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Theoretical Analysis of the Impact of Generative Artificial Intelligence on Computer Science Education

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Abstract

Generative artificial intelligence (generative AI) has emerged as one of the most transformative technological advancements of the 21st century. In the realm of computer science education, its potential to revolutionize curriculum design, pedagogy, and the overall learning experience has generated considerable interest. This paper offers a comprehensive theoretical analysis of the multifaceted impact of generative AI on computer science education. Distinct from empirical studies, this research exclusively engages in a rigorous discussion anchored in existing theoretical frameworks and scholarly insights. Drawing from constructivist learning theory, technology acceptance models, and ethical considerations, the paper explores how generative AI tools might reshape the roles of educators and learners, transform the delivery of educational content, and stimulate innovation in computer science curricula. Furthermore, the analysis interrogates the potential challenges and risks associated with these technologies, including the dilemmas of academic integrity, algorithmic bias, and a possible overreliance on automation. The discussion concludes with reflections on the future trajectory of AI-enhanced learning environments and recommendations for theoretical development that may guide future empirical inquiries.

Keywords: Generative AI; Computer Science Education; Theoretical Analysis; Technology Acceptance

1. Introduction

The exponential growth and rapid development of artificial intelligence (AI) over the past decade have catalyzed transformative changes across industries, society, and academic research. Among the various branches of AI, generative artificial intelligence is particularly distinguished by its ability to create novel content, be it natural language, code, graphics, or even music, based on learned patterns from large datasets. In computer science education ─ a field continuously shaped by technological evolution ─ generative AI is poised to become a major agent of change

(Dai et al, 2023). This paper examines, from a purely theoretical perspective, how the integration of generative AI into computer science curricula might impact educational practices, curricular frameworks, and the nature of student learning.

Historically, computer science education has mirrored the pace of technological advancement. As programming languages, algorithmic methodologies, and computational paradigms have evolved, so too have pedagogical approaches aimed at equipping students with the required technical competencies. In recent years, the advent of generative AI has raised important questions about the future of education in this field (Alasadi and Baiz, 2023). How will machine-generated content change the nature of learning and teaching? In what ways might AI serve as a catalyst for innovation in content delivery and assessment? What ethical and theoretical challenges arise from the pervasive deployment of such technology? This paper does not address these questions through data collection or empirical research but instead offers a critical theoretical discussion built on established academic literature and conceptual models.

The significance of this study is twofold. First, it seeks to synthesize diverse theoretical insights concerning both AI technology and educational theory into a coherent narrative that explains the potential dynamics of human–machine interaction in educational settings. Second, by highlighting potential risks and challenges alongside the promising opportunities, the paper aims to stimulate further theoretical inquiry and eventually guide experimental research in the future. In doing so, it adds to the growing scholarly conversation regarding the role of disruptive technologies in shaping academic environments, while also urging careful consideration of the broader implications for pedagogy, academic integrity, and ethical governance.

The paper is structured as follows. In the subsequent section, a review of relevant literature and theoretical underpinnings is presented, focusing on constructivist learning theory, technology adoption models, and the ethical dimensions of AI integration in education. This is followed by a detailed theoretical analysis that synthesizes these perspectives into a set of integrative conceptual arguments regarding the transformative role of generative AI in computer science education. The discussion section then elaborates on the practical implications for educators, curriculum designers, and policy-makers, along with a critical examination of potential limitations of the proposed ideas. Finally, the paper concludes with a summary of key insights and recommendations for future theoretical and empirical research.

2. Theoretical Foundations and Literature Review

In order to understand the potential impact of generative AI on computer science education, it is necessary to first examine the foundational theories that have shaped our understanding of both the learning process and technological integration in educational settings. Two predominant theoretical traditions are particularly salient: constructivist learning theories and technology acceptance frameworks.

