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Teaching Ethical Reasoning in AI-Powered Construction: Broadening Professional Responsibilities

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Abstract

The construction industry is experiencing rapid change as artificial intelligence (AI) technologies are integrated into design, planning, and project execution. From AI-supported cost estimation to drone-assisted surveying and automated project scheduling, these advancements are transforming professional practices and the skills required of new graduates. For example, integrated AI could enable a single worker to operate multiple machines at once. While this could significantly reduce labor costs and potentially increase workplace efficiency, it also raises the risk of more accidents happening on job sites. Ethical considerations must be addressed to balance the advantages of cost savings and efficiency with the vital need for workplace safety. Although technical skills are developing quickly, students' capacity to think critically about these issues remains underdeveloped, particularly among construction management students, whose curricula have traditionally focused more on technical and managerial skills than on the ethical principles behind these practices.

This paper examines a pedagogical initiative that integrates ethical reasoning about AI into an existing senior-level course, Construction Professional Development, which students take alongside their capstone project. The first author serves as the course instructor, while the second author, a philosophy professor and guest lecturer, offers instruction in applied ethics and moral philosophy. Together, the authors created an instructional framework to enhance students' ability to recognize and assess ethical issues that arise in AI-driven construction practice. This paper outlines an approach that incorporates ethical reasoning into AI-related examples, taught concurrently with students' capstone projects. This setting provides an opportunity to explore how ethical theory can be directly connected to emerging professional challenges.

The approach combines several strategies: (1) developing classical ethical reasoning skills; (2) engaging in case-based learning with realistic scenarios; (3) participating in classroom discussions and structured debates to uncover value conflicts and conflicting responsibilities; (4) using surveys of student perceptions before and after instruction to measure changes in ethical awareness and reasoning skills.

Preliminary findings show that students initially approach AI and high-tech tools with excitement for efficiency and accuracy but often overlook or underestimate their ethical issues. For example, many students see drones mainly as tools for productivity in surveying and quantity takeoff, without considering possible concerns about worker privacy or data security. Similarly, reliance on AI-based estimating tools often conceals questions of accountability when results are inaccurate or biased. Through focused instruction and reflection, students become better at identifying these issues and applying ethical reasoning, including rights, fairness, and responsibility, to determine proper professional actions.

This initial work aims to bridge the gap between abstract ethical theory and the real-world practices of AI-driven construction. By incorporating ethics education, students not only learn to recognize ethical issues but also gain the skills to analyze and resolve them in environments similar to professional decision-making. The paper argues that construction education should go beyond teaching technical mastery of new technologies to preparing students as reflective practitioners capable of balancing efficiency, accountability, and social responsibility. This combination of ethics and AI-based case studies offers a model for rethinking construction management education in an age increasingly shaped by technology.

1. Introduction

Artificial intelligence (AI) is rapidly transforming decision-making in the construction industry. Tools like AI-assisted cost estimating, automated scheduling, drone-based surveying, and computer-vision safety monitoring provide increased efficiency, accuracy, and productivity [1], [2], [3], [4], [5], [6]. As these technologies become more integrated into professional practices, they are no longer just minor innovations but essential factors that influence how engineers and construction managers plan projects, allocate resources, and ensure the safety of workers and the public. While education on technical skills for these tools is progressing quickly, instruction on the ethical reasoning needed to ensure their responsible use has not kept pace. This creates an expanding “responsibility gap,” where automated systems influence decisions, but accountability remains with human professionals.

AI now influences estimating, scheduling, design assistance, and site monitoring. These tools increase speed and insight but can blur responsibility, privacy, and bias. Although studies show that the public is less concerned about invasions of privacy by construction companies, assuming they collect data only for legitimate business purposes, unlike drones operated by the government, military, or police [7], [8], [9], it is vital that construction engineers respect public privacy, for example by not recording data from private property when using drones to monitor safety, conduct structural assessments, or perform other engineering tasks on private locations. We promote a “human-in-the-loop” approach: licensed professionals and project managers validate inputs, methods, and outputs; they hold responsibility for decisions, documentation, and escalation if tool recommendations conflict with safety or codes. According to Policy Statement 573 - Artificial Intelligence and Engineering Responsibility, approved July 18, 2024, by the American Society of Civil Engineers (ASCE), “AI cannot serve as a replacement for the professional judgement of a licensed Professional Engineer.” [10] Relying on AI data without careful human verification is a clear ethical violation, even though there might be concern that extensive human oversight could diminish automation benefits. Students must also understand that many traditional personal indemnity policies might not cover errors or accidents on construction sites caused by AI data [11]. An additional challenge is that AI algorithms used in construction are often opaque (“black boxes”), making them hard to interpret or explain when engineers perform their due diligence as the “human-in-the-loop,” who bears moral responsibility for correcting errors or overriding bias in these systems [12]. Students examine data lineage, validation across groups, and criteria for human override. A key rule remains: accountability cannot be outsourced—software vendors may warrant tools, but it is the professionals who verify and disclose their limitations.

