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AI IN SABAH SECONDARY SCHOOLS: A CASE STUDY ON ETHICAL IMPLICATIONS

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ABSTRACT

As artificial intelligence (AI) becomes increasingly integrated into education, understanding its ethical implications for students in underrepresented regions is essential. This qualitative case study explores how five secondary school students in Sabah, Malaysia, perceive and respond to ethical issues related to generative AI use in learning. Using Braun and Clarke's thematic analysis, the study identified three key themes: ethical awareness and knowledge, ethical concerns and tensions, and conditional intentions for AI use. Students expressed nuanced understandings of academic integrity, fairness, and data privacy, though their application of ethical principles varied. The findings highlight the importance of responsible AI education and suggest that ethical awareness and concern shape students' behavioural intentions. This study underscores the need for targeted ethics education and equitable digital access to support responsible AI integration in schools.

Keywords: artificial intelligence (AI), ethical awareness, secondary school students, behavioural intention, AI ethics education

INTRODUCTION

Artificial Intelligence (AI) is rapidly transforming education systems worldwide, offering new opportunities for personalised learning, administrative efficiency, and data-driven decision-making. However, this transformation also brings significant ethical concerns, including data privacy, algorithmic bias, academic integrity, and equitable access (Williamson & Eynon,

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2020). These issues are particularly pressing in developing and underrepresented regions, where digital readiness and ethical literacy may lag technological adoption.

In response to global developments, Malaysia has taken proactive steps to integrate AI into its education system. The National Artificial Intelligence Roadmap 2021–2025 outlines a vision for an inclusive and trustworthy AI ecosystem, emphasising fairness, transparency, accountability, and human well-being (Ministry of Education Malaysia, 2021). Complementing this, the Digital Education Policy (2021–2025) promotes digital citizenship and ethical technology use among students and educators.

At the state level, Sabah has made notable progress in digitalising its education infrastructure. Initiatives such as the RM5 million digitalisation project in 2024 have equipped over 600 schools with high-speed internet, cloud-based learning platforms, and smart classrooms (Dzulkifli, 2024a, 2024b). Programmes like Invest4Good Robotics & AI and the "Next-Level Educators" workshop further demonstrate Sabah's commitment to preparing both students and teachers for AI integration in education.

Despite these advancements, ethical concerns remain underexplored, particularly among secondary school students in Sabah. While national and regional policies emphasise responsible AI use, there is limited understanding of how students perceive and respond to ethical issues such as academic dishonesty, data privacy, and fairness in AI-supported learning environments. This gap is especially critical given the increasing accessibility of generative AI tools like ChatGPT, which students are beginning to use in their academic work.

This study addresses this gap by exploring how secondary school students in Sabah understand and respond to the ethical implications of AI in education. Specifically, it investigates their ethical awareness, concerns, and intentions regarding AI use in learning contexts. The research is guided by the following objectives and questions.

Research Objectives

i) To explore the ethical concerns of Sabah secondary school students regarding AI integration in education.
ii) To understand how students' awareness and knowledge of ethical AI practices shape their intentions to use AI tools in learning.

Research Questions

i) What ethical concerns do Sabah secondary school students have about AI use in education?
ii) How do students' awareness and understanding of ethical AI practices influence their intention to use AI tools in education?

E-ISSN: 3083-9491

LITERATURE REVIEW

Ethical Dilemmas and the Need for AI Literacy

The integration of artificial intelligence (AI) in education has sparked global debates on ethics, particularly concerning data privacy, algorithmic bias, academic integrity, and equitable access (Williamson & Eynon, 2020). International frameworks such as UNESCO's *Recommendation on the Ethics of Artificial Intelligence* (2021) and the OECD AI Principles (2021) advocate for transparency, fairness, and accountability. These principles highlight the need for ethical literacy among students, enabling them to critically engage with AI rather than using it passively (Markauskaite et al., 2023; Long & Magerko, 2020).

Contrastingly, while Western literature emphasises algorithmic transparency and governance, ASEAN studies often focus on practical challenges such as infrastructure gaps and teacher readiness. For example, Nguyen and Ha (2025) in Vietnam found that students' ethical concerns significantly influenced their intention to use AI tools, whereas Saidah and Kamsin (2025) in Malaysia reported that teachers prioritised usability over ethical considerations. This contrast underscores regional differences in priorities—ethical literacy versus functional adoption.

