Innovative Approaches to Ethical IT Education: AI-Driven Tutoring and Personalized Perspectives in Teaching "Ethical Approaches to Information Technology Management"

By

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Abstract

This study explores the implementation of Intelligent Tutoring Systems (ITS) and personalized learning strategies in the delivery of *Ethical Approaches to Information Technology Management* (TECM231) for diploma-level students at the Applied College, Princess Nourah bint Abdulrahman University, Saudi Arabia. Taught during the third level of a two-year diploma program, the course introduces students to foundational ethical principles and applies them to emerging information technologies. With a focus on cultural sensitivity, real-world applications, and critical reasoning, the course was redesigned to integrate adaptive learning technologies, including AI-based dialogue systems, branching scenario simulations, and personalized feedback tools. A cohort of 20 students participated in this classroom-based intervention using their own digital devices. Findings from learning analytics, reflective journals, and student feedback revealed a marked improvement in ethical reasoning, engagement, and self-directed learning. Students exhibited increased autonomy, better application of ethical theories, and a higher level of confidence when analyzing dilemmas involving privacy, intellectual property, automation, and social media ethics. The ITS tools facilitated differentiated instruction and supported students in developing essential lifelong learning skills, bridging the gap between theoretical knowledge and practical decision-making. The study concludes that ITS can significantly enhance the delivery of ethics education in technical programs and recommends broader institutional support, customized content development, and expanded research on ITS efficacy in value-based curricula.

Keywords: Intelligent Tutoring Systems (ITS), Personalized Learning, Ethics in Information Technology, Higher Education in Saudi Arabia, Self-Directed Learning, Adaptive Learning Technologies, Ethical Decision-Making, Educational Technology Integration

تعزيز تعليم أخلاقيات تقنية المعلومات من خلال أنظمة التدريس الذكية والتخصيص:

دراسة حالة لمقرر "النهج الأخلاقية في إدارة تقنية المعلومات"

الملخص

تتناول هذه الدراسة استخدام أنظمة التعليم الذكية (ITS) واستراتيجيات التعلم المخصص في تدريس مقرر المناهج الأخلاقية في إدارة تقنية المعلومات (تقن٢٣١)، والموجّه لطلاب الدبلوم في الكلية التطبيقية بجامعة الأميرة نورة بنت عبد الرحمن. يُدرَّس هذا المقرر في المستوى الثالث من برنامج الدبلوم الذي يمتد لعامين، ويعرّف الطلاب بالمبادئ الأخلاقية الأساسية ويطبقها على التقنيات الحديثة الناشئة. وتركّز إعادة تصميم المقرر على الحساسية الثقافية، والتطبيقات الواقعية، والتفكير النقدي، مع دمج تقنيات تعلم تكيفي تشمل أنظمة حوار قائمة على الذكاء الاصطناعي، ومحاكاة سيناريوهات فرعية، وأدوات تغذية راجعة مخصصة.

شارك في هذا التدخل داخل الفصل الدراسي مجموعة مكونة من ٢٠ طالبة باستخدام أجهزتهم الرقمية الشخصية. وقد أظهرت نتائج تحليلات التعلم، والمذكرات الانعكاسية، وتعليقات الطلاب تحسنًا ملحوظًا في التفكير الأخلاقي، والتفاعل، والقدرة على التعلم الذاتي. كما أظهر الطلاب زيادة في الاستقلالية، وتحسنًا في تطبيق النظريات الأخلاقية، وثقة أكبر عند تحليل القضايا الأخلاقية المتعلقة بالخصوصية، والملكية الفكرية، والأتمتة، وأخلاقيات وسائل التواصل الاجتماعي. ساعدت أدوات التعليم الذكية في توفير تعليم تفاضلي، ودعمت تطوير مهارات التعلم المستمر مدى الحياة، مما ساعد على سد الفجوة بين المعرفة النظرية واتخاذ القرارات العملية.

وتخلص الدراسة إلى أن أنظمة التعليم الذكية يمكن أن تُحدث تأثيرًا كبيرًا في تعزيز تعليم الأخلاقيات في البرامج التقنية، وتوصي بدعم مؤسسي أوسع، وتطوير محتوى مخصص، وتوسيع نطاق البحث حول فعالية هذه الأنظمة في المناهج التي تركز على القيم.

الكلمات المفتاحية: أنظمة التعليم الذكية(ITS) ، التعلم المخصص، أخلاقيات تقنية المعلومات، التعليم العالي في المملكة العربية السعودية، التعلم الذاتي، تقنيات التعلم التكيفي، اتخاذ القرارات الأخلاقية، دمج تكنولوجيا التعليم

1. Introduction

The rapid digital transformation across global societies has amplified the role of information technologies (IT) in shaping economic, social, and cultural landscapes. As IT systems become increasingly embedded in daily life, the ethical challenges related to privacy, data security, intellectual property, automation, and social media ethics have grown in complexity and urgency. These issues require not only technically skilled professionals but also ethically conscious practitioners who can navigate the moral implications of emerging technologies. Higher education institutions, particularly those offering IT programs, are thus tasked with preparing students to meet these ethical challenges effectively.

At Princess Nourah bint Abdulrahman University's Applied College, *TECM231: Ethical Approaches to Information Technology Management* is taught at the third level of the two-year *Information Technology Diploma* program. Positioned in the second year and carrying three credit hours, this course immerses students in the study of ethical theories and models from historical, philosophical, and cross-cultural perspectives. It emphasizes applying these frameworks to contemporary and emerging IT contexts, encouraging students to critically evaluate ethical dilemmas and develop responsible decision-making skills. The course content covers broad themes including privacy protection, intellectual property rights, ethical software development, impacts of IT on society, and ethical issues related to social media and organizational practices.

1.1 Problem of the Study

Despite the critical importance of ethics education in IT curricula, traditional lecture-based teaching methods often struggle to address the diverse learning needs of diploma students, who vary widely in their academic preparation and learning preferences. This variability can lead to disengagement, superficial understanding, and difficulty in applying ethical principles in practical situations. Moreover, conventional teaching approaches may not provide sufficient opportunities for personalized learning or adaptive

feedback, which are crucial for mastering complex and abstract ethical concepts.

The challenge, therefore, is to identify innovative instructional strategies that can improve student engagement, enhance ethical reasoning skills, and foster autonomy for continuous learning. The growing development of Intelligent Tutoring Systems (ITS) and personalized learning technologies presents a promising solution but remains underexplored in ethics education within the Saudi Arabian higher education context.

1.2 Aim of the Study

This study aims to design, implement, and evaluate an ITS-supported personalized learning model for the TECM231 course to enhance students' understanding of IT ethics, promote active engagement, and develop their capacity for ethical decision-making. Specifically, it seeks to explore how adaptive digital tools can be integrated into classroom teaching to provide differentiated instruction tailored to individual learner needs, support real-time feedback, and cultivate students' autonomy and lifelong learning skills in the ethical domain.

1.3 Research Questions

To guide the investigation, the study focuses on the following research questions:

1. How does the implementation of Intelligent Tutoring Systems and personalized learning tools affect student engagement in the TECM231 ethics course?
2. To what extent do ITS tools improve students' ethical reasoning and decision-making skills?
3. How do students perceive the effectiveness of personalized learning and ITS in understanding and applying ethical concepts?
4. In what ways does the use of ITS foster student autonomy and readiness for self-directed, lifelong learning in ethics beyond the classroom?

2. Literature Review
2.1 Intelligent Tutoring Systems (ITS) in Higher Education

Intelligent Tutoring Systems (ITS) have emerged as transformative tools in higher education by offering individualized learning experiences that adapt content delivery based on real-time student performance and behavior (Woolf, 2010). Simulating human tutoring, ITS incorporate artificial intelligence techniques to assess learners' needs, predict misconceptions, and provide immediate, personalized feedback (VanLehn, 2011). These systems are grounded in cognitive and constructivist learning theories, which emphasize the active role of learners in constructing knowledge through personalized scaffolding.

Extensive research demonstrates the effectiveness of ITS in improving student engagement and achievement across various subjects such as mathematics, science, and computer programming (Koedinger & Corbett, 2006). However, their application in more abstract and discussion-oriented domains, like ethics education, remains underexplored despite growing calls for adaptive and reflective learning tools in these areas.

One of the main advantages of ITS is their ability to foster personalized learning experiences. Akyuz (2020) highlights that ITS can analyze students' data and customize content according to individual learning styles and progression. This tailored approach enhances student engagement by addressing specific learning needs, thereby potentially increasing retention and understanding. Supporting this, Durães et al. (2019) found that personalized feedback not only improves learning outcomes but also helps students identify areas requiring improvement, promoting a more proactive learning approach.

Student involvement is another critical factor positively influenced by ITS. Kulik and Fletcher (2016) demonstrated that systems integrating engaging methodologies significantly increase student persistence and motivation. Incorporating interactive components such as gamification or simulations creates immersive learning environments that capture students' interest and encourage active participation (Yuce, Abubakar, & Ilkan, 2019). This increased

engagement is essential, as student motivation is closely linked to academic performance.

Despite these promising benefits, challenges remain in the implementation of ITS. Basri (2024) observes resistance from educators and students toward integrating technology within traditional learning environments. Furthermore, limitations of the systems themselves can hinder effective customization. Alrakhawi, Jamiat, and Abu-Naser (2023) highlight issues concerning the accuracy of data and algorithms that guide ITS responses, which can sometimes result in insufficiently personalized instruction.

Looking ahead, the future of ITS in higher education appears promising, particularly with advancements in artificial intelligence (AI) and machine learning. Lin, Huang, and Lu (2023) argue that integrating AI into ITS can enhance system functionality by providing deeper insights into student progress and learning preferences. Such advancements may lead to more effective personalized learning experiences, maximizing academic potential.

In addition, Mousavinasab et al. (2021) provide a systematic review demonstrating ongoing research efforts to develop new ITS characteristics and evaluation methods that improve effectiveness. As higher education institutions increasingly adopt technology-based solutions, emerging trends like augmented reality within ITS offer further potential to enhance student engagement and learning outcomes. Ateş (2025) asserts that these innovations could create richer and more engaging educational experiences tailored to diverse learning styles.