This paper explores a teaching approach that integrates ethical reasoning about AI directly into a senior-level construction management course, Construction Professional Development, which students take alongside their capstone project. The first author acts as the course instructor, while the second author, a philosophy professor and guest lecturer, offers instruction in applied ethics and moral philosophy. The third and fourth authors serve as co-instructors for teaching and research in this class. By embedding ethical reasoning within an existing technical and professional development framework, the course positions ethics not as a mere theoretical requirement but as a practical skill that influences actual project decisions. The instructional approach considers ethical reasoning as a form of professional judgment that must operate alongside considerations of cost, schedule, safety, and performance.

The main research question of this study is: How can structured ethical reasoning be developed among construction management students facing AI-related professional dilemmas?

To answer this question, the instructional framework uses four interconnected strategies:

1. Case-based learning using realistic scenarios drawn from current industry applications of AI in estimating, scheduling, surveying, and site monitoring;
2. Facilitated classroom discussions and debates that expose value conflicts among efficiency, accountability, fairness, and care for stakeholders;
3. Pre- and post-instruction surveys to assess changes in students' ethical awareness and confidence in ethical reasoning; and
4. Dialogues with practicing professionals invited to the class who describe how AI tools reshape responsibility and judgment in real projects.

Preliminary observations indicate that students initially view AI with strong technological optimism, mainly emphasizing efficiency and accuracy while overlooking ethical issues like data privacy, algorithmic bias, and accountability for mistakes. Through guided reflection and engagement with various ethical frameworks—including deontological duty, utilitarian reasoning, virtue ethics, justice and fairness, and care ethics—students start to develop more nuanced professional judgments. They learn that responsibility cannot be shifted to technology and that ethical reasoning is vital for maintaining trust, safety, and professionalism in AI-driven practice.

By situating ethics instruction within a live capstone context, this initiative bridges the gap between abstract ethical theory and the tangible realities of construction management [13], [14], [15]. It redefines ethics as applied judgment amid real-world pressures of time, cost, data, and risk. The paper contends that construction education must go beyond teaching technical mastery of emerging technologies to fostering reflective practitioners who can balance innovation with accountability, fairness, and social responsibility. In an era when AI increasingly mediates professional decisions, integrating ethics directly into technical and professional courses provides a crucial foundation for shaping the moral and professional identity of future construction leaders.

2. Course Context and Author Roles

The initiative operates within an existing senior course, Construction Professional Development, taken alongside the capstone. The first author (course instructor) integrated AI-ethics modules and assessments; the second author (philosophy professor and guest lecturer) delivered applied ethics content and co-developed cases and rubrics; the third and fourth authors are co-instructors of teaching and research.

3. Instructional Design

This section describes how the course shifts from highlighting the practical importance of ethical responsibility to explaining fundamental ethical concepts, and ultimately to equipping students with structured analytical tools for AI-related decision-making.

The AI ethics module was carried out over a three-week span in the middle of the semester. The teaching sequence adhered to this structure:

- Week 1: Pre-instruction survey administered. Introduction to AI in construction and ethical frameworks (one 60-minute class session).
- Week 2: Case-based analysis of AI-related construction scenarios (Bangkok collapse case and AI estimating scenario). Structured small-group discussions and guided debate (one 60-minute session).
- Week 3: Application workshop in which students applied the Quick Ethical Decision Checklist and Structured Case Analysis framework to related dilemmas (one 60-minute session). Post-instruction survey administered at the end of the week.