Constructivist theories of learning — rooted in the work of scholars such as Jean Piaget, Lev Vygotsky, and Jerome Bruner — advocate that learners construct knowledge actively rather than passively receiving information (Yıldız, 2025). According to constructivism, learning is most

effective when students are engaged in problem-solving, experimentation, and reflective practice that connects new knowledge with their pre-existing mental frameworks (Al Abri et al, 2024). In traditional computer science education, constructivist approaches have frequently been used to promote hands-on experiences, collaborative projects, and iterative learning cycles. Generative AI has the potential to serve as both a tool and a medium within this pedagogical framework (Baskara, 2024). By generating diverse code snippets, simulating computational problems, and providing adaptive feedback, AI can facilitate a learning environment that is dynamically responsive to individual student needs. This potential aligns closely with constructivist ideals by transforming the classroom into an interactive space where learners are empowered to explore multiple pathways to understanding complex technical content.

Parallel to constructivist thought, the study of technology acceptance and user adoption has produced numerous models designed to explain how and why individuals incorporate new technologies into their practices. The Technology Acceptance Model (TAM), first popularized by Davis (1989), posits that the perceived usefulness and ease of use of a technology are primary determinants of its adoption. Successive refinements, such as the Unified Theory of Acceptance and Use of Technology (UTAUT), extend this framework by considering additional factors including social influence, facilitating conditions, and user expectations regarding performance outcomes. Within computer science education, these models offer insights into the adoption curves of emerging technologies like generative AI and suggest that its impact will depend not only on the inherent capabilities of the technology but also on the perceptions, readiness, and training of both educators and students.

Another significant strand of theoretical work relates to the ethical implications of AI in education. The integration of AI systems in academic contexts raises critical questions concerning algorithmic bias, data privacy, academic integrity, and the transparency of machine-generated content. The literature highlights that while AI can provide personalized and scalable learning opportunities, it can also perpetuate existing social biases if not carefully monitored and regulated (Esmaeilzadeh, 2024). This duality necessitates the development of robust ethical frameworks that account for both the opportunities and risks of AI integration. Scholars argue that any theoretical analysis of generative AI in education must incorporate ethical deliberations as a core element, ensuring that technology augments rather than undermines the educational process (Baskara, 2024).

When these theoretical perspectives are synthesized, a complex picture of the potential influence of generative AI on computer science education emerges. On one hand, the constructivist framework emphasizes the potential for AI to foster active, experiential learning and to catalyze critical thinking through dynamic content generation. On the other hand, technology acceptance models remind us that the positive impact of AI is mediated by perceptions of usability and effectiveness. Finally, ethical considerations constrain the unbridled application of AI by emphasizing the need for oversight, transparency, and equitable access. In bringing these perspectives together, it becomes evident that the integration of generative AI in computer science education must be understood as a multidimensional phenomenon that simultaneously advances pedagogical innovation and challenges traditional academic values.

3. Theoretical Analysis and Integration

The core of this paper is devoted to a detailed theoretical analysis that integrates the previously discussed perspectives into a comprehensive framework. In so doing, the paper offers a series of interconnected arguments about the transformative potential and inherent challenges of incorporating generative AI into computer science education.

At its essence, the integration of generative AI into educational practices can be conceptualized as a process of cognitive augmentation (Yan et al, 2024). In traditional educational models, the transfer of knowledge has been largely linear, with educators delivering information in a top-down manner (Singh & Hardaker, 2017). Generative AI challenges this paradigm by enabling a bidirectional flow of information in which both educator and student become active participants in the learning process. By providing immediate, adaptive responses and generating novel educational content on demand, AI systems can act as cognitive partners that supplement the intellectual capabilities of human instructors. This not only supports a more individualized learning experience but also encourages students to engage in higher-order thinking processes as they interpret, critique, and adapt AI-generated outputs.

A key theoretical argument revolves around the notion that technology should serve as a mediator rather than a mere transmitter of knowledge. From the perspective of constructivist learning, generative AI can help create a learning environment wherein the traditional boundaries between teacher and learner, content creator and recipient, become blurred. In this new model, the role of the educator shifts from being the sole source of knowledge to becoming a facilitator of learning who orchestrates interactions between the student and the AI system. This is consistent with emerging pedagogical theories that advocate for a "blended" model of instruction, where human expertise and machine intelligence work in tandem to foster a deeper understanding of complex concepts. The AI system is not viewed as a replacement for human thought; rather, it functions as an extension of the educator's cognitive toolkit (Baker, 2000). Such a model is particularly apt for computer science education, where problem-solving, code synthesis, and debugging skills can be enhanced by iterative interactions with intelligent systems.

Central to this theoretical integration is the concept of "perceived utility." Rooted in technology acceptance models, the perceived utility of generative AI in the learning process is hypothesized to be a critical driver for its adoption. When students and educators alike recognize that an AI system can enhance understanding, reduce cognitive load, or stimulate creative problem-solving, they are more likely to integrate it into their daily routines (Lin & Chen, 2024). This perception is not static but evolves as users become more familiar with the technology and as its applications become more diversified. For instance, an AI tool that initially serves primarily as an automated code-completion assistant may later be repurposed to function as an interactive tutor that provides contextualized learning scenarios. Thus, the dynamic nature of perceived utility suggests that the influence of generative AI is likely to intensify over time as both its capabilities and user expectations mature.

Alongside utility, the ease of use of these systems is equally pivotal. According to TAM, if an AI system is perceived as overly complex or difficult to interact with, even its most advanced

functionalities may be rendered ineffective. Hence, any theoretical model of AI integration into education must account for the interplay between technical usability and pedagogical effectiveness. Ease of use is not merely a technical metric; it also encompasses the degree to which the technology aligns with the cognitive and motivational patterns of its users (Sobhanmanesh, 2023). In computer science education, where learners are often assumed to be more technically adept than in other disciplines, the baseline expectation for usability is higher. This creates a dual challenge: while AI systems must be sophisticated enough to offer genuinely intelligent feedback, they must also be designed in a manner that is intuitive and engaging for students whose primary focus is on mastering complex computational concepts.

Beyond utility and usability, a critical component of the theoretical framework is the examination of ethical considerations. The ethical dimensions of generative AI in education cannot be an afterthought; rather, they must be integrated into the very fabric of the learning process. The widespread adoption of AI tools raises issues related to intellectual property, data security, and academic honesty. For example, when a student relies on AI-generated code to solve an assignment, the question of authorship and academic integrity becomes problematic (Vetter, 2024). Similarly, if AI systems are trained on biased or incomplete datasets, there is a risk that these biases will be replicated in the educational content delivered to students. Addressing these challenges necessitates the development of ethical guidelines that govern the deployment and usage of AI in academic settings. Theoretical models must, therefore, incorporate ethical constraints as a moderator of technology adoption; that is, the positive impact of generative AI on learning outcomes is contingent upon the successful mitigation of ethical risks. This interplay between technological innovation and ethical responsibility forms a fundamental tension within the overall theoretical model.

Another significant theoretical concept concerns the evolving nature of assessment and feedback in an AI-enhanced educational context. Traditional assessment methodologies in computer science education have relied heavily on static examinations and periodic assignments. However, the incorporation of generative AI offers the potential to transform assessment into a continuous, adaptive process. With the assistance of AI, educators can provide real-time, nuanced feedback that is tailored to the evolving understanding of each student. This shift from static to dynamic assessment aligns with constructivist theories that view learning as an iterative process of hypothesis, experimentation, and reflection. The theoretical implications are profound: if assessment becomes an ongoing dialogue between the student and an intelligent system, the very nature of evaluation—and by extension, the nature of knowledge—must be reconsidered.

The integration of generative AI thus implies a transformative reconfiguration of the computer science educational ecosystem. Rather than viewing the technology merely as a supplemental resource or a tool for automating routine tasks, the proposed theoretical model conceptualizes AI as a central participant in the educational process. This reconceptualization has several far-reaching consequences. First, it challenges the traditional hierarchies within academic institutions, suggesting a model in which the pedagogical role is shared between human educators and intelligent machines. Second, it blurs the boundaries between content creation, learning, and assessment, thereby fostering a more holistic approach to education. Third, it highlights the

necessity of ongoing professional development and curricular reform, as educators must continually update their methodologies and strategies in order to fully capitalize on the benefits afforded by AI.