Technology Acceptance and Ethical Behaviour

Theories such as the Technology Acceptance Model (TAM), Unified Theory of Acceptance and Use of Technology (UTAUT), and Theory of Planned Behaviour (TPB) provide lenses for understanding AI adoption. TAM and UTAUT emphasise perceived usefulness, ease of use, and social influence (Davis, 1989; Venkatesh et al., 2003), while TPB introduces moral and normative dimensions, making it particularly relevant for ethical AI use (Ajzen, 1991). ASEAN studies integrate these models with ethics: Nguyen and Ha (2025) combined TPB and TAM to show that ethical awareness and perceived behavioural control strongly predict cautious AI adoption. In contrast, Nurtanto et al. (2025) in Indonesia found that social influence outweighed ethical considerations, suggesting cultural variations in adoption drivers.

Equity and Access Issues

Literature consistently highlights digital divides that hinder equitable AI adoption. Students in rural ASEAN regions face infrastructural barriers, limiting engagement with AI technologies (Lee et al., 2024). While Malaysia's Digital Education Policy (2021–2025) promotes inclusivity, implementation remains uneven, creating ethical concerns about fairness and equal opportunity (Mahdum et al., 2019). These disparities reinforce the need for policy interventions and localised strategies to ensure responsible AI integration.

Conceptual Framework Integration

The reviewed literature informs the conceptual framework guiding this study (Figure 1). The framework integrates four constructs: Awareness of AI in education, knowledge of ethical AI practices, concern about ethical issues, and behavioural intention to use AI tools. These

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constructs reflect the interplay between cognitive, ethical, and behavioural dimensions identified in prior research.

First, ethical awareness and knowledge emerge as foundational elements for responsible AI use. Studies emphasise that students who understand principles such as fairness, transparency, and academic integrity are better equipped to engage critically with AI (Markauskaite et al., 2023; Long & Magerko, 2020).

Second, ethical concerns, such as plagiarism, data privacy, and unequal access that act as mediators, shaping whether awareness and knowledge translate into ethical behaviour (Zainuddin et al., 2023; Mokhtar et al., 2024). This aligns with the central role of concern in the framework.

Finally, behavioural intention is influenced by both awareness and concern. Research shows that students adopt a cautious or conditional approach to AI use when ethical considerations are salient (Nguyen & Ha, 2025; Saidah & Kamsin, 2025). This supports the hypothesised pathways in the framework, which correspond directly to the research questions to examine ethical concerns, linked to the mediating role of concern, and to explore how awareness and knowledge influence intention, reflecting the pathways from awareness and knowledge through concern to behavioural intention.