3.1 Establishing the Practical Stakes of Ethical Judgment

The way decisions are made—about materials, methods, scheduling, data, and safety—directly impacts workers and the public. AI raises these stakes: algorithmic suggestions now affect estimating, scheduling, surveying, and site monitoring. Ethical reasoning is therefore a practical skill, not just an idea; it builds trust, reduces disputes, and helps graduates balance efficiency with accountability and social responsibility. A case study of the Bangkok High-Rise Collapse was included.

3.1.1 Background

In March 2025, a 30-story high-rise under construction in Bangkok—meant to serve as the headquarters of Thailand's State Audit Office—collapsed after a 7.7-magnitude earthquake centered in neighboring Myanmar. Although the epicenter of the earthquake was about 1,000 kilometers (600-620 miles) away, Bangkok felt tremors. However, this was the only major building in the city to completely fail. At that time, construction was about 30% finished.

The disaster resulted in at least 92 deaths, with many others injured or missing. Because of Bangkok's strict building codes, which include seismic regulations for buildings, and the fact that nearby structures remained intact, attention quickly shifted to construction practices and oversight [16], [17].

3.1.2 The Ethical Failures

- Use of substandard materials: Investigators found that the steel and concrete used did not meet required specifications, raising suspicions of cost-cutting and procurement fraud.
- Noncompliant design: Structural and architectural plans reportedly did not meet earthquake resilience codes, indicating potential oversight in professional review and approval.
- Document forgery: Reports uncovered falsified signatures and fraudulent engineering documents submitted to regulators.
- Negligence in oversight: Regulators and contractors failed to notice warning signs during the design and construction process, allowing unsafe practices to continue.
- Profit over safety: Developers allegedly prioritized speed and cost savings instead of safety.

Figure 1. A 30-story Building Collapses in Bangkok after a Massive Quake in Myanmar.

This case, therefore, not only warns about misconduct but also explores the core moral principles and professional standards that help prevent such failures in both traditional and AI-assisted construction practices.

Although the Bangkok collapse case is described here in detail due to its immediacy and instructional value, students examined multiple case scenarios during the module. These included AI-assisted estimating errors, drone-based site monitoring and privacy concerns, and scheduling override decisions involving worker safety. The Bangkok case served as a high-impact anchor example, while the additional cases allowed students to apply ethical frameworks across diverse AI-mediated construction situations.

3.2 Concise Concepts of Values, Morality, Ethics, and Law

- Values are what we prioritize, such as safety, fairness, and efficiency.
- Morality transforms values into guidelines of right and wrong for behavior.
- Ethics involves the reflective analysis and professional codification of how we should act—often going beyond what the law requires. Multiple ethical theories or approaches can be adopted, and various codes of ethics are used by professional engineers and construction professionals (NSPE, ASCE, CMAA, etc.). Students are encouraged to

examine the moral challenges arising from AI-driven construction from a pluralist perspective, evaluating each using the ethical frameworks introduced in the course and comparing their outcomes.
- Law establishes the enforceable minimum; ethics strive for more.

Students received a summary of values, morality, ethics, and law (Table 1). Table 1 displays these four concepts along a spectrum from personal, internally guided commitments (values and morality) to more formalized, externally enforced structures (ethics and law).

Table 1. Summary and Comparison of Values, Morality, Ethics, and Law

Aspect	Values	Morality	Ethics	Law
Nature	Priorities, ideals, and beliefs about what is important	Rules of personal right and wrong	Study of systematic rules/principles/ codes of right and wrong; moral reasoning	Rules enforced by society
Scope	More personal, cultural, or community-wide	More universal, socially binding	Domain/role-specific; professional/organizational	Applies within a jurisdiction to all persons/organizations
Function	Shapes preferences, life choices	Guides behavior, enforces norms	Provides decision frameworks for roles; sets best practices; governs professional conduct	Maintains order; sets minimum standards; resolves disputes; prescribes penalties
Origin and Source	You, culture, upbringing, experience, community	Your value, conscience, culture, and religion	Philosophy, profession/ discipline	Legislative body, government, law enforcement
Enforcement	None	Internal	Peer/credential	External (court, law enforcement
Time horizon	Long	Long	Evolve with practice	Can lag/change
Examples	"I value freedom," "I value family." "I value honesty."	"Don't steal." "Don't lie." Refusing to fudge test results	Following conflict-of-interest rules	Tax law, traffic law, construction law. Wearing hard hats because OSHA requires it

With these conceptual distinctions in place, students are better equipped to analyze AI-driven dilemmas from multiple ethical perspectives instead of relying only on intuition or minimal legal compliance.