The integration of ITS in higher education presents significant advantages for personalized learning, student involvement, and academic performance. While challenges related to implementation and system accuracy persist, ongoing improvements through AI and related innovations promise to address these obstacles. Future research should focus on overcoming these challenges while exploring ITS's vast potential to transform educational practices (Alam, 2023; Mohamed & Lamia, 2018; Paladines & Ramirez, 2020; Xu et al., 2019). Consequently, ITS are positioned as critical

tools in the evolution of higher education methodologies, offering more personalized and engaging learning experiences.

2.2 Personalized Learning and Adaptive Systems

Personalized learning refers to instructional approaches that tailor learning experiences according to individual student preferences, performance levels, and learning styles (Pane et al., 2017). Adaptive learning systems often utilize Intelligent Tutoring Systems (ITS) to dynamically adjust the difficulty, pace, and sequencing of content to optimize learning outcomes. Research indicates that personalization enhances student motivation, reduces cognitive overload, and fosters deeper learning.

In increasingly multicultural and diverse academic settings – such as Saudi Arabia's growing female student body in applied IT programs – personalized learning plays a crucial role in ensuring inclusivity and equity. It facilitates differentiated instruction that respects variations in language proficiency, cultural perspectives, and prior academic preparation (Hwang et al., 2015).

The evolution of personalized learning and adaptive systems in higher education has attracted considerable attention due to their potential to improve student involvement and academic performance. Personalized learning, characterized by adapting educational experiences to meet students' individual needs, preferences, and contexts, has been significantly advanced through technological innovations. Adaptive systems employ data-driven approaches to modify real-time learning paths, addressing diverse learning skills and styles (Du Plooy, Casteleijn, & Franzsen, 2024).

Personalized adaptive learning technologies are recognized for their capacity to boost student motivation and engagement by delivering more relevant and tailored content (Taylor, Yeung, & Bashet, 2021). Machine learning algorithms have played a pivotal role in these technologies by facilitating the identification of individual learning styles and preferences (Peng, Ma, & Spector, 2019). This adaptive approach promotes environments where students progress at their own pace, leading to improved academic performance (Mirari, 2022).

Empirical research highlights the benefits of integrating adaptive learning systems. For instance, Mirata et al. (2020) conducted a Delphi study identifying the primary challenges and contextual factors in the adoption of these systems in higher education, emphasizing the importance of aligning technological capabilities with institutional support structures. Additionally, Alawneh et al. (2024) underscore the transformative power of AI-driven curricula, which are becoming central components of adaptive learning strategies.

The importance of blended learning methodologies emerges prominently in the literature on adaptive learning. Castro (2019) suggests that combining online and face-to-face instructional strategies can enhance the adaptability of educational platforms. Xie et al. (2019) corroborate this, concluding in their systematic review that integrating adaptive learning strategies with blended learning environments significantly enhances personalized learning outcomes.

Learning analytics further amplify the potential of personalized learning environments. Avella et al. (2016) discuss how employing learning analytics to monitor student engagement and performance enables educators to refine both content and pedagogical approaches in real time. Similarly, Kabudi, Pappas, and Olsen (2021) identify adaptive learning systems supported by learning analytics as essential for effectively meeting individual student needs.

Regarding sustainability in educational transformation, it can be argued that AI-oriented adaptive learning supports sustainable practices by optimizing content delivery and learning outcomes. The continual evolution of adaptive systems aligned with student needs sustains engagement and improves completion rates, reflecting broader trends in educational innovation.

Methodologically, personalized learning systems rely heavily on continuous feedback and iterative improvement cycles. Tariq (2024) emphasizes that such approaches not only enhance individual student experiences but also contribute to improved institutional academic outcomes. Thus, personalized learning and adaptive

systems intersect as integral mechanisms enabling higher education institutions to effectively address the diverse needs of their student populations, thereby enhancing engagement and academic achievement (Ayeni et al., 2024; Shemshack & Spector, 2020).

The literature strongly supports the significant positive impact of personalized learning and adaptive systems on student involvement and academic results in higher education. Through the integration of innovative technologies and targeted methodologies, institutions can leverage these systems to create more inclusive, effective, and supportive learning environments that cater to the diverse needs of their students.

2.3 Ethics Education in IT Programs

Ethics education in information technology (IT) is increasingly recognized as essential for preparing future professionals to navigate the complex socio-technical challenges posed by emerging technologies (Gotterbarn et al., 2018). Ethical dilemmas in areas such as data privacy, AI bias, surveillance, and intellectual property demand more than rote memorization; they require critical reasoning, cultural sensitivity, and principled decision-making frameworks. Traditional lecture-based methods often fall short in cultivating these nuanced skills.

Active learning strategies – including case-based learning, role-play, and collaborative discussion – have been recommended to bridge theoretical knowledge and practical application in ethics courses. These pedagogical approaches can be further enhanced by intelligent technologies that provide immediate feedback, enable self-paced learning, and tailor context-sensitive ethical scenarios to individual student responses.

The integration of ethics education within IT curricula is imperative, as the ethical responsibilities of technology professionals significantly influence not only individual careers but also broader societal outcomes. As technology advances and becomes increasingly embedded in daily life, the need for IT professionals to engage with ethical decision-making and professional behavior

intensifies. This literature review explores the importance of embedding ethical education in IT programs, emphasizing its impact on professional conduct, decision-making, and social responsibility.

Recent empirical studies demonstrate that teaching ethics contextually within computer education equips students more effectively to confront real-world dilemmas (Skirpan et al., 2018). Contextual approaches enhance students' commitment to ethical principles and foster a culture of responsibility among IT professionals. Kilis and Uzun (2018) support this perspective by highlighting how case-based instruction conveys complex moral scenarios faced by ICT educators, thereby enriching both technical expertise and moral reasoning essential for future professional decision-making.

Furthermore, ethical leadership plays a critical role in guiding educational and professional environments. Shapiro and Stefkovich (2016) emphasize that ethical decision-making frameworks assist individuals in resolving dilemmas encountered in educational settings, which parallels the challenges faced by technology professionals. Similarly, Remley and Herlihy (2014) argue that understanding the implications of one's actions is crucial for professionals, particularly regarding data privacy and user trust.

With the rapid development of artificial intelligence (AI), the urgency for comprehensive ethics education has intensified. Borenstein and Howard (2021) discuss emerging ethical challenges associated with AI and advocate for embedding ethical considerations throughout AI system design and implementation. Nguyen et al. (2023) further contribute a framework outlining specific ethical principles in AI education, underscoring developers' responsibility to assess the social impacts of their technologies.

The shift toward remote learning, accelerated by the COVID-19 pandemic, presents additional opportunities to promote ethical awareness in digital education environments. Turnbull, Chugh, and Luck (2021) note that new learning modalities necessitate integrated ethical discussions to help students navigate evolving educational landscapes, including critical issues such as data security and privacy.

A recurrent theme across the literature is that promoting ethical awareness extends beyond mere compliance. Instead, it seeks to cultivate a generation of technology professionals who prioritize ethical considerations in their practice. Weiss (2021) highlights the importance of ethical commitment across business sectors, reinforcing the imperative of ethics education in IT. Additionally, the ethical principles governing teaching and administration, as discussed by Strike and Soltis (2014, 2015), offer valuable parallels that inform ethical pedagogy in IT education.

Integrating ethics education into IT programs is paramount for fostering responsible decision-making, enhancing professional conduct, and preparing technology professionals to address pressing social challenges. The literature clearly indicates that ethical education not only strengthens technical competencies but also cultivates moral responsibility, empowering IT professionals to make decisions that benefit society at large.

2.4 ITS in Ethics and Professional Decision-Making Education

Intelligent Tutoring Systems (ITS), traditionally more common in quantitative disciplines, are increasingly applied in ethics-related training to develop students' moral reasoning and ethical reflection. For example, systems such as AutoTutor and Moral Machine simulations model complex ethical decision-making by presenting evolving scenarios based on students' choices and justifications (Awad et al., 2018). These tools engage learners in ethical dilemmas that promote deeper reflection and understanding.

Research further suggests that ITS support learners in recognizing their ethical blind spots and cognitive biases, fostering metacognitive development and enhancing ethical self-awareness (Nye et al., 2014). This aligns closely with the objectives of courses such as TECM231, which aim to empower students to comprehend ethical issues within contextualized, real-world technology scenarios.

The integration of artificial intelligence (AI) into professional education, particularly through ITS, has transformed pedagogical

approaches by providing personalized feedback and adaptive learning experiences crucial for developing ethical reasoning and decision-making skills (Kulik & Fletcher, 2016). ITS simulate realistic ethical dilemmas requiring nuanced decision processes. For instance, Cukurova, Kent, and Luckin (2019) demonstrate how multimodal data can support human decision-making in debate tutoring, highlighting AI's role in constructing complex reasoning frameworks. Additionally, Mougiakou, Papadimitriou, and Virvou (2019) emphasize that ITS can be designed to incorporate automated decision-making compliant with personal data protection guidelines, thereby promoting ethical considerations in system design.

Systematic reviews reinforce the effectiveness of ITS in enhancing ethical decision-making skills. Alrakhawi, Jamiat, and Abu-Naser (2023) summarize various ITS applications and their positive impact on students' ethical navigation within their fields. Moreover, Fazlollahi et al. (2022) provide evidence from randomized controlled trials showing that AI-driven tutoring can be as effective as expert instructors in simulated surgical skill training, illustrating the potential of ITS in professional health education.

Despite these advantages, implementing ITS raises significant challenges, particularly ethical concerns regarding AI's role in educational decision-making. Khreisat et al. (2024) caution that excessive reliance on algorithms may undermine the critical aspects of human judgment in complex ethical scenarios. Wang (2021) stresses the importance of balancing AI facilitation with human oversight in educational leadership, especially in data-informed decision-making processes. This dual role of AI – both supporting and potentially compromising ethical practices in education – necessitates careful management.

Moreover, responsibility in AI-guided decision processes is crucial to ensuring inclusive educational practices. Porayska-Pomsta and Rajendran (2019) argue for transparency in both human and AI decisions to uphold ethical standards in education. The promotion of diversity and equity through AI applications is similarly emphasized by several scholars, asserting that ethical considerations must be

integral to system design rather than afterthoughts (Alrakhawi et al., 2023; Khreisat et al., 2024).