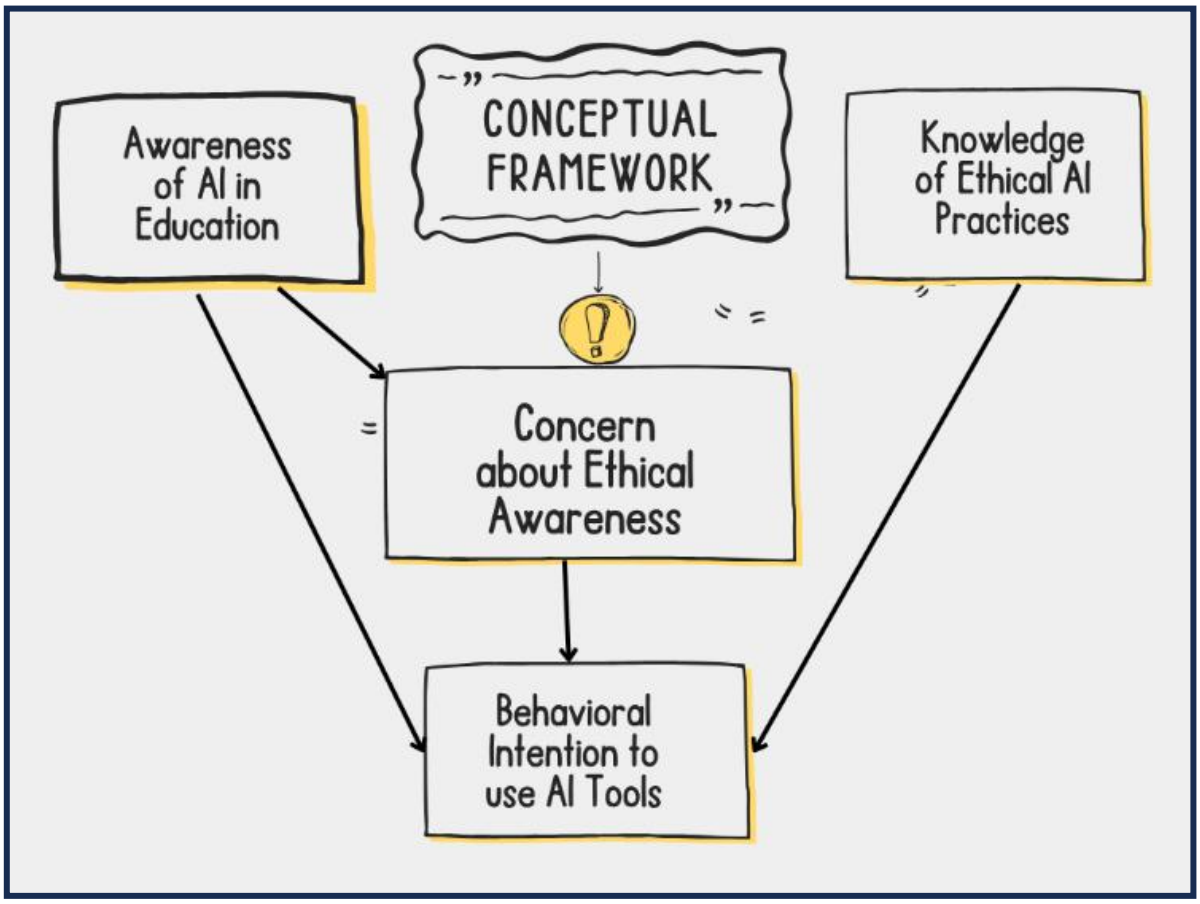

Figure 1. Conceptual Framework Integration

E-ISSN: 3083-9491

Gaps in the Literature

Despite growing interest in AI ethics, most studies focus on higher education or technologically advanced regions, leaving secondary schools in rural contexts underexplored (Zawacki-Richter et al., 2019; Holmes et al., 2022). Few studies examine how ethical awareness and knowledge interact with behavioural intention among younger learners. Moreover, ASEAN research often addresses policy and infrastructure but rarely investigates students' moral reasoning or conditional use of AI tools. This gap justifies the present study, which explores these dynamics among secondary school students in Sabah, a region where digital transformation is ongoing but ethical literacy remains limited.

METHODOLOGY

Research Design

This study adopted a qualitative case study design to explore the ethical awareness, concerns, and behavioural intentions of secondary school students in Sabah regarding the use of AI in education. The case was defined as the collective experiences and ethical perspectives of secondary school students in Sabah who have used generative AI tools in their learning. A qualitative approach was selected to capture the depth and complexity of students lived experiences and moral reasoning.

Participants and Sampling

Five secondary school students (3 female, 2 male), aged 16–18, were selected through purposive sampling. The participants represented a mix of academic streams (science and arts) and came from four different schools located in both urban and semi-urban areas of Sabah. The selection criteria required that students have prior experience using generative AI tools (e.g., ChatGPT) for school-related tasks.

Although the sample size was small, data saturation was achieved through the emergence of recurring themes across interviews. The research team determined saturation had been reached when no new codes or insights were identified in the final interview, consistent with qualitative research standards for small, focused case studies.

Data Collection

Data were collected through in-depth, semi-structured interviews guided by a pre-developed interview protocol (see Appendix A). The guide included open-ended questions on students' understanding of AI ethics, perceived risks and benefits, and their behavioural intentions. Interviews were conducted face-to-face in a private setting, lasted 45–60 minutes, and were audio-recorded with consent. Transcripts were produced verbatim and anonymised.

E-ISSN: 3083-9491

Data Analysis

Thematic analysis was conducted following Braun and Clarke's (2006) six-phase framework. Initial codes were generated inductively and iteratively refined through team discussions. A codebook was developed collaboratively and applied consistently across transcripts. Coding was conducted manually by the research team, with regular peer debriefing sessions to ensure consistency and reduce bias.