3.3 Five Lenses for the AI Cases

The following five ethical lenses offer a structured framework for analyzing AI-related scenarios in construction practice, helping students assess responsibilities, consequences, character, fairness, and human impact in technology-integrated environments.

- Deontology (duties/rules): Professionals hold responsibility for safety, honesty, and disclosure—automation does not transfer responsibility.
- Utilitarianism (outcomes): Evaluate total benefits versus harms (productivity versus safety, privacy, and job impacts) across all stakeholders.

- Virtue Ethics (character): Develop integrity, prudence, and humility—be cautious of "black-box" tools; verify before depending on them.
- Justice/Fairness: Prevent bias and unequal access (e.g., datasets that disadvantage certain crews; platforms that favor large firms).
- Care Ethics (relationships): Reflect on the lived effects on workers and communities (e.g., stress from surveillance; loss of autonomy).

3.3.1 Quick Decision Checklist for Making Choices Under Pressure

When time runs out and an immediate decision is essential, these five questions offer a quick ethical guide:

- Duty – What do professional codes, laws, or my role require in this situation?
- Harm – Who might be affected by this decision—workers, the public, clients, or the environment?
- Transparency – Can I publicly justify and defend this decision based on a careful, well-reasoned process that aligns with professional standards and ethical principles?
- Fairness – Are stakeholders being treated fairly, without favoritism or bias?
- Long-Term Impact – How would everything change if everyone acted this way? Would it benefit or harm the profession or society?

This quick checklist covers the main ethical frameworks: duty ethics (rules), utilitarianism (outcomes and harm), virtue ethics (honesty and character), justice (fairness), and Kant's categorical imperative (long-term universal principles).

3.3.2 Structured Case Analysis for In-Depth Reflection

When time permits, professionals can tackle dilemmas more methodically.

- Identify the Facts – Collect all relevant information. What is known? What assumptions are being made?
- Define the Stakeholders – Who is directly or indirectly affected? Workers, clients, subcontractors, the public, regulators, future generations?
- Identify conflicts—Where do values, professional codes, legal requirements, and personal beliefs clash?
- Apply ethical theories – examine the issue from various perspectives:
    - Virtue ethics: What actions would a person of integrity take?
    - Deontology: Which duties or rules are applicable in this situation?
    - Utilitarianism: Which outcome maximizes the greatest overall good?
    - Justice: Is the solution fair and equitable?
    - Care ethics: How are relationships and vulnerabilities taken into account?
- Select and justify a decision – choose the course of action that best balances these perspectives, and be ready to explain why it is ethically justified.

Figure 2 shows a Quick Ethical Decision Checklist diagram with five guiding questions in a clear, step-by-step order. It can be used alongside the full decision-flow diagram: one for urgent decisions made quickly, and another for detailed, structured analysis.