In synthesizing these diverse theoretical strands, the framework proposed in this paper rests on a tripartite foundation. The first pillar is the constructivist principle that learning is an active, self-directed process enhanced by adaptive, interactive technologies. The second pillar is the technology acceptance model, which asserts that perceptions of usefulness and ease of use are critical to successful technology integration. The third pillar is an ethical framework that moderates the application of technology through transparent guidelines and responsible practices. This integrated model provides a lens through which the impact of generative AI on computer science education can be understood, not as a monolithic process, but as a dynamic interplay of cognitive, technical, and ethical factors.

In theoretical terms, generative AI embodies a form of "machine creativity" that both challenges and complements human cognition. It offers the promise of generating multiple, equally valid solutions to complex problems — a capability that is particularly relevant in the context of coding and algorithm design. From a constructivist perspective, this multiplicity of solutions encourages students to explore different problem-solving strategies, thereby promoting a deeper and more resilient understanding of computational concepts. At the same time, the very unpredictability of machine-generated content can serve as a catalyst for critical reflection, as learners must constantly evaluate and discern the quality and appropriateness of the information presented. In this way, generative AI has the potential to transform the traditional dichotomy between teacher-led instruction and self-directed learning into a more fluid, interactive process.

The theoretical exploration presented here is not without its tensions. While the potential benefits of generative AI are numerous, it is imperative to acknowledge the risks inherent in relying too heavily on automated systems. One major concern is the possibility that extensive reliance on AI-generated outputs may result in a diminished capacity for independent thought and problem solving. If students become accustomed to receiving instant, machine-crafted answers, the incentive to engage in deep, analytical work may wane. This phenomenon, often described as "learned dependence," poses a significant challenge to the very foundations of academic inquiry. Educators must, therefore, strike a delicate balance between harnessing the pedagogical power of AI and ensuring that students continue to develop robust critical thinking skills. The theoretical model advanced in this paper contends that this balance can be maintained by integrating AI as a tool for augmentation rather than replacement; that is, by positioning generative AI as an assistant that prompts intellectual engagement rather than as a substitute for cognitive effort.

Another critical aspect of the theoretical analysis is the reconceptualization of the roles of both educator and student within the AI-enhanced classroom. In traditional models, the educator is viewed primarily as a knowledge provider, while the student is the passive recipient. In contrast, a learning environment augmented by generative AI demands a redefinition of these roles. Educators are increasingly required to assume the role of facilitators — designing interactive learning experiences that leverage the strengths of both human insight and machine intelligence.

Similarly, students must adopt a more active stance, engaging with AI systems in ways that foster analytical dialogue and reflective inquiry. This role redefinition aligns with emerging educational paradigms that prioritize collaboration and dialogue over unilateral information transmission. It also suggests that the development of soft skills—such as ethical reasoning, critical analysis, and collaborative problem solving — will become increasingly important in computer science education.

Moreover, the theoretical integration of generative AI into education raises important questions about the evolution of knowledge itself. In a traditional academic setting, knowledge is often viewed as a static body of information that is passed down from one generation to the next. By contrast, the dynamic and iterative nature of AI-generated content implies that knowledge may become more fluid and open to reinterpretation over time. This perspective resonates with postmodern views of knowledge as inherently provisional and contested (Cadag, 2024). In an AI-enhanced classroom, the creation of new knowledge becomes a collaborative enterprise, one that involves a continuous exchange between human creativity and machine-generated insights. The theoretical implications of this shift are profound, as they challenge long-held assumptions about the fixity of academic disciplines and the methods by which knowledge is validated and disseminated.