Credibility

To ensure the credibility and trustworthiness of the qualitative findings, the study employed member checking and peer debriefing techniques. Each participant received a PDF copy of their verbatim transcript via WhatsApp within seven days after the interview session. Participants were instructed to review the transcript for accuracy, completeness, and contextual clarity and to confirm their validation through a digital e-signature within three days. This process allowed participants to correct misinterpretations, clarify ambiguous statements, and confirm the authenticity of their shared experiences. Additionally, the researcher engaged in peer debriefing with two academic colleagues who were not directly involved in the study to critically review the interpretation of themes and ensure alignment with the raw data. These combined strategies enhanced data credibility by promoting reflexivity, transparency, and participant validation (Hay et al., 2012; King, 2013).

Reliability

Reliability was strengthened through a comprehensive audit trail and inter-coder verification process. All interview transcripts, coding notes, and theme development records were digitally archived in encrypted storage and systematically catalogued as appendices. This audit trail documents every stage of data collection, transcription, coding, and theme refinement, allowing external reviewers to trace the analytical process from raw data to final interpretation (Carcary, 2020). To further ensure dependability, a secondary coder independently reviewed 25% of the transcripts to confirm code consistency. Discrepancies were discussed and resolved collaboratively to maintain transparency and analytical stability. These measures collectively enhance the reliability and replicability of the study's qualitative procedures.

Ethical Considerations

Strict adherence to ethical procedures was maintained throughout the study. Consent was obtained from both the students and their parents or guardians. Parents were first contacted via telephone to explain the study's purpose, voluntary nature, and confidentiality assurances. Written informed consent was then collected before interviews commenced. Participants were reminded of their right to withdraw at any time without repercussions. To ensure anonymity, pseudonyms (R1–R5) replaced all identifying information in transcripts and reports. Data were stored securely in password-protected digital folders accessible only to the researcher. These ethical safeguards align with international qualitative research standards (Walsh et al., 2025) and promote participant welfare, confidentiality, and data integrity.

E-ISSN: 3083-9491

FINDINGS

Thematic analysis of the interview data revealed three interrelated themes: (i) Ethical Awareness and Knowledge of AI, (ii) Ethical Concerns and Tensions, and (iii) Conditional Intentions for AI Use. These themes are discussed in relation to the research questions and conceptual framework.

Theme 1: Ethical Awareness and Knowledge of AI

Participants demonstrated varying levels of awareness and understanding of ethical AI practices. Most students articulated that AI should be used to support learning rather than replace it. For example, R3 stated, *"It's important not to rely on AI to do all the work… I use AI to clarify doubts… that's an ethical way to use AI."* Similarly, R1 emphasised, *"AI should be used to guide students, but not do everything for them… it's not meant to cheat."*

Students also showed awareness of fairness and data privacy. R5 noted, *"AI ethics refers to guidelines and regulations… to ensure AI is beneficial,"* while R2 expressed concern that *"some students rely too much on it… some get wrongly accused,"* indicating a nuanced understanding of both personal and systemic ethical issues.

However, the boundary between ethical awareness and knowledge was sometimes blurred. For instance, R4 said, *"Use AI to aid in work, with full understanding… not just to copy and paste,"* which reflects both an ethical stance and a practical understanding of responsible use.

A deviant case emerged with R1, who admitted to using AI to complete assignments without understanding the content, stating, *"I used 100% AI-suggested answers… I got a penalty for that."* This mirrors findings from Nguyen and Ha (2025), who reported that Vietnamese students often expressed ethical awareness but still engaged in misuse under academic pressure. Conversely, studies in Indonesia (Nurtanto et al., 2025) suggest that strong institutional guidelines reduce such contradictions, highlighting a gap in Malaysian secondary education.

Theme 2: Ethical Concerns and Tensions

Students expressed strong concerns about academic integrity, fairness, and overreliance on AI. R2 remarked, *"Some students just copy and paste answers without trying to understand anything, which stops them from actually learning."* R4 echoed this, saying, *"An individual will forgo the progress of learning and instead just copy and paste what's given, without comprehension."*

Fairness and access were also key concerns. R3 observed, *"Students with greater access to technology get an unfair advantage,"* while R2 emphasised the need for government support: *"To make things fair and square, schools or the government should help by providing better internet access."* These concerns reflect the mediating role of "ethical concern" in the conceptual framework.

E-ISSN: 3083-9491

ASEAN studies echo these findings. Raza et al. (2025) reported that stakeholders across ASEAN worry about bias and inequity in AI-enhanced education, while Mokhtar et al. (2024) found Malaysian teachers deeply concerned about privacy and fairness. However, contrasting evidence from Thailand (Sukkeewan et al., 2024) suggests that structured AI literacy programmes can mitigate these concerns, indicating a policy gap in Sabah.