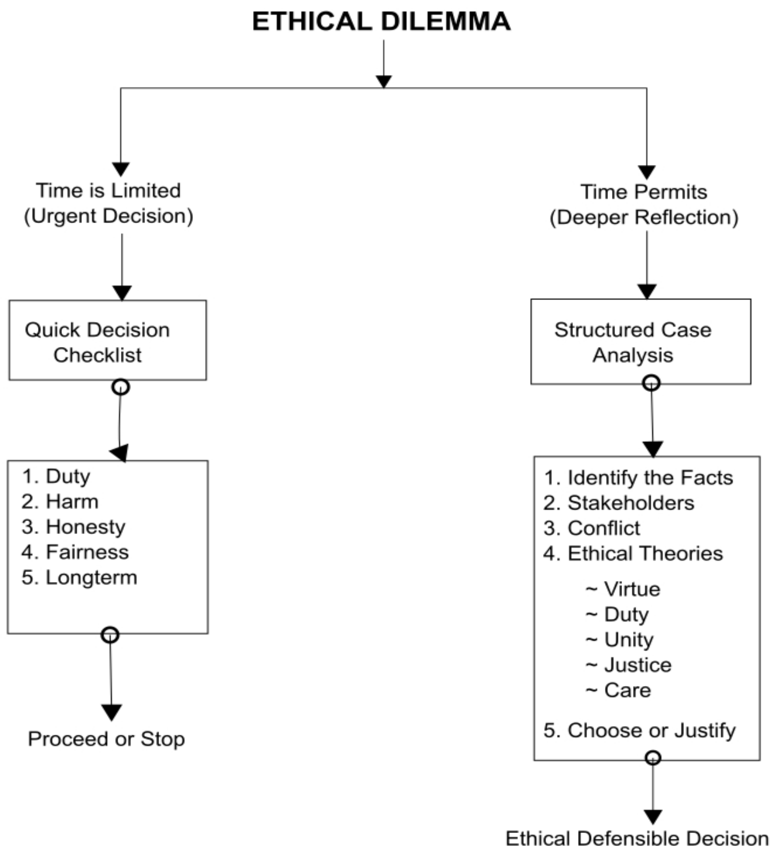

Figure 2. Ethical Reasoning Process: Decision Flow

4. Methods

This section describes the research design, data collection methods, and analytical approach used to assess the instructional intervention.

4.1 Survey Instrument

A paired pre- and post-instruction survey was given to evaluate students' ethical awareness and confidence in their reasoning about AI in construction. The survey featured nine multiple-choice questions addressing attitudes toward AI benefits, accountability, privacy, fairness, professional responsibility, data ethics, and personal confidence in ethical reasoning.

All nine survey items were presented as Likert-scale statements (Strongly Agree to Strongly Disagree). Table 2 offers condensed thematic descriptions instead of the full survey wording for brevity.

Table 2. Survey Items and Questions

Dimension	Example Survey Item	Underlying Ethical Focus
Perceived Benefits of AI	AI tools that make construction work faster and cheaper are automatically beneficial.	*Critical awareness vs. technological optimism*
Accountability	If an AI-based estimate turns out wrong, the responsibility lies primarily with the software.	*Deontological duty and professional accountability*
Privacy	Using drones for site monitoring raises privacy concerns that must be addressed in company policy.	*Rights, fairness, care ethics*
Fairness Principle	Which ethical principle best applies when ensuring that AI systems do not unfairly disadvantage certain groups?	*Justice as fairness (Rawls)*
Moral Courage	A project manager ignores an AI system's scheduling recommendation to protect worker safety.	*Virtue and duty ethics*
Data Ethics	When using digital tools that store data in the cloud, professionals should primarily ensure…	*Confidentiality and informed consent*
Confidence	I feel confident identifying ethical issues related to AI use in construction projects.	*Self-efficacy in ethical reasoning*
Value of Ethics	Ethical reasoning is as important as technical skill for a successful construction professional.	*Integration of ethics and professionalism*
Personal Values	Personal values and morality play a crucial role in reasoning through construction dilemmas.	*Link between personal and professional ethics*

A comparison of results from 38 pre-instruction and 28 post-instruction participants was conducted descriptively.

5. Results

This section summarizes the results. The findings show measurable changes in students' ethical awareness, perceptions, and professional judgment after the instructional intervention.

5.1 Key Shifts in Ethical Awareness

5.1.1 Technological Optimism Tempered by Reflection

- Agreement that "AI tools are automatically beneficial" decreased (62% → 46%), while neutrality increased (31% → 39%).
- *Students became more critical of unqualified enthusiasm for AI.*

5.1.2 Greater Sense of Professional Accountability

- Disagreement that "responsibility lies with the software" dropped significantly (66% → 39%), and strong agreement only doubled slightly.
- Students are increasingly understanding that accountability cannot be handed over to technology.

5.1.3 Heightened Concern for Privacy and Policy

- Agreement that "drones raise privacy concerns" increased slightly (63% → 68%), showing consistent ethical awareness after instruction.

5.1.4 Improved Understanding of Fairness as a Core Principle

- Selection of "Principle of fairness" remained dominant (82% → 75%), confirming the continued use of fairness as a guiding standard.

5.1.5 Increased Recognition of Responsibility in Safety Decisions

- Choosing "Responsibility" for the safety scenario stayed strong (82% → 64%), with small shifts indicating nuanced thinking among frameworks.

