Artificial Intelligence (AI) in Educating Next Generation of Engineering Technology Students

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Abstract

Artificial Intelligence (AI) is transforming education, particularly for electrical engineering technology (EET) students, by presenting adaptive learning, immediate responses, and unconventional tools. Therefore, this paper proposes investigating modern learning to employ AI in educating future electrical engineering technology students. Firstly, the paper explores how to shape AI knowledge for EET students, supplying them with hands-on skills in AI tasks, clarifying coding, data analysis, and AI ethical usage. Then, as educators, what are the efficient AI tools to utilize in teaching, such as tailored tutoring, automated code assessment, AI-driven design/simulation, lecture dictation, and smart content creation? Key tools, for instance, Google Gemini, GitHub Copilot, and Wolfram Alpha, offer personalized support for multifaceted topics and project advancement. Second, a key discussion of the benefits of AI in education includes equipping students with future-ready skills, nurturing innovation, providing personalized aid, enabling quicker prototyping, improving educational proficiency, enhancing problem-solving capabilities, training for future jobs to build a diverse workforce, and reinforcing national competitiveness. Then, this discussion is extended to include AI challenges regarding precision, ethics, availability, and data confidentiality. Finally, a well-prepared, measurable, short survey and analysis are supplied to investigate students' opinions and thoughts regarding how they can utilize AI to prepare them for future careers, as an essential learning assistant, help in coding, aid in design, research roadmaps, and overcome challenges in an ethical way.

Keywords

Artificial Intelligence, Education, Future Students, AI Benefits, AI Challenges

Introduction

Artificial Intelligence (AI) is transforming education, particularly in training for Electrical Engineering Technology (EET) students, by making education personalized, offering real-time feedback, and innovating with new teaching tools. This article investigates recent approaches to AI-enhanced EET education and its impact on equipping future industry-trained students. First, it presents a theory of how to organize knowledge of AI so that it provides EET students with practical exposure to AI tools, honing their coding and data analysis skills, and promoting ethical practices for AI use. It also covers AI-powered teaching materials for facilitators, including customizing tutoring solutions, code analysis, design and simulation assistance from AI, transcription of lectures, and intelligent content generation. Significant tools such as Google Gemini, GitHub Copilot, and Wolfram Alpha are cited for their power to support difficult topics and accelerate project development, yet all need to be used in a way that supports governance over privacy and integrity [1-4]. This article is followed by an outline of the benefits of integration of AI tools within an educational framework, providing students with essential skills relevant to their future occupations, developing problem-solving skills, speeding up prototyping processes, and bringing workforce readiness into line with the requirements of accreditation. In addition, it aims to handle problems of accuracy, bias, and data protection with a risk-management approach, while also addressing accessibility and confidentiality issues and the use of AI with global guidelines. Engineering education is usually lagging in the implementation of AI when compared with industry applications (e.g., robotic vision systems that are currently used in industry have integrated AI systems, and they are way more advanced technology than the ones that are usually available in undergraduate electrical engineering technology labs).

Background and Related Work

GenAI in Engineering Education - Evidence in engineering education has started to describe the benefits to content creation, tutoring, and supportive interaction provided by GenAI. However, such an application has raised multiple questions of academic integrity, ethics, and trustworthiness. Moreover, core design principles for the evaluation of AI implementation are also open to review.

Code-Help Tools That Influence Learning Outcomes - Tools like GitHub Copilot [13] offer suggestions for code completion to quicken the pace of implementation; data has shown that some productivity gains can be directly associated with coding assistants themselves. Modern engineering software now even includes these as default options, so integration of these tools is necessary for updated engineering education instruction (e.g., in MATLAB).

Ethical Implications of Risks - As AI tools have been integrated more deeply into educational systems, it is necessary to create principles of guidance around transparency as well as the protection of user privacy from possible harm. Others can also include protection of data that should be stored and safely accessed, such as data banks, exam solutions, and other various purposes.

Aligning Accreditation Standards for Engineering Technology Courses - Regularly accredited programs standardize their curricula by implementing an ideal outcome of work from organizations like ABET [5-6], which encourages constant enhancement alongside performance assessments reflecting student achievements. New course management tools, such as Canvas, enable integration of student learning outcomes and program outcomes, but the data analytics that is available with these tools is still in the developmental phase and is not widely understood by engineering instructors.

