an assistive tool, not as a substitute for my academic ability.
	EAI7	I realize that unethical AI use can harm academic integrity.
	EAI8	I believe that higher education institutions need clear guidelines on the ethical use of AI.
Inclusive AI adoption	IAI1	AI use in higher education should be accessible to all students.
	IAI2	Higher education institutions need to provide training so that students can use AI appropriately.
	IAI3	Higher education institutions need to ensure that AI use does not widen inequalities among students.
	IAI4	Students with limited technological access need support in using AI.
	IAI5	AI use in learning should consider fair access for all students.
	IAI6	Guidelines for AI use should consider differences in students' digital abilities.
	IAI7	Campuses need to provide digital facilities that support equal use of AI.
	IAI8	Good AI adoption should consider technological, ethical, and equal-access aspects.

All questionnaire items were measured using a five-point Likert scale: 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree