Computing Science Education on the AI Innovation Landscape

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Abstract

Recent advances in artificial intelligence (AI), including the widespread adoption of foundational models, have triggered changes across Computing Science (CS) programs. Developments include, but are not limited to, revisions to assessment practices, updates to academic integrity policies, curriculum redesign to integrate emerging concepts, and the growing use of conversational agents to support instruction. These developments aim to address effective preparation of graduates for an evolving AI innovation landscape.

The response of the CS education community over the past few years has been characterized by rapid experimentation, provisional deployments, and ad hoc adaptations. This work aims to move beyond a reactive response by synthesizing observations and experiences from students, educators, and industry stakeholders to identify key challenges, emerging patterns, and lessons learned. Drawing on the insights from this analysis and at a pivotal moment when institutions are shifting from exploratory adoption to long-term integration, we articulate recommendations and potential pathways to inform the sustainable and pedagogically grounded integration of AI in the future of CS education.

CCS Concepts

• **Social and professional topics → Computing education**.

Keywords

Computing Education, Computing Science, Computer Science, AI, Artificial Intelligence, Curriculum, Pedagogy, Higher Education

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1 AI and CS Higher Education

The recent emergence and adoption of foundational models have significantly reshaped education. Computing Science (CS) education has been affected in two distinct yet interconnected ways: First, as a field responsible for preparing scientists to drive AI innovation, its curriculum has been impacted through cycles of update and integration in many institutions worldwide. Second, as an educational discipline; its pedagogy, assessments, and policies are transformed

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through adoption and integration of AI and changes in student learning behaviors impacted by the use of AI technologies[1].

The rapid pace of change has prompted reactive, ad hoc responses to pressing concerns such as student adoption of AI tools, the redesign of assessments, and the revision of academic integrity policies to address AI-assisted code generation, content production, and problem solving. These responses, while necessary, have often been developed under time pressure and without a comprehensive pedagogical or curricular framework. As a result, current practices risk missing systematic engagement with the deeper educational implications of AI for the CS discipline.

The adoption of AI is not a transient trend, but a fundamental technological shift that will continue to expand in capabilities, accessibility, and influence. AI systems are becoming embedded in software development workflows, data analysis, system design, and decision-making processes across industries. For CS graduates, AI literacy, ranging from understanding model limitations and ethical implications to effectively collaborating with AI-driven tools, is becoming a core professional competency. Consequently, CS education must move beyond provisional accommodations and adopt a forward-looking perspective that treats AI as an enduring element of the computing landscape, rather than a temporary disruption.

Recent literature has reported on the applications and implications of AI within CS education [4, 8]. For example, Cambaz and Zhang [2] and Prather et al. [7] examined AI-driven code generation in programming courses. Brito et al. [1] explored content generation for course support. Choi et al. [3] considered applications such as student performance prediction. Prather et al. [5] explored educators' response to fast-paced advancements, and Prather et al. [6] assembled GenAI usage and perceptions to gain an understanding of the broader trends of AI adoption in the field. Most works focus on AI as an instructional aid, assessment and feedback practices, or academic integrity concerns. A significant gap remains in understanding how CS programs should prepare students for the future in the current landscape of AI innovation. In particular, there is limited guidance on how AI should be integrated into CS curricula and pedagogy in ways that align learning outcomes, disciplinary identity, and long-term workforce needs. Although familiarity with contemporary AI systems can be valuable, an overemphasis on specific tools and their adoption risks producing graduates whose skills quickly become obsolete. CS education must enable students to effectively contribute to the design and construction of new systems, and critically evaluate, adapt to, and innovate with future AI technologies, rather than consuming the current generation of tools. Addressing this gap and answering the question of how to adjust CS curricula to prioritize enduring foundational knowledge over a fast-expiring set of tools and platforms is essential for moving from reactive adaptation toward a coherent, sustainable, and pedagogically grounded strategy for CS education.

2 Methodology and Goals

In this study, we examine the evolving relationship between AI innovation and computing science higher education, specifically how emerging technologies reshape pedagogy and curricula and how academic programs, in turn, prepare students to drive future AI advancements. We ask:

RQ1: What is the state of AI adoption in CS higher education?
RQ2: How well does CS higher education curricula and pedagogy align with the demands of the *current* AI landscape?
RQ3: How should CS higher education prepare graduates to shape the *future* of the AI innovation landscape?

We address these questions by examining perspectives from students, educators, and industry stakeholders, focusing on themes including learning experiences, assessment practices, academic integrity, and the development of skills relevant to AI-enabled computing work. We will conduct a mixed-methods study, starting with a review of the literature, and complemented by qualitative and quantitative analysis of surveys and interviews conducted with these three groups. These perspectives will be synthesized alongside findings from the literature to identify recurring themes and areas of convergence that help characterize the landscape of AI in CS education. We will reflect on implications for CS education and strategies to position and transform with ongoing AI innovation, and provide recommendations for preparing the next generation of scientists to thrive within an evolving AI innovation landscape.

[1]We used AI-enabled tools in editing this article at sentence and paragraph levels.

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