When faced with a scenario where a project manager overrides an AI scheduling recommendation to prioritize worker safety, 82% of students selected "Responsibility" as the main ethical principle before instruction, compared to 64% after instruction.

Although there was a decrease in single-principle selections, responses after instruction were more evenly spread across duty, virtue, and fairness frameworks. This indicates that students shifted from relying on a single dominant perspective to adopting a more pluralistic approach to ethical theories when evaluating safety-related decisions.

5.1.6 Stable Commitment to Data Ethics

- 'Confidentiality and informed consent" remained high (66% → 68%), reaffirming understanding of professional duties in digital settings.

5.1.7 Growth in Ethical Confidence

- Students expressing confidence in identifying AI-related ethical issues increased from 74% to 78%, with more in the "Strongly Agree" category (26% → 36%).
- Shows measurable improvements in ethical self-efficacy.

5.1.8 Elevated Perceived Importance of Ethical Reasoning

- Agreement that ethics equals technical skill remained steady (89% → 89%), but " Strongly Agree" responses increased (61% → 68%).
- The instruction reinforced ethics as essential to professionalism.

Agreement with the statement "Ethical reasoning is as important as technical skill for a successful construction professional" remained high across both administrations (89% pre-instruction; 89% post-instruction, combining Agree and Strongly Agree).

However, the proportion choosing “Strongly Agree” rose from 61% to 68%, suggesting a shift toward greater conviction rather than just maintaining baseline support. Instruction seems to have strengthened—not just maintained—the perceived balance between ethical reasoning and technical skill.

5.1.9 Sustained Link Between Personal and Professional Morality

- “Strongly agree” responses decreased slightly (63% → 50%), while “Agree' responses increased (24% → 32%), indicating that students perceived moral reasoning as more nuanced and context-dependent after case analysis.

5.2 Results, Findings, and Summary of Learning Impact

Overall, the results indicate:

- Reduced blind optimism about AI
- Enhanced recognition of human accountability and fairness
- Confidence in ethical reasoning remains stable to improving.
- Strengthened conviction that ethics and technical skills are equally important for professional success.
- These findings support the idea that when ethical frameworks are incorporated into real-world AI scenarios, students not only develop conceptual understanding but also adopt reflective habits vital for professional judgment.

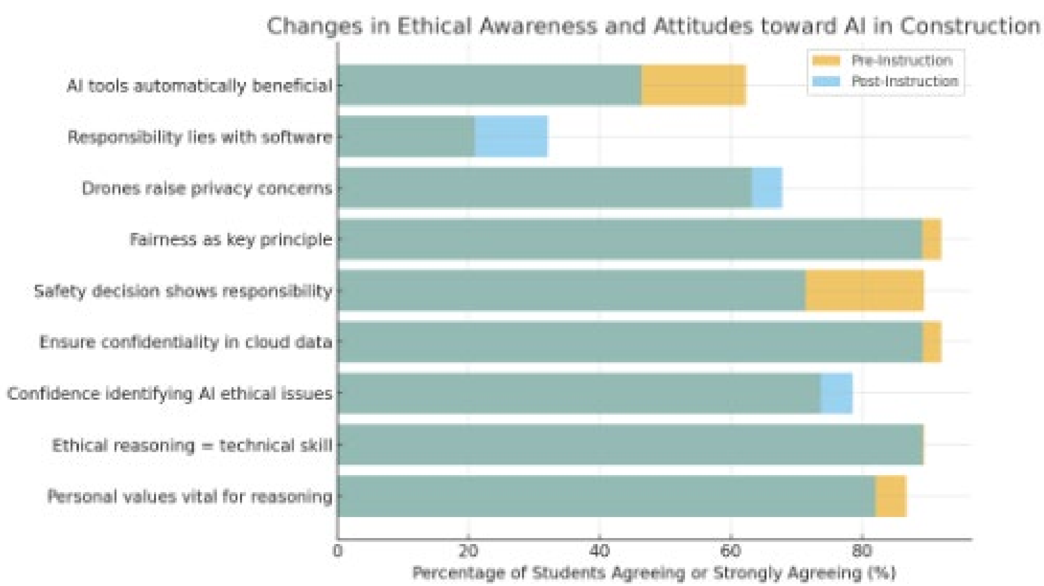

Figure 3. Pre-instruction (gray) and post-instruction (blue) percentages across survey items. Yellow bars represent Neutral responses.