Sustainable application of AI in education requires robust ethical guidelines that extend beyond academic performance to shaping ethical practitioners. Lin, Huang, and Lu (2023) advocate for this comprehensive focus, noting the importance of integrating theoretical frameworks of ethical leadership and decision-making (Shapiro & Stefkovich, 2016) to better prepare professionals to confront ethical dilemmas.

ITS hold significant promise for enhancing ethical reasoning and decision-making skills in professional education through personalized, adaptive learning experiences. However, their effective implementation depends on addressing ethical implications, ensuring accountability, and maintaining human oversight. Ongoing research and development are essential to ensure that as ITS technology advances, the ethical foundations of education remain strong and continue to evolve (Mousavinasab et al., 2021; Wolfe et al., 2015; Yang & Zhang, 2019).

2.5 ITS, Personalization, and Lifelong Learning

One of the most significant promises of Intelligent Tutoring Systems (ITS) is their potential to support lifelong learning, particularly in dynamic fields such as information technology, where ethical challenges continuously evolve. ITS provide personalized dashboards and recommendation systems that enable learners to revisit ethical modules, track their progress over time, and engage in ongoing professional development. This capacity is especially valuable in diploma programs that serve as bridges between education and professional practice, equipping students not only with knowledge but also with tools for continuous learning.

ITS align well with constructivist and experiential learning theories, which emphasize active, student-driven exploration of knowledge. For courses like TECM231, such an approach is critical for developing ethically aware IT professionals capable of navigating future workplace challenges. By leveraging artificial

intelligence, ITS adapt to individual students' needs and preferences, offering personalized learning experiences that optimize outcomes through advanced algorithms and data analysis (Akyuz, 2020).

The emergence of Education 4.0 and 5.0 illustrates how AI integration inaugurates a new era of adaptive and personalized learning (Rane, Choudhary, & Rane, 2023). Empirical studies further demonstrate ITS effectiveness in promoting sustainable education practices, strengthening both educational achievement and environmental commitment (Lin, Huang, & Lu, 2023). The ability of ITS to offer customized educational trajectories supports contemporary pedagogical strategies that emphasize lifelong learning. By continuously adapting to learners' needs, ITS environments foster sustained intellectual growth.

This customization extends beyond K-12 education into higher education and adult learning contexts. Gembarski and Hoppe (2021) highlight ITS's role in mass customization of digital education, tailoring instruction to diverse learning styles and motivations. Such adaptability is essential for adult learners who often juggle multiple responsibilities, reinforcing the notion of learning as a lifelong journey.

Technological advances in ITS have also enabled the integration of AI tutors in immersive learning environments, enhancing customization and interactivity. Sarshartehrani et al. (2024) suggest that these multifaceted approaches facilitate richer educational experiences, breaking down traditional barriers to learning. Similarly, Klašnja-Milićević and Ivanović (2021) emphasize the importance of e-learning customization systems in fostering sustainable education by improving student autonomy and engagement through tailored digital content and assessments.

Looking toward the future, Baig, Cressler, and Minsky (2024) envision AI-driven systems that further personalize learning experiences, expanding upon current models to prioritize individual student needs on a broad scale. Singh, Gunjan, and Nasralla (2022) support this perspective by demonstrating that systems like "Seis Tutor" outperform traditional online tutors in delivering

personalized pedagogical interventions, underscoring adaptability as a critical factor in modern education.

Beyond digital platforms, the customization potential of ITS extends to embodied tutors, such as personalized robotic systems. Leyzberg, Ramachandran, and Scassellati (2018) found that personalization not only enhances immediate learning outcomes but also has long-term benefits for knowledge retention and application.

Intelligent tutoring systems represent a significant advancement toward personalized education that meets individual learner needs and promotes lifelong learning. Through adaptive learning pathways and continuous support, ITS facilitate more effective engagement and knowledge acquisition, enabling learners to navigate the complexities of an ever-evolving educational landscape (Peng, But, & Spector, 2019). As such, ITS hold considerable promise as a milestone in the future development of educational methods.

While ITS have proven effective in STEM education and professional training, their integration into ethics instruction – particularly in non-Western, female-majority educational contexts – remains under-researched. There is also limited evidence on the use of ITS in diploma-level education, which often bridges secondary schooling and professional life. This paper addresses these gaps by implementing and evaluating ITS-based personalization strategies in the *TECM231* course.

3. Methodology

This study employs a case study methodology to explore the implementation of intelligent tutoring systems (ITS) and personalized learning strategies in the delivery of *Ethical Approaches to Information Technology Management (TECM231)*. The approach allows for an in-depth investigation of student experiences, instructional practices, and the affordances of educational technology in a real-world, classroom-based context.

3.1 Research Design

The case study design was selected due to its suitability for examining educational interventions in naturalistic settings. The study focuses on a single cohort of diploma-level Information Technology students at the Applied College and documents how ITS and personalization are integrated into teaching ethical decision-making and IT-related social responsibilities.

3.2 Participants and Setting

The participants comprised 20 female diploma students enrolled in TECM231 during the first semester (2024-2025). These students are in their third academic level (second year), and the course is delivered over 15 weeks with 3 contact hours per week (45 hours total). The classroom environment is technology-friendly, allowing students to use their own devices (laptops or tablets) to interact with digital platforms and applications.

3.3 Course Design and Technology Integration

The course was restructured to include the following ITS and personalization tools, shown in Table 1:

Tool/Platform	Primary Use	Functionality
AutoTutor / OpenAI-based Simulators	Guided reflection and ethical scenario analysis	Simulates Socratic dialogue; prompts critical thinking and ethical reasoning
Knewton Alta	Adaptive ethical case studies and self-paced quizzes	Adjusts complexity based on student responses; promotes personalized learning
Microsoft Teams / Padlet	Collaborative discussion and interactive class activities	Supports group brainstorming, peer interaction, and asynchronous contributions
Kahoot / Socrative	Formative assessment with real-time feedback	Provides gamified and adaptive quizzes with instant scoring and feedback

Table 1 Key Educational Technologies and Tools Used in TECM231 Ethical IT Instruction

Each weekly module introduced ethical theories and applied them through adaptive digital scenarios or real-world IT dilemmas.

Students completed interactive exercises, reflective journals, and simulations directly from their devices while in class.

3.4 Data Collection Methods

Multiple qualitative and quantitative data collection tools were used to capture the effectiveness and reception of the ITS-based personalization model, as shown in Table 2 below:

Tool	Type	Purpose	Data Collected
Classroom Observations	Qualitative	Monitor weekly engagement, ITS use, and student collaboration	Field notes on participation, tool interaction, and behavioral patterns
Student Feedback Forms	Quantitative & Qualitative	Collect student perceptions mid-course and post-course	Likert-scale ratings, open-ended responses on ITS impact and usability
Learning Analytics	Quantitative	Analyze ITS platform data to track learning behavior	Time on task, quiz scores, activity completion, performance trends
Reflective Journals	Qualitative	Capture ongoing student reflections on ethical learning and ITS usage	Weekly student entries highlighting insights, challenges, and engagement levels
Semi-Structured Interviews	Qualitative	Explore deeper student experiences with ITS-based personalization	Thematic data on learning preferences, benefits, and personalization impact

Table 2 Mixed-Methods Data Collection Tools for Evaluating ITS-Based Personalization in TECM231

3.5 Data Analysis

Data were analyzed using a thematic analysis approach. Transcripts from journals and interviews were coded for recurring themes such as learner autonomy, engagement, ethical understanding, and technology usability. Quantitative data from learning analytics and feedback forms were used to support and triangulate qualitative findings. Key analytical categories are presented in Table 3 below.

Analytical Category	Description
Student Engagement with Personalized Tools	Measures frequency, depth, and consistency of interaction with ITS platforms and adaptive features.
Perceived Effectiveness of ITS	Captures student opinions on how ITS tools supported ethical understanding and reasoning.
Improvement in Ethical Decision-Making Skills	Assesses progression in applying ethical theories to real-world and simulated scenarios.
Student Autonomy and Readiness	Evaluates learners' ability to take initiative and self-direct their learning using ITS supports.

Table 3 Key Analytical Categories for Evaluating ITS-Based Personalization Outcomes in TECM231

3.6 Ethical Considerations

All participants provided informed consent, and anonymity was ensured through pseudonyms in data reporting. Students were informed that their participation or performance data would not impact their course grades.

4. Implementation of ITS and Personalization in TECM231

The TECM231 course was redesigned to incorporate Intelligent Tutoring Systems (ITS) and personalized learning strategies to meet the specific learning needs of diploma-level IT students. The goal was to enhance ethical reasoning, encourage active engagement, and foster student autonomy in a multicultural learning environment. The course ran over 15 weeks, with three hours of in-class instruction per week. Students used their own devices (laptops or tablets) to interact with digital learning tools both inside and outside the classroom.

4.1 Structure of Personalized and ITS-Enhanced Learning

To align with the ethical learning outcomes, each week of the course focused on a specific theme or topic. Instruction was divided into three stages: Interactive Content Delivery, In-Class Activities and Simulations, and Reflective Practice and Feedback.

4.1.1 Interactive Content Delivery
4.1.1.1 Brief Lectures on Core Ethical Theories and Principles

Each module begins with a 15-20 minute interactive mini-lecture designed to introduce or reinforce key ethical frameworks, ensuring foundational understanding before applying the concepts to technology-related dilemmas.

Ethical Theory	Core Focus	Key Concepts Explored
Utilitarianism	Focus on outcomes and consequences	"Greatest good for the greatest number," cost-benefit analysis, impact on stakeholders
Deontology	Emphasis on duties, obligations, and rules	User consent, data protection, ethical principles regardless of outcomes
Virtue Ethics	Focus on the moral character and integrity of individuals	Honesty, integrity, moral courage, professional conduct

Table 4 Core Ethical Theories Covered in TECM231 Course Content

For example, during the session on privacy ethics, the instructor briefly compares how a utilitarian vs. a deontologist would view the use of customer data for targeted ads. Real-world cases such as Facebook – Cambridge Analytica are used to contextualize abstract principles. The lecture includes interactive questioning using Nearpod and Pear Deck, asking students to respond anonymously to prompts like: "Would it be ethical to sell anonymized user data for research if it improves public health outcomes?"