Identify Relevant Competencies for Electrical Engineering Technology Students

Although some AI techniques are widely known and used in the engineering technology realm for multiple decades (machine learning, computer vision, etc.), understanding how to teach with appropriate use of AI technologies that are available nowadays and how to do it effectively in EET courses requires awareness of practical applications. Additionally, the ethical implications should be considered, instead of simply exploring abstract technology in terms of machine learning techniques. Table 1 gives the key competency areas along with learning targets and example evidence.

Table 1: Proposed Competencies for EET

Competency Area	Learning Targets (EET-relevant)	Example Evidence
AI literacy & limitations	Distinguish predictive vs. generative tools; recognize hallucinations; verify engineering principles	Reflection + verification checklist on lab report
Data basics	Cleaning, feature meaning, sensors/data logging context; bias from instrumentation or sampling	Data preprocessing notebook + error analysis
Coding with AI support	Prompting scaffolding, refactoring, unit tests; reading and debugging AI-produced code	Code review rubric + test coverage report
AI-assisted design workflow	Use AI to propose architectures, constraints, component tradeoffs; validate in simulation	Design memo + simulation results
Documentation & communication	Drafting technical documentation; citing tool use; traceability	Report with "AI-use disclosure" section
Ethics, privacy, and IP	Avoid entering sensitive data; understand policy constraints; proper attribution	Ethics case study + policy quiz

Incorporating AI Across the Curriculum

Consider embedding AI-driven activities across multiple domains instead of homing in on discussions of artificial intelligence exclusively in electives alone:

- Introductory programming/embedded systems: Use AI-aided debug/testing generation limited to defined constraints.
- Circuitry/Electronics labs: Use AI-supported troubleshooting guides that fulfill verification criteria
- Automation/control systems: Include model suggestion support with AI validated with stability/responsiveness specifications
- Capstone projects: Acknowledge AI's improvement in productivity on documentation/prototyping/project planning subjects once audit governs.

This approach builds upon the core values inherent in any electrical engineering technology subject and, thereby, provides learners with a perspective of working with tools already available, and a form of accountability for accuracy attached to them.

Teaching Techniques with Artificial Intelligence and Classroom Applications

Personalized Tutoring with Generative Systems

Generative AI platforms could provide prompt support on guided explanations/examples combined with Socratic questioning strategies. Suitable educational frameworks should reduce risks regarding misuse, avoid bypassing the core learning goals, and facilitate understanding by users in need of guidance/support by UNESCO [8].

Proposed format for classroom:

- Students ask for specific explanations from the system.
- Post interaction verification artifacts need to consist of derivation equations/simulated outputs/reference confirmations.
- Brief disclosure of when pupils used generative instruments during working should be embedded well in-sourced.

Automated Testing Together with Coding Support

GitHub Copilot has great features for more effective completion, but it requires course design. The comprehensive demonstration has been retained despite engagement efforts (evidenced in productivity work done on developers in different contexts), showing significant time savings gained to control task environments as described [11].

Recommended protective actions are:

- Implementation: unit tests and accurate interpretation of failures.
- Compulsory provision detailing the critical functions and explanations behind the code applied.
- Application prompts encourage verbal/written justification of inputs used iteratively during the process, collectively aiding in clarifying.

Design/Simulation Support Enhanced By Artificial Intelligence

Students commonly turn to simulations validating circuits/systems where integration seeks increasing effectiveness coming from techniques beyond classical techniques. This is done to obtain parameter sweeps/making sense of outputs, suggesting different designs, and creating exploratory planning thinking “what-if” situations. This will expand coverage, considering options which create a greater variety of possible outputs, yielding insights with better efficacy [15].

Summarization Techniques Using Lecture Transcriptions and Content Generation Features

Although generative models can provide functions, which enable summarization/study guidance/practice inquiries, and quality assurance. There are marked benefits which are evident in their use, but only to a qualified extent, to allow for a potential benefit when sourcing them according to firm protocols, which are also derived from ASEE investigations as discussed by [9,10]. Education recommendation points to ungraded rehearsal sets created using generational means by using mainly supplemented teacher-sanctioned evaluation in place to maintain quality assurance.

Benefits and Barriers to AI Integration in Educational Constructions for Electrical Engineering Technologies

Fostering Future-ready Skillsets - A knowledge of responsible use increases employability prospects, matching employment requirements. It promotes confidence-enhancing behavior, observes developments change, and moves industries' evolving paradigms. It develops a variety of areas to pursue active careers in labor markets worldwide, looking at skilled individuals navigating complexities, demonstrating skills [12].