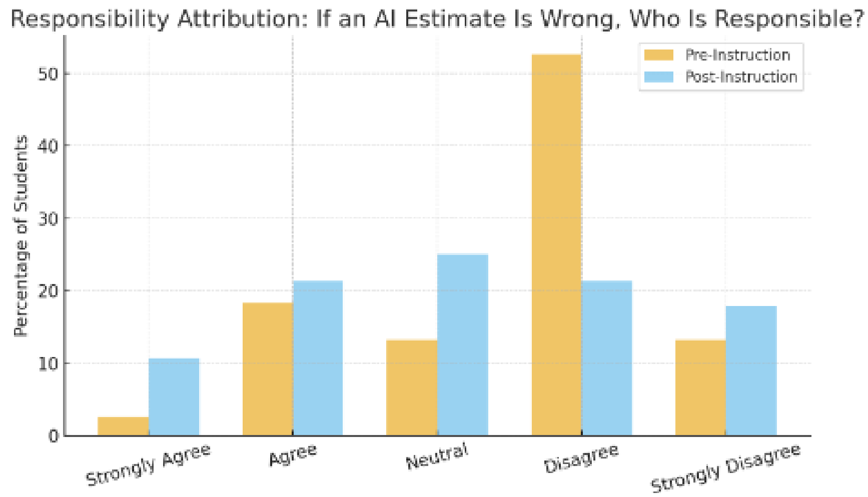

Figure 4. Responsibility Attribution in AI Estimate Errors (Survey Item 2; Section 5.1.2 – Professional Accountability).

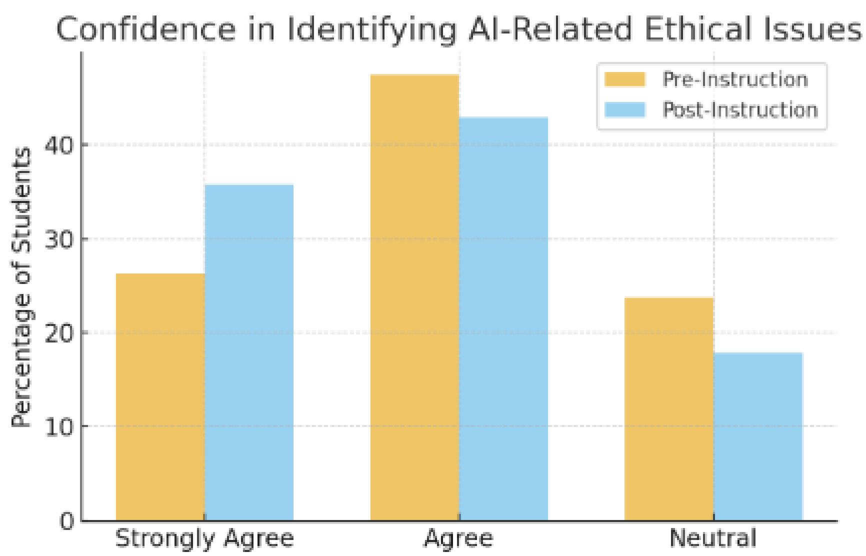

Figure 5. Confidence in Identifying AI-Related Ethical Issues.

The results indicate that:

- Responsibility Attribution – showing that after instruction, significantly fewer students attributed errors to “the software,” and more accepted shared or human responsibility.
- Confidence in Identifying AI-Related Ethical Issues – showing an increase in “Strongly Agree” responses after instruction, indicating higher ethical self-efficacy.

From Figure 3: Comparison of pre-instruction (n = 38) and post-instruction (n = 28) survey results across nine items related to AI, ethics, and professional responsibility. Post-instruction data reveal increased critical awareness, a stronger recognition of human accountability, and a continued belief that ethical reasoning is essential to professional competence.

From Figure 4: Distribution of student responses to the statement "If an AI-based estimate turns out to be wrong, the responsibility primarily lies with the software."

After the instruction, the percentage of students who disagreed or strongly disagreed increased significantly, showing a better understanding that accountability stays with licensed professionals rather than automated tools.