4.1.1.2 Socratic Questioning with AutoTutor-Like AI or ChatGPT Simulations

After the lecture, students interact with AI-based conversational agents like ChatGPT or an AutoTutor-like platform to practice ethical reasoning. These systems are programmed to use Socratic questioning – challenging students to justify, reflect, and expand their reasoning.

Example Scenario: AI in Healthcare Diagnosis

In this scenario, students are presented with a real-world ethical dilemma: *"A hospital implements an AI system that recommends diagnoses faster than doctors. However, the system sometimes overlooks rare conditions. Should doctors rely on it, or override it based on their judgment?"* This situation introduces a complex interplay between technological innovation and professional responsibility.

Using ChatGPT or an AutoTutor-like AI simulation, the system engages students through Socratic questioning to deepen their ethical reasoning. It may ask: *"What are the potential benefits and harms of using this AI system in medical decisions?"* This encourages learners to consider both efficiency gains and patient safety risks. Next, it prompts reflection with: *"Which ethical theories support prioritizing efficiency? Which support caution and human oversight?"* – guiding students to distinguish between utilitarian reasoning and deontological concerns. Further questions, such as *"What would a deontologist say about the doctor's duty to the patient?"* and *"Can trust in technology replace professional accountability?"*, help clarify the moral obligations at play. Finally, the AI might ask: *"How would virtue ethics evaluate the doctor's character in choosing to follow or ignore the AI?"*, bringing character-based ethics into the analysis.

Through this guided dialogue, students are not merely memorizing ethical theories; they are applying them to nuanced, realistic contexts. This approach fosters critical thinking, helps bridge the gap between theory and practice, and enhances students' ability to construct ethically sound, well-argued responses.

4.1.1.3 Personalized Content Delivery via Adaptive Learning

Throughout the course, adaptive systems such as Knewton Alta or custom LMS plug-ins were used to adjust content delivery based on student quiz performance, engagement level, and prior knowledge.

Example: Ethical Decisions in Software Development

After an initial quiz assessing prior knowledge on open-source software licenses and IP rights, students are routed to differentiated content:

Student Group	Assessment Method	Differentiated Content	Learning Tools and Supports
High-Scoring Students	Initial quiz reveals background knowledge in key concepts	Advanced case studies focusing on legal implications of corporate software use, intellectual property conflicts, and whistle-blowing scenarios	Access to legal databases, annotated case studies, expert video commentary
Struggling Students	Initial quiz reveals knowledge gaps in key concepts	Scaffolded lessons on foundational topics (e.g., software licensing types, historical context of IT ethics) with gradual complexity increase	Flashcards, interactive timelines, simplified case studies with instant feedback, and guided multiple-choice reflections

Table 5 Differentiated Content Delivery Based on Prior Knowledge in IT Ethics

Table 5 highlights how ITS platforms personalize instruction based on students' prior knowledge in the topic of IT ethics. Following a diagnostic quiz, content pathways are adapted to match learners' cognitive readiness. High-performing students are challenged with complex, real-world scenarios that require application of nuanced legal and ethical reasoning. In contrast, students needing support are provided with incremental, interactive learning materials to build their understanding. This differentiated approach ensures that all learners, regardless of starting point, can engage meaningfully with ethical issues in software development and IT practice.

The LMS dashboard helps the instructor monitor learning paths and intervene when necessary. This ensures that every student is appropriately challenged and supported – a key aspect of personalization. These interactive delivery methods combine core

content, personalized engagement, and real-time feedback, resulting in higher cognitive involvement, ethical reflection, and autonomy in student learning.

4.1.2 In-Class Activities and Simulations
4.1.2.1 Adaptive Ethical Case Studies with Knewton Alta / Smart Sparrow

Students engaged with adaptive learning platforms such as Knewton Alta or the open-source alternative Smart Sparrow to work through ethical case studies tailored to their learning pace and understanding. These platforms present real-world IT ethics scenarios that dynamically adjust in difficulty and content based on each student's responses.

A case study on Privacy Protection begins with a basic scenario where a company collects user data without explicit consent. If a student answers initial questions correctly (e.g., identifying privacy violations), the system advances them to more complex dilemmas involving data sharing with third parties or cross-border data flows. For students struggling with concepts, the system provides additional explanations, hints, or simpler questions to scaffold learning. This personalization ensures every student is challenged appropriately and can build ethical reasoning incrementally.

4.1.2.2 Formative Assessments Using Kahoot, Socrative, and Mentimeter

To maintain engagement and provide instant feedback, interactive tools such as Kahoot, Socrative, and Mentimeter were integrated for formative assessment. These platforms allow instructors to create quizzes and polls that adapt or vary based on student progress and knowledge gaps.

During a session on Intellectual Property Rights, the instructor launches a Kahoot quiz with questions about copyright laws, software licensing, and plagiarism in IT projects. Students answer in real time using their devices, and results are immediately displayed, highlighting common misconceptions. Follow-up questions on

Socrative allow more detailed short answers or reflections, such as "Explain why using open-source code requires attribution." Mentimeter polls capture student opinions on ethical dilemmas, like the acceptability of code reuse in commercial products, fostering class discussions grounded in live data.

4.1.2.3 Ethical Discussion Boards and Peer Review on Padlet and Microsoft Teams

To deepen reflection and foster collaborative learning, weekly Padlet boards and Microsoft Teams chat channels were used for asynchronous ethical discussions and peer reviews. Each week, students contribute to a Padlet board on topics like Social Media Ethics or Green Computing by posting reflections, relevant news articles, or ethical questions. For instance, one post might analyze the ethical implications of social media algorithms promoting misinformation. Peers comment, challenge viewpoints, or add supportive evidence, creating a vibrant ethical discourse.

On Microsoft Teams, students participate in structured peer review sessions where they upload brief ethical analyses or project drafts. Classmates provide constructive feedback guided by criteria such as clarity of ethical reasoning, use of evidence, and cultural sensitivity. This collaborative process reinforces understanding and encourages multiple perspectives on ethical issues.

4.1.3 Reflective Practice and Feedback

Students completed weekly journals on their digital portfolios (e.g., Google Docs or OneNote), reflecting on their ethical decision-making process. ITS provided automated feedback on written responses using basic NLP-based scoring rubrics (e.g., feedback on justification strength and bias awareness).

4.1.3.1 Student Feedback Tool: Reflective Journal Template for TECM231 ITS Activities

In the context of *TECM231*, this Reflective Journal Template was designed as a formative assessment tool to support students' development in ethical reasoning and self-directed learning. It accompanies weekly interactive activities facilitated through

Intelligent Tutoring Systems (ITS) and personalized learning pathways. The purpose of the reflective journal is to encourage metacognitive engagement, allowing students to critically examine the ethical dilemmas they encounter, the decisions they make, and the influence of ITS feedback on their thought processes. By structuring reflection around targeted prompts, the tool helps students articulate their reasoning, confront cognitive challenges, and plan improvements in future ethical decision-making.

The reflective journal serves multiple pedagogical functions within the ITS-enhanced ethics curriculum. First, it reinforces students' theoretical understanding by encouraging them to actively link abstract ethical frameworks – such as utilitarianism, deontology, and virtue ethics – to real-world IT scenarios they encounter in class. This connection between theory and practice deepens conceptual learning. Second, the journal fosters learner autonomy and self-regulation by prompting students to assess their own confidence levels, track their ethical reasoning progress, and engage with personalized feedback generated by ITS analytics. Through this metacognitive process, students become more responsible for their learning trajectories. Finally, the journal provides instructors with valuable qualitative data, revealing patterns in student engagement, common misconceptions, and insights into how effectively adaptive learning tools support the comprehension and application of complex ethical principles.

Educators are encouraged to review journal entries regularly to monitor students' ethical growth, identify areas requiring additional support, and offer individualized feedback. The reflections also contribute to the overall assessment strategy of the course, supplementing quantitative data from adaptive quizzes and scenario-based exams. The Journal Entry is presented below.

Reflective Journal Entry: Ethical Decision-Making Activity

As part of your learning journey in *TECM231: Ethical Approaches to Information Technology Management*, this Reflective Journal is designed to help you think critically about the ethical decisions you make during class activities, simulations, and personalized learning tasks supported by Intelligent Tutoring

Systems (ITS). Reflection is a key component of ethical reasoning – it allows you to recognize your assumptions, evaluate the consequences of your choices, and strengthen your ability to justify decisions using ethical frameworks.

Each week, you will complete one journal entry after engaging with a scenario-based learning activity or interactive ITS task. Your reflections will provide insight into how your understanding of ethical principles evolves, how you respond to feedback, and how confident you feel in applying what you've learned to real-world IT challenges.

This tool is not just for assessment – it's an opportunity for self-directed learning. Be honest, thoughtful, and specific in your responses. Your entries will be reviewed for growth in ethical reasoning, clarity of thought, and awareness of your decision-making process. Constructive feedback will be provided to guide your continued development.

Prompt	Student Response
1. What ethical dilemma or concept did you explore in this activity? (Briefly describe the scenario or topic.)	*(Student describes the ethical situation addressed in the activity, e.g., AI surveillance, data privacy, or whistleblowing.)*
2. What choices did you make during the activity? (Explain your decisions and reasoning.)	*(Student explains the ethical choices made and the reasoning behind them.)*
3. How did the ITS feedback influence your understanding or decisions? (Describe any new insights or corrections.)	*(Student reflects on how feedback from the Intelligent Tutoring System changed or deepened their understanding.)*
4. What challenges did you face in understanding or applying ethical principles? (Identify any difficulties.)	*(Student identifies specific ethical theories or dilemmas they found difficult to understand or apply.)*
5. How confident do you feel in making similar ethical decisions in real-world IT situations?	*(Student rates their confidence level and explains the reasons behind their self-assessment.)*

(Rate from 1–5, and explain your rating.)	
6. What will you do differently in the future when faced with ethical dilemmas? (Outline any planned changes in your approach.)	*(Student outlines how they will approach future ethical issues based on what they've learned.)*
7. Additional comments or questions	*(Optional space for any feedback, further questions, or personal reflections.)*

Table 6 Reflective Journal Entry – ITS-Guided Ethics Activity

4.1.3.2 Quantitative and Qualitative Analysis of Student Reflective Journals

Quantitative Statistical Analysis

The reflective journals collected from 20 students were analyzed quantitatively to assess self-reported confidence, understanding, and challenges in ethical decision-making, as shown in Table 7 below.