Customized learning opportunities - The flexible explicated experience with tailored address to the individual needs was significantly correlated with improved efficiency of the different participants gaining engagement. It encourages continued participation, crucially fostering long-term motivation, maintaining interest, and initiating progressive levels of progress. This achieved enthusiasm proved alive, excited, and witnessed pathways that opened new doors, with potential for shared aspirations.

Accelerated Prototyping Processes - Faster iterations enable deeper analyses to allow teams to enhance generations by maximizing effort in their respective undertakings, resulting in successful alliances yielding productive partnerships. It increased the level necessary for communications transparency, sustaining momentum, and driving initiatives forward to achieve expected target benchmarks. It enhances collaborative goal setting, envisages communities, sparks creativity, and drives change agendas.

Enhanced Communication Skills - Leverage innovative collaborative features embedded to educate drafting clearer articulations, technical aspects, and accuracy, supported by presenting information. It reflects professionalism, dedication, quality craftsmanship, prioritizing clarity, conciseness, and effectiveness in conveying messages. Effective communication facilitates productive exchanges and the exchange of ideas, clarifying misunderstandings, cultivating relationships, and building trusted interactions.

Alignment with Desired Outcomes Established Through Accreditation Standards - It improves accountability, transparency, partnerships with stakeholders, and shared vision, scope, and objectives, as well as defines metrics to measure success. It also determines vision ambitions, drives pursuits, is anchored in solid grounding beliefs, inherent goodness, humanity, capable of extraordinary feats, surpassing limitations imposed, and surpassing barriers overcome. Various research questions will be addressed, such as the following:

RQ1: How do EET students currently use AI tools to support learning coding and designing skills to learn?

RQ2: What positive and negative reasons, barriers for students, help process an understanding of confidence, fairness, efficiency perceptions about the use of AI tools? What value do they believe in efficiency, confidence, and fairness, and how useful is understanding them?

RQ3: What awareness of ethical considerations for awareness of ethical privacy issues?

RQ4: Which instructional use cases were identified as most useful? #### Study Design for Deployments

An overview of the survey structure delivered a midterm and end-of-term survey, designed and delivered with a structure:

Part A Demographics Context Non-identifying

1) Program level: freshman, sophomore, junior, senior, other.
2) Intro circuits, electronics, embedded controls, and capstone projects are completed through courses.
3) Comfort level of programming (scaled Likert) on self-rating.

Part B (Usage Frequency) Likert Scale.

Categories of frequency used measured frequency scale never once monthly weekly several times a day, detailing interaction type like:

- I use artificial intelligence to explain concepts.
- I use the software to help debug code.
- I use system-generated syntax snippets/functions, coded assist circuitry/system design.

Mapping controls to AI risk categories

NIST AI RMF emphasizes identifying risks and managing them across the AI lifecycle [7], see Table 2, which presents course-friendly mapping.

Table 2. Risk controls for EET classroom AI use (illustrative)

Risk	Example in EET	Control
Incorrect output	Wrong circuit analysis steps	Verification checklist + required simulation/measurement
Overreliance	Student submits AI code without understanding	Oral code check + unit tests + reflection
Privacy leakage	Uploading lab partner data or employer project info	"No sensitive data" rule + approved tools with protections
Bias/unfairness	AI rubric feedback inconsistent across groups	Standardized rubric + instructor moderation
Integrity	AI-written lab report	Disclosure + process evidence (notes, logs, version history)

Professional ethics principles, public good, harm avoidance, and honesty provide strong reinforcement for this governance approach [14].

Conclusion

This paper presents a pragmatic framework embedding artificial intelligence into electrical engineering technology education. It offers focus-oriented competency maps and identifies key instructional applications of governance controls grounded in recognizable risk management education. Its directives offering deployment as a survey instrument evaluation, measure perceptions, usage, ethical cognition, and cognizance teaching outcomes, enrich an educational sphere that adds more foundational building blocks for future expansions. Agile tailoring responses will be proposed. It will respond to adapt to the changing needs of a student population, identify gaps, provide enhancements, upgrade curricula, promote engagement, and drive motivated, engaged learners. It will deliver detailed, targeted solutions for diverse student profiles, catering to varied populations, considering nuances, and contextualizing learning with experiential elements, traditional pedagogical methods, and embracing agile multi-dimensional instructional approaches utilizing digital infrastructure. This serves remote hybrid modalities, increasing accessibility for distance learners and equity integration with widening participation.

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