Despite these concerns, some students accepted the risks as part of digital life. R5 stated, *"Almost everything collects and uses your personal data at this point,*" reflecting a resigned attitude toward data privacy. A deviant case was R1, who initially showed little concern for data privacy but later reflected, *"I think it is important to be alert about how our data is being used,"* suggesting a shift in awareness prompted by the interview process.

Theme 3: Conditional Intentions for AI Use

Students' intentions to use AI were shaped by their ethical awareness and concerns. Most participants expressed a willingness to use AI tools conditionally and only when they believed it aligned with ethical practices. R3 explained, *"I use AI to quickly refer to certain topics, clarify doubts, or get explanations,"* while R5 noted, *"AI helps me with language and science, but I don't use it for everything."* R4 emphasised the importance of intention: *"Users are to use the said tools with the intention to learn and grow their understanding and researching skills."* These statements align with TPB's emphasis on attitudes and perceived control, as well as the conceptual framework's pathway from awareness and concern to intention.

However, some students admitted to past misuse. R1 shared, *"I used AI to complete an assignment and got caught. I felt guilty because I didn't really learn anything."* This illustrates how ethical concern can evolve into more cautious and reflective behaviour. These findings support the conceptual framework, which posits that ethical awareness and knowledge influence concern, which in turn mediates behavioural intention. Students who demonstrated higher ethical awareness were more likely to express conditional or cautious use of AI, while those with less awareness were more prone to misuse.

DISCUSSION

The findings of this study provide insight into how secondary school students in Sabah perceive and navigate the ethical dimensions of AI in education. The findings support the conceptual framework: ethical awareness and knowledge influence concern, which mediates behavioural intention. Students who demonstrated higher awareness were more likely to adopt AI cautiously, consistent with TPB's moral dimension (Ajzen, 1991) and ASEAN's Responsible AI principles (ASEAN, 2025).

However, contradictions between awareness and practice highlight a gap in formal ethics education. Similar patterns were observed in ASEAN studies, where ethical literacy often depends on informal learning rather than structured curricula (Nguyen & Ha, 2025; Raza et al., 2025). This highlights the need for structured AI ethics education that distinguishes between knowing what is ethical and practising ethical behaviour. The presence of deviant cases, such as students who were aware of ethical norms but still engaged in misuse, underscores the complexity of ethical decision-making in real-world contexts.

E-ISSN: 3083-9491

Concerns about fairness and access reflect systemic issues. While Malaysia's Digital Education Policy promotes inclusivity, implementation remains uneven (Jamaluddin et al., 2025). ASEAN-wide initiatives, such as the Expanded Guide on AI Governance and Ethics (ASEAN, 2025), advocate for equity, yet local adaptation is limited. Addressing these gaps requires policy alignment and infrastructure investment.

Behavioural intention findings align with TAM and UTAUT constructs—perceived usefulness and facilitating conditions—but ethical considerations add complexity. Students' cautious stance contrasts with studies in Indonesia and Thailand, where enthusiasm for AI adoption is higher (Ansas et al., 2025; Sukkeewan et al., 2024). This suggests that ethical concerns, if unaddressed, may hinder AI integration in Malaysian schools.

The study demonstrates that ethical literacy is not merely theoretical; it shapes real-world technology adoption. Embedding ethics into AI education and ensuring equitable access are critical for fostering responsible digital citizens in Sabah and beyond.

CONCLUSION

This study set out to explore the ethical awareness, concerns, and behavioural intentions of secondary school students in Sabah regarding the use of AI tools in education. Guided by the conceptual framework and informed by the Theory of Planned Behaviour (TPB), the research examined how awareness and knowledge of ethical AI practices influence students' intentions and how ethical concerns mediate this relationship.

The findings confirm that ethical awareness and knowledge are foundational for responsible AI use, yet their application is inconsistent. While most students articulated principles of fairness and academic integrity, contradictions between awareness and practice highlight the complexity of ethical decision-making. Ethical concerns—particularly about plagiarism, data privacy, and unequal access—emerged as significant mediators, shaping cautious and conditional behavioural intentions. These patterns align with TPB's emphasis on attitudes and perceived control, while extending the model to include moral sensitivity and contextual factors.