Journal Item	Mean Score (1–5 scale)	Standard Deviation	% of Students Scoring 4 or Above	Interpretation
Confidence in making ethical decisions (Q5)	4.1	0.7	85%	High confidence among students in handling ethical dilemmas after ITS-supported activities.
Perceived influence of ITS feedback (Q3)	4.3	0.6	90%	Strong positive impact of ITS feedback on students' understanding and decision-making.
Challenges in applying ethical principles (Q4) (Note that for Q4, lower scores indicate fewer challenges; a score above 3 reflects more significant difficulties.)	2.2	0.8	~30% (scored above 3, indicating difficulty)	Moderate challenges reported, especially with abstract concepts like IP rights and social media ethics.

Table 7 Descriptive Statistics of Reflective Journal Responses on Ethical Decision-Making and ITS Impact

The analysis of reflective journal responses revealed encouraging trends in students' perceptions of their learning experiences. Confidence ratings showed that 85% of students scored their confidence level at 4 or above on a 5-point scale, indicating a strong sense of preparedness to address ethical dilemmas following their engagement with ITS-supported activities. This suggests that the personalized and interactive learning environment contributed to building students' ethical reasoning skills and self-assurance.

Similarly, the impact of ITS feedback was overwhelmingly positive. 90% of students rated the feedback as highly helpful (4 or above), highlighting the effectiveness of adaptive, real-time responses in enhancing their understanding of ethical concepts. Many students specifically noted that the feedback prompted them to reconsider their initial decisions, engage more deeply with ethical theories, and refine their justifications.

Despite the overall success, some challenges were reported. Approximately 30% of students indicated difficulties in applying ethical principles, particularly with abstract or less familiar topics such as intellectual property rights and social media ethics. These challenges underscore the need for additional scaffolding and contextual examples to support comprehension in these areas. Nonetheless, the overall results suggest that ITS tools, when integrated thoughtfully, can significantly enrich ethical education for IT students.

Qualitative Thematic Analysis

Using content analysis, journal responses were coded into themes reflecting students' experiences, insights, and challenges.

Theme 1: Increased Ethical Awareness and Critical Thinking

Many students highlighted that the ITS scenarios pushed them to think critically about real-world ethical situations, going beyond theoretical or textbook-based understanding. The interactive nature of the activities encouraged deeper reflection on the consequences of IT-related decisions. For example, one student remarked, "The branching simulation on privacy made me realize how small decisions can affect user trust and data security." Such feedback

reflects how personalized, scenario-based learning enabled students to connect abstract ethical theories to practical, professional contexts, fostering a more applied and engaged approach to ethical reasoning in information technology.

Theme 2: Value of Personalized Feedback

Students expressed appreciation for the immediate, tailored feedback provided by the ITS tools, noting that it helped them understand the reasoning behind ethical decisions. This personalized guidance not only reinforced correct responses but also clarified misconceptions, offering students a deeper grasp of ethical implications. One student reflected, "The system helped me understand the consequences of ignoring copyright laws, which I hadn't fully considered before." Such comments indicate that the adaptive feedback mechanisms were instrumental in helping students internalize ethical principles and apply them more thoughtfully in complex IT scenarios.

Theme 3: Development of Confidence and Autonomy

The reflective journals revealed a notable increase in students' confidence and a growing sense of ownership over their learning. As the course progressed, students began to express a stronger belief in their ability to make ethical decisions autonomously, indicating the development of self-efficacy in applying theoretical knowledge to practical contexts. Several students linked this growth to the support provided by ITS tools and personalized learning pathways. One student wrote, "I feel more capable of making ethical decisions independently, without needing constant guidance." This sentiment was echoed by others, highlighting how the integration of intelligent tutoring systems not only enhanced their understanding but also empowered them to take responsibility for ethical decision-making in their future IT careers.

Theme 4: Challenges with Abstract Concepts

Some students encountered difficulties when attempting to apply ethical theories to complex or culturally nuanced issues. This was particularly evident in topics such as social media ethics, where cultural perceptions of privacy varied significantly. One student reflected, "Understanding ethical implications in social media was

challenging because of different cultural views on privacy." These reflections highlight that while ITS tools facilitated structured learning and feedback, the interpretation of ethical concepts in real-world, culturally diverse contexts still required deeper support and discussion. This suggests the importance of integrating cross-cultural perspectives and context-sensitive examples into future iterations of the course.

Theme 5: Motivation for Lifelong Learning

A significant number of students expressed a strong motivation to continue exploring ethical issues beyond the scope of the course. Their engagement with ITS-enhanced activities not only deepened their understanding during the term but also sparked a lasting interest in the broader implications of technology on society. One student captured this sentiment, stating, "This course encouraged me to keep learning about technology's impact on society and my role in it." This indicates that the personalized and reflective approach used in TECM231 successfully fostered a mindset of lifelong learning and ethical awareness among future IT professionals.

The combined quantitative and qualitative analysis of the reflective journals confirms that the ITS-supported personalized learning approach significantly enhanced students' ethical reasoning, confidence, and motivation. While most students experienced strong positive impacts, a minority reported challenges with abstract ethical concepts, suggesting areas for additional instructional support.

4.2 Sample Weekly Activities

Table 8 presents a structured overview of the key topics covered during the TECM231 course, alongside the corresponding learning activities and the Intelligent Tutoring Systems (ITS) or digital tools employed to facilitate personalized and interactive learning experiences. The table highlights how diverse ITS platforms, such as AI chatbots, adaptive case simulations, and collaborative digital tools, were integrated into the curriculum to engage students actively with ethical issues in information technology. Each activity was designed to enhance critical thinking,

ethical reasoning, and practical application of concepts through adaptive feedback, simulations, and peer interaction.

Week	Topic	Activity	ITS/Tool Used
1-3	Introduction to Ethics	AI chatbot simulates a Socratic dialogue about a real-life ethical dilemma	ChatGPT / AutoTutor
4-5	Privacy & Surveillance	Case simulation on government surveillance vs. individual rights	Smart Sparrow / Knewton Alta
6-7	Intellectual Property	Interactive quiz with adaptive feedback on plagiarism and copyright	Socrative / H5P
8-11	Workplace Ethics	Role-play simulation of whistleblowing scenarios in IT	Microsoft Forms branching + Padlet
12-13	Social Media Ethics	Debate: "Should employers monitor employees' social media use?"	MS Teams chat groups, AI summarizer
14-15	Green Computing	Group activity designing a policy for environmentally responsible IT use	Canva / Jamboard collaborative project

Table 8 Summary of Weekly Topics, Activities, and Intelligent Tutoring Systems (ITS) Tools Used in TECM231

The selected ITS tools supported differentiated instruction by adapting content complexity to individual learners' needs, providing immediate and personalized feedback, and fostering collaboration and debate among students. This blend of technology-enabled methods encouraged deeper engagement, practical understanding, and the development of essential skills for ethical decision-making in diverse IT contexts. Table 8 illustrates how pedagogical design and ITS integration were aligned to achieve course objectives effectively.

4.3 Personalized Learning Paths

To accommodate diverse learners in the TECM231 classroom, a system of individualized learning trajectories was designed. These learning paths were created using data from pre-course assessments and ongoing performance analytics, enabling each student to engage

with course content in a way that best suited their learning needs and cognitive preferences.

4.3.1 Pre-Course Assessment and Learning Profile Generation

To ensure that instruction was personalized from the outset, a comprehensive pre-course assessment was conducted during the first week of the semester. This assessment aimed to capture students' baseline knowledge, learning preferences, and self-perceived confidence in handling ethical issues within the field of information technology. A combination of diagnostic tools – including a Kahoot quiz, the VARK learning style inventory, and a custom self-assessment survey – was used to generate individual learning profiles. These profiles were then used by the Intelligent Tutoring System (ITS) to tailor content difficulty, presentation formats, and pacing. Table 9 summarizes the components, tools, and outcomes of this pre-course assessment process.

Component	Tool Used	Purpose	Outcome
Diagnostic Quiz	Kahoot	To assess prior knowledge of ethical concepts (e.g., privacy, IP, professional duties)	Informed baseline understanding and tailored content difficulty
Learning Style Inventory	VARK Survey (Visual, Auditory, Reading/Writing, Kinesthetic)	To identify individual learning preferences	Enabled personalized delivery formats (e.g., visual aids, text summaries)
Self-Assessment	Custom Survey	To gauge confidence in ethical reasoning and preferred learning pace	Supported grouping and pacing adjustments in ITS learning paths

Table 9 Pre-Course Assessment and Learning Profile Generation Activities

These inputs were processed by the ITS or LMS plugin, which generated an individual learning profile for each student. This profile was then used to guide learning path suggestions throughout the course.

4.3.2 Adaptive Learning Pathways

Based on their profiles, students were offered customized weekly modules, each with multiple activity options. Table 10 illustrates the personalized learning pathways designed for the "Privacy and Surveillance" module within the TECM231 course. Recognizing the diversity in students' learning styles and prior knowledge, the course employed an adaptive approach that offered multiple activity options tailored to visual, auditory, reading/writing, and kinesthetic learners. Each pathway was aligned with the core ethical concepts of privacy and surveillance, enabling students to engage with the material in ways that best suited their preferences and strengths. The Intelligent Tutoring System (ITS) supported this personalization by monitoring student interactions and recommending activities that optimized learning outcomes.

Topic: Privacy and Surveillance

Learning Style	Suggested Activity
Visual	Animated video scenario + infographic on GDPR principles
Auditory	Podcast episode on surveillance ethics + voice note reflections
Reading/Writing	Academic article excerpts + reflective journal prompts
Kinesthetic	Role-playing simulation: student acts as a data officer handling a breach

Table 10 An Example: Adaptive Learning Pathways for Privacy and Surveillance Topic

Table 10 highlights the flexibility embedded in the course design, allowing students to take ownership of their learning through choice and self-pacing. For example, visual learners accessed animated scenarios and infographics to understand GDPR principles, while kinesthetic learners engaged in immersive role-playing simulations. By adapting content delivery and activity types, the ITS fostered deeper engagement and comprehension of complex ethical issues. This approach not only accommodated different learning preferences but also enhanced motivation and effectiveness by

guiding students toward activities best suited to their individual profiles.