From Figure 5: Comparison of pre- and post-instruction responses for the statement "I feel confident identifying ethical issues related to AI use in construction projects."

The percentage of students choosing Strongly Agree rose from 26 percent to 36 percent, indicating measurable improvements in ethical self-efficacy after the embedded ethics module.

To provide a clear summary of directional trends, Table 3 consolidates responses by calculating the combined percentage of students selecting "Agree" or "Strongly Agree" for each item. While the previous sections discuss changes across categories, including Neutral and Disagree, Table 3 specifically emphasizes affirmative responses as a measure of students' overall agreement with each statement. This consolidation facilitates easier comparison of pre- and post-instruction trends across all nine survey dimensions. Table 3 presents the Pre- and Post-Instruction Survey Summary with key interpretations (n = 38 pre, 28 post).

Table 3. Pre- and Post-Instruction Survey Summary: Ethical Reasoning and AI Awareness (n = 38 pre, 28 post)

Survey Item (Condensed Statement)	Pre-Instruction (% Agree + Strongly Agree)	Post-Instruction (% Agree + Strongly Agree)	Key Interpretation
1. AI tools automatically beneficial	**62**	**46**	Students became more critical of unqualified technological optimism.
2. Responsibility lies with software	**21**	**32**	Fewer students blamed software alone; more recognized shared or human accountability.
3. Drones raise privacy concerns	**63**	**68**	Privacy awareness remained high and slightly strengthened.
4. Fairness is key ethical principle	**92**	**89**	Fairness retained as dominant principle guiding AI ethics.
5. Safety decision shows responsibility	**90**	**71**	Responsibility remained the majority choice though slightly diversified across frameworks.
6. Ensure confidentiality in cloud data	**92**	**89**	Stable, high concern for data security and informed consent.
7. Confidence identifying AI ethical issues	**74**	**79**	Greater self-efficacy in recognizing ethical dilemmas.
8. Ethical reasoning = technical skill	**90**	**89**	Sustained belief that ethics is integral to professional success.
9. Personal values vital in reasoning	**87**	**82**	Slight drop reflects nuanced understanding after discussion of competing frameworks.

The previous item-by-item analysis (Sections 5.1.1–5.1.9; see Figures 3–5) examined shifts across response categories, including changes in Neutral and Disagree selections. The bottom part of this page summarizes those findings by combining responses into the overall percentage choosing “Agree” or “Strongly Agree” for each item. This summary (Table 3) highlights trends in affirmative endorsement and makes it easier to compare across different areas of ethical awareness.

Consistent with the earlier discussion, Item 1 shows a decline in affirmative endorsement, indicating less technological optimism. Items related to accountability, data ethics, and ethical confidence either remain stable or see modest increases, supporting the interpretation that students gained a stronger understanding of professional responsibility after instruction.

6. Conclusion

This study examined integrating structured ethical reasoning into a senior-level Construction Professional Development course. By incorporating AI-related ethical dilemmas into realistic construction scenarios, ethics was framed as a practical aspect of professional judgment rather than a standalone theoretical subject.

Comparative pre- and post-survey results reveal noticeable changes in student perspectives. After instruction, students exhibited less uncritical technological optimism, greater awareness of human responsibility in AI-driven decisions, sustained focus on privacy and fairness, and slight gains in ethical self-efficacy. Although the sample size is small and the results are descriptive rather than statistical, the consistent trends suggest a meaningful impact from the instruction.

The results reinforce a key educational principle: responsibility for safety, fairness, and transparency cannot be handed over to automated systems. Incorporating ethical reasoning directly into technical and professional coursework provides a scalable way to prepare construction management graduates to handle AI-driven practices with reflective judgment and professional responsibility. Future versions should include paired statistical analysis and rubric-based assessments to enhance empirical validation.

Future iterations of this study should incorporate inferential statistical analysis to determine the significance of observed changes. Depending on whether responses are paired or independent, appropriate tests would be Wilcoxon signed-rank or Mann–Whitney U tests for ordinal Likert data, or chi-square tests of independence for categorical distribution comparisons. Reporting effect sizes (e.g., Cohen’s d or Cramér’s V) would also help clarify the magnitude of the instructional impact.

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