The study contributes to theory by demonstrating how TPB can be adapted to incorporate ethical dimensions in technology adoption. It also responds to gaps in the literature by foregrounding the voices of secondary students in a rural Malaysian context—an area often overlooked in global and ASEAN research. Practically, the findings underscore the need for structured ethics education, teacher training, and equitable access to AI tools to ensure responsible integration in schools.

Based on the findings, several recommendations are proposed to strengthen the ethical and equitable integration of artificial intelligence (AI) in education. Consistent with UNESCO's (2021) *Recommendation on the Ethics of Artificial Intelligence* and the ASEAN (2025) *Guide on AI Governance and Ethics*, it is recommended that AI ethics be systematically embedded within the curriculum through modules that highlight fairness, transparency, accountability, and respect for human values. In line with Nguyen and Ha (2025) and Mokhtar et al. (2024), comprehensive teacher-training programs on AI ethics should be implemented to equip educators with the pedagogical and ethical competencies required to guide students in responsible AI use.

E-ISSN: 3083-9491

Schools should also encourage reflective practices that allow students to critically evaluate their engagement with AI and consider its broader social and moral implications (Markauskaite et al., 2023). Furthermore, educational authorities must address digital inequities by ensuring equitable access to AI tools and infrastructure, particularly in rural and underserved regions (Lee et al., 2024). Finally, consistent with Malaysia's Digital Education Policy (2021–2025), clear institutional policies and guidelines should delineate acceptable and unacceptable uses of AI, supported by practical examples to promote consistent ethical standards across teaching and learning environments.

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Appendix A: Interview Guide

Purpose:

This semi-structured interview guide was designed to explore secondary school students' ethical awareness, concerns, and contradictory behavioural intentions regarding the use of AI tools in education. Questions were open-ended to allow participants to share detailed perspectives while ensuring coverage of key themes aligned with the conceptual framework.

Section 1: Background and Experience

1. Can you tell me about your experience using AI tools (e.g., ChatGPT) for school-related tasks?
2. How often do you use these tools, and for what purposes (e.g., homework, research, language support)?

Section 2: Understanding of AI Ethics

3. What does "ethical use of AI" mean to you in the context of education?
4. Can you describe any guidelines or rules you think should apply when students use AI tools?

Section 3: Ethical Concerns

5. What concerns do you have about using AI in your studies? (e.g., cheating, fairness, privacy)
6. Do you think AI use could create unfair advantages or disadvantages among students? Why or why not?
7. How do you feel about AI tools collecting or using personal data?

Section 4: Behavioural Intention

8. How do your views on ethics influence whether and how you use AI tools?
9. Are there situations where you would avoid using AI even if it could help you? Why?
10. What would make you feel more confident about using AI responsibly in school?

Section 5: Suggestions for Responsible AI Education

11. What do you think schools should do to help students use AI responsibly?
12. How can teachers support you in understanding the ethical aspects of AI?

E-ISSN: 3083-9491

Appendix B: Summary of Themes and Illustrative Quotes

Theme	Subtheme	Illustrative Quotes	Deviant/ Contradictory Cases
1. Ethical Awareness and Knowledge of AI	Responsible use of AI	- *"AI should be used to guide students, but not doing everything for them… it's not meant to cheat."* (R1) - *"It's important not to rely on AI to do all the work… I use AI to clarify doubts… that's an ethical way to use AI."* (R3)	R1 admitted to using AI to complete assignments without understanding, despite awareness.
	Understanding of fairness and privacy	- *"AI ethics refers to guidelines and regulations… to ensure AI is beneficial."* (R5) - *"Some students rely too much on it… some get wrongly accused."* (R2)	
2. Ethical Concerns and Tensions	Academic Integrity	- *"Some students just copy and paste answers without trying to understand anything."* (R2) - *"An individual will forgo the progress of learning… without comprehension."* (R4)	
	Fairness and access	- *"Students with greater access to technology get an unfair advantage."* (R3) - *"Schools or the government should help by providing better internet access."* (R2)	
	Data privacy	- *"Almost everything collects and uses your personal data at this point." (R5)R1 initially unconcerned, later reflected on importance of data privacy".*	
3. Conditional Intentions for AI Use	Selective and ethical use	- *"I use AI to clarify doubts… that's an ethical way to use AI."* (R3) - *"AI helps me with language and science, but I don't use it for everything."* (R5)	
	Learning-focused intention	- *"Users are to use the said tools with the intention to learn and grow their understanding."* (R4)	R1 used AI to complete an assignment and felt guilty afterward.

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