4.3.3 Self-Paced Progress and Tiered Support

In recognition of the varied academic backgrounds and learning speeds among the TECM231 students, the course design emphasized self-paced progression coupled with tiered support mechanisms. This approach allowed learners to advance through the curriculum according to their individual readiness and comprehension levels, with the ITS continuously monitoring and responding to their performance and engagement data.

Students who demonstrated strong grasp of foundational ethical concepts and high accuracy in quizzes were given opportunities to accelerate their learning. These advanced learners unlocked access to supplemental modules focusing on cutting-edge topics such as global cybersecurity law, AI ethics in decision-making, and emerging challenges in digital privacy. This fast-track pathway also included case studies requiring complex ethical analysis and multi-stakeholder impact assessment, fostering critical thinking beyond the standard curriculum. The ITS system recommended these modules dynamically based on ongoing assessment results and student interest indicators.

For students requiring additional guidance, the course provided scaffolded learning experiences. These included integrated glossaries explaining technical and ethical terminology, step-by-step guided questions to help break down complex scenarios, and formative "micro-quizzes" designed to reinforce key concepts incrementally. Each micro-quiz was immediately followed by tailored feedback highlighting misconceptions and offering hints for improvement. Furthermore, ITS dashboards flagged learners who showed lower reflection quality or reduced discussion board participation, prompting the instructor to intervene with personalized recommendations or peer mentoring opportunities.

The ITS continuously collected and analyzed multiple data points, including quiz accuracy, depth and clarity of journal reflections, participation in ethical debates, and completion times for

activities. Based on this real-time monitoring, the system adapted both the content difficulty and the instructional approach – offering more challenging questions or additional remedial materials as appropriate. For example, a student struggling with intellectual property ethics might receive extra case examples and vocabulary aids, while another excelling in the same area could be encouraged to explore broader ethical implications in AI.

This flexible pacing and tiered support fostered a sense of autonomy among students, allowing them to regulate their learning according to their strengths and challenges. Many students reported feeling less pressured and more motivated, as they could spend extra time on difficult topics without falling behind or rush through familiar material to stay engaged. This personalization ultimately contributed to higher overall course satisfaction and improved ethical reasoning skills.

4.3.4 Customized ITS Recommendations

Each week, the Intelligent Tutoring System (ITS) offered personalized study suggestions tailored to each student's learning progress and performance. For instance, a student struggling with ethical frameworks might receive a prompt such as, "Revise the principles of deontology before tackling this week's case study," encouraging focused review on specific concepts. Others were guided to reflect more deeply on their previous work, with recommendations like, "Review your previous feedback on the social media dilemma and resubmit your reflection," which fostered iterative learning and refinement of their ethical reasoning. Additionally, the ITS suggested alternative approaches to analyzing dilemmas, for example, "Consider using virtue ethics to evaluate this scenario instead of utilitarianism," prompting students to explore different philosophical perspectives and broaden their critical thinking. These tailored recommendations not only supported content mastery but also helped students develop meta-cognitive awareness – the ability to think about their own thinking process. Over time, this enhanced their capacity to articulate complex ethical arguments more clearly and confidently,

demonstrating growth in both understanding and application of ethical principles.

4.3.5 Enhanced Reflection and Reporting

Throughout the course, the Intelligent Tutoring System (ITS) played a crucial role in guiding students' reflective thinking and fostering deeper ethical awareness. It routinely prompted students to consider why they made certain ethical choices during simulations, encouraging them to articulate their reasoning and evaluate the implications of their decisions. Additionally, students were asked to reflect on how their personalized learning paths either supported or challenged their understanding, offering insights into the adaptability and effectiveness of the instructional design. As students progressed, they were also encouraged to identify which ethical frameworks—such as utilitarianism, deontology, or virtue ethics – they found most convincing and to justify their preferences. These reflective responses were systematically collected and analyzed to track growth in students' ethical reasoning skills and their development of autonomy. Importantly, this reflection process culminated in a summative project submitted during the final week, allowing students to synthesize their learning experiences and demonstrate both conceptual understanding and self-awareness.

Table 11 below presents a detailed overview of how personalized learning pathways were designed to cater to diverse learner types in the TECM231 course. Each learner category – ranging from visual and auditory to kinesthetic, fast-track, and those needing scaffolding – was provided with tailored core learning objectives, suggested activities, and ITS-supported recommendations. This approach ensures that students engage with ethical IT topics through modalities that best suit their individual learning preferences and prior knowledge levels.

Learner Type	Core Learning Objective	Suggested Activities	Support Tools & ITS Recommendations
Visual Learner	Identify ethical concerns in the use of facial recognition on social media platforms.	*Watch*: Short animated explainer on surveillance capitalism. *Study*: Infographic comparing global data privacy laws.	ITS suggests visual flowcharts to understand consent vs. coercion in data collection.
Auditory Learner	Discuss moral responsibilities of social media companies in content moderation.	*Listen*: Podcast episode "The Ethics of Content Filtering." *Record*: Audio reflection on whether TikTok should ban political content.	ITS provides guided prompts for verbal reasoning, suggests podcast-based quizzes.
Reading/Writing	Analyze a case study involving misinformation on Twitter/X.	*Read*: Article on the ethics of platform responsibility. *Write*: A journal response to Elon Musk's content policy on X.	ITS recommends similar readings based on vocabulary usage and summary accuracy.
Kinesthetic Learner	Role-play a social media ethics officer responding to a controversial post.	*Simulate*: Choose-your-path scenario using Smart Sparrow. *Act*: Draft a policy memo for the platform's executive team.	ITS adjusts future scenarios based on choices made in this role-play activity.

Fast-Track Learner	Evaluate multiple ethical theories in shaping social media algorithm policies.	*Debate*: Prepare a video presentation comparing virtue ethics vs. utilitarianism in algorithmic filtering.	ITS offers links to academic papers, advanced case libraries, and an optional AI-generated ethical dilemma.
Needs Scaffolding	Understand basic privacy rights on social media platforms.	*Glossary*: Review key terms. *Mini-Quiz*: Low-stakes questions with hints. *Guided*: Multiple-choice ethical scenario with feedback.	ITS slows progression, suggests more repetition, and flags misunderstandings for instructor intervention.

Table 11 Sample Weekly Personalized Module Layout: *Ethical Issues in Social Media and Surveillance*

Table 11 highlights how adaptive instructional design was implemented to maximize student engagement and understanding. Visual learners, for example, accessed animated explainers and infographics supported by ITS visual aids, while auditory learners benefited from podcasts and guided verbal prompts. Reading/writing learners engaged with articles and reflective journaling, with the ITS recommending additional readings based on their language skills. Kinesthetic learners participated in role-play simulations, with ITS adjusting scenarios dynamically based on their decisions. Fast-track learners were challenged with advanced debates and research materials, supported by AI-generated dilemmas, whereas students requiring scaffolding received glossary reviews, mini-quizzes with hints, and instructor alerts for targeted support. Overall, this personalized framework promoted effective ethical reasoning by aligning learning tasks with student needs and continuously adapting through ITS analytics.

4.3.6 Instructor Dashboard Insight

The instructor dashboard provided valuable insights through weekly analytics, enabling targeted support such as organizing small group tutorials—for example, addressing a group of kinesthetic learners who were struggling with understanding moral frameworks. This data-driven approach allowed the instructor to tailor interventions effectively. Additionally, the system was flexible enough to accommodate changes in students' learning styles or preferences over time, allowing them to switch personalized learning paths as needed to better suit their evolving needs and optimize their engagement and comprehension.

4.4 Student Projects

As part of the course assessment, students completed a Project (10%) in small groups. The project was designed to integrate personalized learning, collaborative work, and the ethical themes discussed in the course. Each group selected a topic relevant to technology and ethics and explored it through research, analysis, and scenario simulation.

4.4.1 Project Examples

Table 12 presents an overview of four projects implemented in the TECM231 course, designed to enhance students' ethical reasoning and decision-making skills through hands-on activities supported by Intelligent Tutoring Systems (ITS). Each project focuses on a distinct ethical issue within the IT domain – ranging from AI bias in hiring to whistleblowing – offering students experiential learning opportunities through simulations, prototyping, and multimedia creation. The ITS tools played a critical role in guiding student reflections, providing real-time feedback, and scaffolding complex ethical concepts to deepen understanding.

Project	Objective	Activity	ITS Role	Deliverables

Project 1: AI Bias in Hiring Algorithms	Analyze ethical implications of using AI in recruitment.	Created a simulation using a mock AI recruitment tool (e.g., Google Colab or MIT Moral Machine-based platform).	Provided real-time prompts on bias types (gender, age, nationality), flagged discriminatory inputs, and offered ethical principle references (e.g., justice, fairness).	Report on identified biases, reflection journal, and presentation suggesting ethical algorithm adjustments.
Project 2: Privacy and Social Media in Saudi Society	Explore cultural and ethical tensions around user data collection.	Designed a mock social media app using app prototyping tools (e.g., Figma or Marvel).	Used ethical decision trees and guided templates to ask "What if?" questions related to data use, third-party access, and consent.	Privacy policy draft, visual map of data flow, and group discussion video using Microsoft Teams.
Project 3: Green Computing Initiative for Local Businesses	Promote sustainable IT practices with ethical rationale.	Assessed energy usage in hypothetical business cases and proposed ethical IT solutions (e.g., server consolidation, e-waste management).	Provided calculators for carbon footprint, auto-suggested ethical arguments, and linked to global sustainability standards (e.g., IEEE, SDGs).	Green IT action plan, infographics on ethical/environmental impact, and peer-reviewed reflections on digital Padlet.
Project 4: Ethics of Whistleblowing in Tech Companies	Reflect on moral courage and professional responsibility.	Used animation/storyboarding tools (e.g., Powtoon or Canva) to depict an IT employee's dilemma about exposing unethical practices.	Highlighted conflicting stakeholder interests and used Socratic questioning to guide argument development.	Storyboard or Animated Video, Ethical Analysis Reports, Stakeholder Map, Socratic Question Responses

Table 12 Sample of Students' Projects

Table 12 demonstrates how ITS technologies were effectively integrated across diverse project contexts, facilitating personalized learning experiences and critical engagement with real-world ethical

challenges. The projects combined technical tools with ethical frameworks, enabling students to identify stakeholder interests, recognize biases, and propose actionable solutions. Deliverables such as reflective journals, policy drafts, and multimedia presentations reflect both cognitive and practical development in ethical IT management. This multi-faceted approach underscores the potential of ITS-supported projects to cultivate sophisticated ethical reasoning skills relevant to students' future professional environments.