Central to the analysis is the recognition that the integration of generative AI in computer science education is not a linear process but rather a dynamic and recursive interaction between technology, pedagogy, and ethics. The emergence of AI tools capable of generating complex and contextually relevant outputs necessitates a continuous reevaluation of curricular practices and pedagogical strategies (Oluyemisi, 2023). This ongoing evolution creates what can be termed a "dialectical relationship" between technology and education, wherein each informs and shapes the other in a process of mutual transformation. The theoretical model proposed in this paper is intended to capture this dynamic interplay by emphasizing the need for flexible, adaptive educational frameworks that can evolve in tandem with technological innovations. In doing so, it offers a vision of education that is both resilient in the face of rapid change and capable of harnessing technological advances for the purpose of deeper, more effective learning.

Finally, the theoretical implications of integrating generative AI into computer science education extend beyond the boundaries of the classroom. As AI technologies continue to permeate all aspects of society, the ability of educational institutions to prepare students for a future in which human – machine interaction is ubiquitous becomes a matter of strategic importance. The framework advanced in this paper underscores the idea that computer science education must not only focus on technical proficiency but also cultivate the ethical and cognitive skills necessary to navigate the complexities of an AI-driven world. This includes fostering an awareness of the social and ethical dimensions of technology, promoting responsible innovation, and encouraging lifelong learning that is adaptable to evolving technological landscapes.

4. Theoretical Discussion and Implications

In light of the preceding analysis, it is instructive to reflect on the broader implications of generative AI for computer science education and consider what theoretical insights can be drawn for future educational innovation. This discussion is organized around several core themes: the transformation of pedagogical paradigms, the reconfiguration of educator–learner roles, the evolution of assessment and feedback, and the ethical and social imperatives that accompany technological integration.

First, the advent of generative AI challenges traditional pedagogical paradigms by necessitating the transition from didactic teaching methods to more dynamic, interactive, and student-centered approaches. The classical model of education, which privileges the transmission of fixed knowledge from teacher to student, is increasingly at odds with the realities of a digital world characterized by rapid change and diverse sources of information (Fichman, 2014). In this context, generative AI serves as a catalyst for pedagogical transformation by enabling a more responsive, adaptive, and dialogic mode of instruction. The theoretical implications of this shift are profound. If learning is reimagined as an iterative process that is co-constructed through continuous interaction between human and machine, then educators must develop new strategies that integrate digital tools into the fabric of classroom practice. This may include the use of AI-generated scenarios to simulate real-world problem solving, the deployment of interactive code generation platforms that provide instant feedback, and the creation of virtual learning environments that offer customized learning pathways. By facilitating these innovations, generative AI has the potential to dramatically enhance the quality and relevance of computer science education in a rapidly evolving technological landscape.

Second, the roles of educators and students are likely to undergo significant reconfiguration in an AI-enhanced learning environment. In such settings, educators are no longer the sole arbiters of knowledge but become facilitators who guide students as they navigate a complex array of resources and engage in critical inquiry. This shift in role has important theoretical implications: it suggests that the process of learning is inherently collaborative and that the boundaries between teacher and learner are increasingly porous. In this new paradigm, the educator’s expertise lies not only in delivering content but also in orchestrating interactions between various informational resources—including generative AI—and the student (Ruiz-Rojas et al, 2023). For students, the challenge is to learn how to critically evaluate and integrate AI-generated content within a broader context of academic inquiry and ethical deliberation. This requires the cultivation of new cognitive and metacognitive skills that enable students to discern the validity and reliability of information produced by both human and machine sources. The theoretical framework presented in this paper emphasizes that such a shift will have lasting implications for the nature of learning and the development of professional competencies in computer science and beyond.

A further theoretical consideration concerns the evolution of assessment and feedback mechanisms in the context of AI-enhanced education. Traditional assessment methods in computer science education have largely relied on summative evaluations such as examinations, quizzes, and static project assignments. While these methods provide important benchmarks for

measuring learning, they often fail to capture the dynamic and iterative nature of the learning process. Generative AI offers the possibility of continuous, formative assessment, in which feedback is provided in real time, allowing students to adjust their learning strategies and deepen their understanding incrementally. Theoretically, this represents a shift from assessment as a final judgment to assessment as an integral component of the learning process. By embedding assessment within the interactive experience of learning, educators can promote a culture of ongoing reflection and self-improvement. This has the potential to democratize the assessment process, making it more transparent and responsive to individual learning needs, while also providing educators with valuable insights into student progress and the effectiveness of instructional strategies.