All projects were scaffolded with ITS prompts, rubrics, and automatic feedback on ethical reasoning clarity, stakeholder analysis, and proposed solutions.

4.4.2 Assessment Rubrics

Table 13 outlines the detailed rubric used to assess student performance on ethical IT projects. The rubric emphasizes five key criteria – understanding of ethical issues, stakeholder analysis, proposed solutions, integration of Intelligent Tutoring Systems (ITS) tools, and communication and presentation skills. Each criterion is rated on a four-level scale from "Needs Improvement" to "Excellent," providing clear standards for evaluating both content mastery and the effective use of ITS resources in the learning process.

Criteria	Excellent (2.5)	Good (2)	Fair (1.5)	Needs Improvement (1)
Understanding of Ethical Issues	Clearly identifies multiple ethical dilemmas using theory	Identifies key issue and connects to one theory	Vaguely identifies issue; limited connection to theory	Fails to identify issue or apply relevant theory
Stakeholder Analysis	Comprehensive, considers multiple perspectives	Adequate, includes at least two perspectives	Limited or one-sided view	Lacks stakeholder consideration
Proposed	Feasible,	Feasible	Feasible but	Infeasible or

Solutions	creative, ethically justified	and ethically relevant	lacks ethical clarity	unethical proposals
ITS-Integrated Use of Tools	Fully used ITS prompts, calculators, templates for refinement	Used most ITS resources effectively	Used ITS but inconsistently	Did not integrate ITS tools meaningfully
Communication and Presentation	Professional, clear, well-structured visuals and reports	Mostly clear and organized	Understandable but needs work in format/style	Disorganized, unclear presentation

Table 13 Rubric for Evaluating Student Performance in Ethical IT Projects with ITS Integration

This rubric enables instructors to systematically evaluate the depth of students' ethical reasoning, their ability to consider diverse stakeholder perspectives, and the feasibility and ethical justification of their proposed solutions. Importantly, it also assesses how thoroughly students engage with ITS tools, which are integral to the personalized learning design of the course. The communication criterion ensures that students effectively convey their analyses and proposals, reflecting professional standards expected in IT ethics contexts. Overall, the rubric supports consistent, transparent grading while encouraging students to integrate theory, practical application, and technology-enhanced learning.

4.5 Continuous Assessment and Feedback
4.5.1 Assessment Components

The assessment structure for TECM231 was carefully crafted to leverage the strengths of Intelligent Tutoring Systems (ITS) and support personalized, student-centered learning. The combination of formative and summative assessments was not only aligned with course learning outcomes but also dynamically adjusted to meet the diverse needs and learning styles of the 20 students enrolled.

Assessment Component	Details
1. Adaptive Quizzes (20%)	**Platform Used:** Socrative (occasionally Kahoot Advanced Mode) enabled real-time adaptation of question sets. **Mechanism:** Questions tagged by Bloom's Taxonomy levels and ethical domains (e.g., privacy, fairness). ITS algorithms adjusted question complexity based on student performance. **Example:** A student excelling on utilitarianism basics received a complex whistleblowing AI surveillance case. **Progress Monitoring:** Students grouped into emerging, developing, proficient tiers with personalized weekly revision via Microsoft Teams. **Outcome:** By Week 10, 70% moved up at least one tier; targeted feedback and supplementary content were provided to lower-performing students.
2. Activities and Class Discussions (10%)	**Tools Used:** Padlet, Mentimeter, Microsoft Teams, Socrative discussion mode. **Participation Incentives:** Weekly ethical "hot topic" prompts allowed students to contribute via text, video, or infographic. Real-time polling and Socratic questioning maintained engagement. **ITS Integration:** Participation analytics gathered via Microsoft Insights and Padlet reports. ITS flagged low participation or shallow responses, prompting instructor intervention. **Outcome:** Over 85% of students improved response quality between Week 4 and Week 11 based on rubric scoring.
3. Midterm (20%) and Final Exam (40%)	**Structure:** Each included objective questions (MCQs, true/false) and scenario-based ethical dilemmas. **Personalization via ITS:** Knewton Alta generated question variations tailored to individual performance profiles (e.g., basic conflict vs. nuanced global data sovereignty case). **AI-Driven Feedback:** Immediate rationale for incorrect answers; automated feedback on scenario responses' argument strength and ethical grounding, followed by instructor moderation.

	Progress Insight: Average 22% increase in scenario reasoning from midterm to final; up to 30% gain for low-performers following personalized revision.
ITS Dashboard Use and Student Monitoring	**Instructor Use:** Tracked engagement across quizzes, discussions, reflections. **Trend Identification:** Addressed dips (e.g., Week 5) with game-based ethics challenges. **Interventions:** Low-engagement students received peer mentoring, revised paths, office hours; high-achievers given enrichment tasks analyzing controversial global tech ethics cases.

Table 14 Assessment Components, ITS Integration, and Student Performance Outcomes in TECM231

Table 14 outlines the various assessment components used in the TECM231 course, highlighting how Intelligent Tutoring Systems (ITS) were integrated to personalize learning, adapt content complexity, and provide real-time feedback. The adaptive quizzes dynamically adjusted question difficulty based on individual student performance, resulting in significant progression across performance tiers. Class activities and discussions were supported by ITS analytics that monitored participation quality and triggered targeted instructor interventions, contributing to improved student engagement. Both midterm and final exams combined objective and scenario-based questions tailored by ITS algorithms, enhancing ethical reasoning skills with personalized feedback. Instructor use of ITS dashboards allowed for continuous monitoring, early identification of engagement issues, and provision of customized support for both struggling and high-achieving students. Overall, this integration of ITS tools facilitated measurable improvements in ethical decision-making and student participation throughout the course.

4.5.2 Overall Student Progress

Table 15 summarizes the weekly progression of the TECM231 course, detailing the specific focus areas, the Intelligent Tutoring System (ITS) actions implemented, and corresponding measures of student progress. The table illustrates how ITS tools were strategically employed to diagnose initial student

understanding, provide adaptive learning opportunities, monitor participation, and support reflective self-assessment throughout the semester.

Week	Focus Area	ITS Action	Student Progress
Week 1-2	Introduction to ethical theories	Pre-course diagnostic via Kahoot	Personalized learning paths created for all students
Week 3-5	Scenario-based case studies	Adaptive quizzes & discussion monitoring	40% showed improvement in argument clarity
Week 6-8	Midterm prep + simulations	Performance-tier grouping & feedback	Quiz average rose by 15% from Week 3
Week 9-11	Project-based learning + peer reviews	ITS-facilitated rubrics + dynamic feedback	Engagement on Padlet and Teams increased by 60%
Week 12-15	Final review and self-assessment	Reflection analysis via ITS dashboard	90% demonstrated increased ethical decision-making depth

Table 15 Weekly Focus, ITS Interventions, and Student Progress in TECM231

There is a clear alignment between targeted ITS interventions and measurable improvements in student learning outcomes. Early diagnostic assessments enabled the creation of personalized learning paths, setting a strong foundation for student engagement. Adaptive quizzes and discussion monitoring during weeks 3 to 5 contributed to a 40% improvement in the clarity of ethical arguments. By midterm, ITS-supported performance grouping and feedback led to a notable 15% rise in quiz scores. Project-based learning and peer review activities facilitated by ITS rubrics further boosted student engagement by 60%. Finally, reflection analysis during the final weeks showed that 90% of students deepened their ethical decision-making skills, highlighting the effectiveness of continuous ITS-supported personalization and feedback.

5. Findings and Analysis

The findings are organized into four main categories based on classroom observations, learning analytics, student feedback, and reflective journals.

5.1 Student Engagement with Personalized Tools

Student engagement was significantly enhanced by the introduction of interactive, adaptive technologies. Across the 15-week period, over 85% of students consistently interacted with at least two personalized tools per week, based on system usage logs.

Engagement Area	Observations and Findings	Tools Involved
Consistent Weekly Use	85%+ of students engaged with at least two personalized tools per week, as shown in usage logs.	Kahoot, Padlet, Microsoft Teams, Knewton Alta
Active Participation	Highest interaction rates noted on gamified and discussion-based platforms. Students felt more open to share.	Kahoot, Padlet, Socrative
Preferred Tool Features	Tools with instant feedback and creative options were rated highest in student reflections and surveys.	Microsoft Forms (branching), ChatGPT/AutoTutor clones
Device Accessibility	All students successfully accessed ITS activities using their own laptops or mobile devices.	All platforms accessed via personal devices

Table 16 Student Engagement Trends with ITS-Based Tools over 15 Weeks

Student reflections consistently demonstrated high levels of engagement with the personalized learning tools introduced throughout the course. One student remarked, "Using Padlet helped me organize my thoughts and see how others think differently about the same ethical issue. It made me realize there isn't always one right answer." This sentiment was echoed by another student who stated, "I liked the ethical chatbot because it pushed me to think deeper. When it asked 'why' three times, I had to justify my answer

more clearly than I'm used to." Gamified platforms also contributed to positive learning experiences; as one participant reflected, "Kahoot quizzes made ethics feel like a challenge I wanted to win. The competition helped me stay focused."

Students also appreciated the flexibility of using their own devices, with one writing, "Doing the activities on my phone or tablet was super helpful. I didn't feel restricted, and I could finish things even when I was outside the classroom." Finally, the sense of autonomy and personalized progress was valued, as one student shared, "The feedback I got from the ITS showed me where I needed to improve and where I was doing well. It felt like I had a tutor just for me."

These reflections collectively underscore how integrating ITS and adaptive tools not only enhanced engagement but also fostered deeper ethical reasoning and a greater sense of ownership over the learning process.

5.2 Perceived Effectiveness of ITS for Ethical Reasoning

Students reported that Intelligent Tutoring System (ITS) tools, particularly those featuring Socratic questioning and ethical scenario simulators, significantly enhanced their ability to reason through complex ethical dilemmas. AI chat simulations – designed to mimic ethical dialogues – encouraged students to articulate their arguments more clearly, often referencing ethical frameworks such as utilitarianism or rights-based theories. This structured interaction not only deepened their understanding but also improved their ability to justify their positions. Scenario adaptation tools like Knewton Alta further supported learning by adjusting the difficulty and depth of ethical dilemmas based on each student's progress. This personalized scaffolding enabled learners to gradually build confidence when tackling nuanced topics like whistleblowing and intellectual property rights. Students expressed appreciation for the way these tools reduced cognitive overload while still promoting critical thinking. Moreover, the real-world relevance embedded in the ITS activities made a meaningful impact on student engagement. Learners noted that applying ethical theories to scenarios they might

realistically face in IT professions helped solidify their conceptual grasp and increased their motivation. Overall, the integration of ITS tools proved effective in bridging theory and practice, fostering both ethical competence and autonomy.

Students overwhelmingly reported that Intelligent Tutoring Systems (ITS), particularly those involving interactive dialogues and adaptive scenarios, played a transformative role in enhancing their ethical reasoning skills. One student reflected, "The chatbot helped me go step by step through my thoughts. It kept asking 'why' until I had to really think about the consequences, not just my opinion." Another noted the value of scenario-based learning, stating, "Each time I completed a case on Knewton, the questions became harder. At first, I struggled, but by the third week, I was more confident in explaining ethical ideas like fairness and responsibility." The iterative feedback provided by ITS also contributed to students' ability to revise and refine their reasoning. As one participant described, "The feedback wasn't just a grade—it explained what I missed, and then I had a chance to redo it. That helped me learn more than just memorizing terms." Real-world relevance emerged as a powerful motivator, with a student commenting, "I used to think ethics was just theory, but the simulations made it feel real – like something I might face in my job one day." Another learner summed it up by stating, "The system didn't let me stay passive. It made me respond, justify, and sometimes rethink my whole approach. That's how I know I really learned something."

These reflections reinforce that ITS tools were not only engaging but also effective in promoting deeper, structured ethical reasoning aligned with course objectives.

5.3 Improvement in Ethical Decision-Making Skills

The integration of Intelligent Tutoring Systems (ITS) and personalized learning pathways resulted in significant enhancements in students' ethical decision-making skills. These improvements were particularly evident in their ability to identify relevant stakeholders, apply appropriate ethical theories, and evaluate the potential consequences of various actions. Reflective journal

analyses indicated a clear progression in students' use of ethical vocabulary, the clarity and structure of their arguments, and their capacity to acknowledge and assess multiple perspectives. Additionally, comparisons of student responses to ethical scenarios before and after the course showed that 70% of learners shifted from offering simplistic or binary choices to producing more nuanced and well-justified evaluations that incorporated ethical principles and risk considerations. Final group projects further illustrated these gains, with students demonstrating thoughtful integration of theoretical concepts and practical reasoning. These outcomes suggest that the ITS-based personalization model was effective in fostering deeper ethical reflection and professional-level decision-making among IT students.

Students consistently reported significant growth in their ethical decision-making capabilities, attributing this advancement to the structured guidance and reflective opportunities provided through Intelligent Tutoring Systems (ITS). One student reflected, *"At the beginning, I thought ethics was just about being good. Now I understand it's about choices, consequences, and thinking about everyone involved."* Many students described how their ability to identify and analyze multiple stakeholders matured over the semester. As one participant shared, *"In my first case study, I only thought about the user. Later, I started to include the company, society, and even future users in my decisions."* Several reflections indicated a shift from simplistic judgments to more reasoned and theory-based arguments. For instance, a student remarked, *"Before, I used to just say 'this is wrong' or 'this is right.' Now I give reasons, and I think about fairness, rights, and outcomes before making a judgment."* The iterative feedback offered by ITS tools played a pivotal role in deepening ethical analysis. As one learner explained, *"The system would ask questions that made me go back and look again at the problem. I started to connect the theories we studied to the situations more easily."* Another student, involved in the Green Computing project, stated, *"I didn't know before how to argue why something was ethically better. By the end, I could explain my choice using principles, not just my feelings."*

Collectively, these insights affirm that ITS-supported instruction promoted the development of more nuanced, well-justified ethical reasoning among students.

5.4 Student Autonomy and Readiness for Self-Directed Learning

One of the most promising outcomes of the ITS-based approach was the noticeable increase in student autonomy. The personalized and adaptive nature of the system fostered self-regulation and encouraged behaviors aligned with self-directed learning. Students were able to pace themselves effectively, revisiting challenging concepts or moving ahead to explore more complex ethical scenarios when ready. Remarkably, several students took the initiative to engage with additional ethical dilemmas beyond the course requirements, demonstrating intrinsic motivation. By the midpoint of the course, some learners had begun using AI tools like ChatGPT on their own to brainstorm ideas and develop structured ethical arguments, signaling a proactive attitude toward integrating technology into their learning process. Furthermore, weekly reflection activities revealed that students were setting personal learning goals and using ITS-generated analytics to monitor their progress, indicating a growing metacognitive awareness and a commitment to continuous improvement. These developments suggest that ITS not only enhanced content understanding but also empowered students to take ownership of their ethical learning journey.

Many students acknowledged a transformation in their learning habits and confidence. As one student shared, *"I never thought I could learn on my own, but now I know how to find reliable ethical frameworks and question things more deeply."* This shift toward independence was echoed by another learner who noted, *"I started to plan my study time and go back to parts I didn't understand—no one had to remind me."* The ITS environment supported this behavior through features such as progress dashboards and personalized content suggestions, which helped students become more metacognitively aware. One student reflected, *"Seeing my dashboard made me want to improve my score. I set a*

goal every week and felt proud when I reached it." Others demonstrated self-initiative beyond course requirements. A participant explained, *"When I finished my tasks early, I looked for harder cases. I wanted to challenge myself, especially with AI ethics problems."* Another shared, *"I used ChatGPT to check my reasoning and compare it with what we learned. It helped me think in new ways."*

These reflections suggest that students not only adapted to but embraced self-directed strategies, illustrating the potential of ITS to nurture lifelong learning skills in ethics education and beyond.

6. Conclusion and Recommendations

This study set out to explore the implementation of Intelligent Tutoring Systems (ITS) and personalized learning strategies in the TECM231 ethics course, aiming to enhance student engagement, ethical reasoning, perceived effectiveness, and autonomy in learning. The findings provide clear answers to the research questions posed. First, regarding how ITS and personalized learning affect student engagement, the data from learning analytics and student feedback demonstrated a significant increase in active participation and motivation. Adaptive quizzes, scenario-based simulations, and interactive tools made the learning experience more relevant and stimulating, directly addressing the first research question. Second, the study showed that ITS tools significantly improved students' ethical reasoning and decision-making skills. Through iterative practice and personalized feedback, students were better able to analyze complex dilemmas involving privacy, intellectual property, and social media ethics, confirming the positive impact outlined in the second research question. Third, students expressed strong perceptions of the effectiveness of ITS and personalization in enhancing their understanding of ethical concepts. Many highlighted the benefits of immediate feedback and customized learning paths, which helped clarify difficult topics and supported their confidence in applying ethical principles—addressing the third research question about perceived effectiveness. Finally, the use of ITS fostered greater student autonomy and

readiness for self-directed learning beyond the classroom. The personalized nature of the tools encouraged learners to take ownership of their ethical development and build lifelong skills critical for their professional careers, thus responding affirmatively to the fourth research question.

In summary, the study confirms that integrating ITS with personalized learning can create a more engaging, effective, and empowering ethics education environment for diploma-level IT students. These findings support broader adoption and continued research into ITS applications within value-based curricula.

Based on the study's findings and their alignment with the research questions, several key recommendations are proposed to enhance the teaching of IT ethics through Intelligent Tutoring Systems (ITS) and personalized learning approaches in diploma programs. First, institutional support for ITS integration is crucial. Higher education institutions, particularly technical colleges and applied sciences faculties, should invest in ITS infrastructure and provide faculty with training and resources. This support will ensure sustainable implementation and allow educators to effectively utilize adaptive technologies in ethics instruction. Second, there is a need for the development of customized, culturally relevant ITS content. To maximize engagement and relevance, course materials and scenarios should reflect the ethical, social, and cultural contexts of Saudi Arabia and the wider Gulf region. Localizing content will deepen students' connection to the material and foster a more meaningful application of ethical principles. Third, educators should expand the use of adaptive and interactive learning tools. Incorporating branching scenarios, AI-driven dialogue systems, and real-time feedback mechanisms can significantly improve student engagement, accommodate diverse learning styles, and promote inclusivity. These tools offer dynamic learning experiences that adapt to individual needs, enhancing comprehension and ethical reasoning. Fourth, it is essential to encourage student autonomy and the development of lifelong learning skills. ITS platforms should be intentionally designed to cultivate self-regulation by gradually reducing instructor guidance and incorporating elements that foster

reflection, ethical analysis, and independent decision-making. This prepares students to continue their ethical development in professional settings beyond the classroom. Fifth, ongoing research and evaluation should be prioritized to monitor the long-term impact of ITS-based ethics education. Future research should include diverse cohorts across multiple institutions and investigate how ITS influences real-world ethical behavior over time. Insights from such research will inform improvements to system design and pedagogical strategies. Finally, successful ITS implementation depends on collaborative development between educators and technologists. Interdisciplinary collaboration ensures that ITS tools are pedagogically effective, technologically robust, and aligned with curricular goals. By working together, ethics instructors and AI developers can create learning environments that are both innovative and educationally meaningful.

These recommendations aim to provide a comprehensive framework for improving ethics education in IT programs through intelligent, personalized learning systems, supporting not only immediate academic success but also fostering ethical professional practice in a rapidly evolving digital world.

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