Perhaps one of the most critical theoretical challenges associated with the integration of generative AI into computer science education is the need for robust ethical frameworks. As these technologies become more pervasive, the risk of unintended consequences — ranging from algorithmic bias and data security breaches to academic misconduct and the erosion of intellectual autonomy — grows correspondingly. A purely theoretical analysis must confront these ethical dimensions head on, recognizing that the promise of enhanced educational outcomes carries with it a parallel responsibility to safeguard the integrity of the learning process. Within the framework articulated in this paper, ethical considerations are not peripheral concerns but form a core component of any analysis of AI’ s impact on education. The cultivation of ethical literacy among educators and students, along with the development of institutional policies that promote transparent and accountable use of AI, is essential for ensuring that the adoption of these technologies does not undermine the fundamental values of academic inquiry. In theory, this requires a rethinking of traditional norms surrounding intellectual property, authorship, and the nature of innovation itself, as well as a commitment to continuous ethical review as AI systems evolve.

Finally, the broader social and cultural implications of integrating generative AI into computer science education must be considered. In many respects, the classroom serves as a microcosm of society at large, and innovations in educational practice have the potential to reverberate far beyond academic institutions. As students encounter AI as a routine component of their educational experience, they are likely to develop attitudes and competencies that influence how they interact with technology in their future careers and daily lives. The theoretical model advanced in this paper suggests that education—by virtue of its formative role—plays a critical part in shaping the ethical and intellectual contours of a technologically mediated society. In order to harness the potential of generative AI for social good, it is imperative that educational practices are aligned with broader public values such as fairness, accountability, and inclusivity. This alignment will require ongoing dialogue between educators, technologists, ethicists, and policymakers, as well as a willingness to revise and refine theoretical models in response to emerging challenges and opportunities.

5. Conclusion

In summary, this theoretical investigation has explored the complex dynamics through which generative artificial intelligence may shape the future of computer science education. By synthesizing insights drawn from constructivist learning theory, technology acceptance models, and ethical frameworks, the paper has advanced an integrated perspective that emphasizes the dual potential of AI as both a transformative educational tool and a source of significant challenges. At the core of this analysis is the recognition that generative AI possesses the capability to enhance the learning environment by providing adaptive, personalized, and contextually rich educational experiences. When deployed in ways that align with constructivist principles, AI systems offer the promise of transforming traditional teacher – student relationships into more collaborative, interactive engagements. The dynamic nature of AI-generated content, coupled with its ability to deliver tailored feedback and multiple problem-solving approaches, has the potential to foster a deeper, more resilient form of learning that goes beyond rote memorization and static knowledge transfer.

However, the potential benefits of generative AI cannot be divorced from the inherent challenges that accompany its integration. The theoretical framework developed in this paper underscores that the effective use of AI in education is contingent upon perceptions of both its utility and usability. Moreover, the risks of overdependence on automated systems, ethical dilemmas concerning academic integrity, and issues related to algorithmic bias serve as important moderators that may constrain the transformative potential of AI technologies. It is precisely this tension between opportunity and risk that necessitates a balanced, theoretically informed approach to the integration of generative AI into computer science curricula. The implications of this study extend well beyond the confines of computer science education. As generative AI becomes increasingly ubiquitous, the reconfiguration of educational practices will have broader repercussions for the development of workforce skills, the dissemination of knowledge, and the cultivation of an ethically aware citizenry. The theoretical insights presented here call for a reimagining of what it means to learn, teach, and innovate in an era characterized by rapid technological change. In this context, the successful integration of generative AI into education will require continuous theoretical engagement, agile curriculum design, and a commitment to ethical responsibility that together ensure the technology serves as an aid to human creativity rather than a substitute for it.

Looking ahead, several avenues for future theoretical inquiry and model refinement become apparent. Scholars must continue to interrogate the evolving relationship between human cognition and machine intelligence, exploring new theoretical models that account for the increasingly interactive and dynamic nature of AI-driven learning environments. Moreover, it will be essential to develop more comprehensive frameworks that integrate ethical, social, and technological dimensions, thereby offering a more holistic vision of how education can adapt to and shape the future of a digital society. The integration of generative AI is not a one-off technological intervention but part of a broader historical trajectory in which education and technology coevolve, each influencing the other in profound and unpredictable ways.

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References

Al Abri, M. H., Al Aamri, A. Y., & Elhaj, A. M. A. (2024). Enhancing student learning experiences through integrated constructivist pedagogical models. European Journal of Contemporary Education and E-Learning, 2(1), 130-149.

Alasadi, E. A., & Baiz, C. R. (2023). Generative AI in education and research: Opportunities, concerns, and solutions. Journal of Chemical Education, 100(8), 2965-2971.

Baker, M. J. (2000). The roles of models in Artificial Intelligence and Education research: a prospective view. Journal of Artificial Intelligence and Education, 11, 122-143.

Baskara, F. R. (2024). Generative AI as an Enabler of Sustainable Education: Theoretical Perspectives and Future Directions. British Journal of Teacher Education and Pedagogy, 3(3), 122-134.

Cadag, J. R. (2024). Problems and promises of postmodernism in (re) liberating disaster studies. Disaster Prevention and Management: An International Journal, 33(3), 167-180.

Dai, Y., Liu, A., & Lim, C. P. (2023). Reconceptualizing ChatGPT and generative AI as a student-driven innovation in higher education. Procedia CIRP, 119, 84-90.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS quarterly, 319-340.

Esmaeilzadeh, P. (2024). Challenges and strategies for wide-scale artificial intelligence (AI) deployment in healthcare practices: A perspective for healthcare organizations. Artificial Intelligence in Medicine, 151, 102861.

Fichman, R. G., Dos Santos, B. L., & Zheng, Z. (2014). Digital innovation as a fundamental and powerful concept in the information systems curriculum. MIS quarterly, 38(2), 329-A15.

Lin, H., & Chen, Q. (2024). Artificial intelligence (AI)-integrated educational applications and college students' creativity and academic emotions: students and teachers' perceptions and attitudes. BMC psychology, 12(1), 487.

Oluyemisi, O. M. (2023). Impact of Artificial intelligence in curriculum development in Nigerian tertiary education. International Journal of Educational Research, 12(2), 192-211.

Ruiz-Rojas, L. I., Acosta-Vargas, P., De-Moreta-Llovet, J., & Gonzalez-Rodriguez, M. (2023). Empowering education with generative artificial intelligence tools: Approach with an instructional design matrix. Sustainability, 15(15), 11524.

Singh, G., & Hardaker, G. (2017). Change levers for unifying top-down and bottom-up approaches to the adoption and diffusion of e-learning in higher education. Teaching in Higher Education, 22(6), 736-748.

Sobhanmanesh, F., Beheshti, A., Nouri, N., Chapparo, N. M., Raj, S., & George, R. A. (2023). A cognitive model for technology adoption. Algorithms, 16(3), 155.

Vetter, M. A., Lucia, B., Jiang, J., & Othman, M. (2024). Towards a framework for local interrogation of AI ethics: A case study on text generators, academic integrity, and composing with ChatGPT. Computers and composition, 71, 102831.

Yan, L., Greiff, S., Teuber, Z., & Gašević, D. (2024). Promises and challenges of generative artificial intelligence for human learning. Nature Human Behaviour, 8(10), 1839-1850.

Yıldız, T. (2025). From Constructivism To Cultural Cognition: A Comparative Analysis Of Piaget, Vygotsky, And Tomasello'S Theories Of Cognitive Development. Humanitas-Uluslararası Sosyal Bilimler Dergisi, 13(25), 411-429.