BRAIN. Broad Research in Artificial Intelligence and Neuroscience

e-ISSN: 2067-3957 | p-ISSN: 2068-0473
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2025, Volume 16, Issue 1, pages: 10-21.
Submitted: January 2nd, 2024 | *Accepted for publication:* January 25th, 2025

Generative AI in the Information Society: Implications for Higher Education and Research

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Abstract: *Generative Artificial Intelligence (GenAI) represents a fundamental shift in AI development, moving from rule-based systems to neural networks capable of creating novel content and solving complex problems through pattern recognition and contextual understanding. This evolution challenges traditional Computer Science (CS) paradigms, as evidenced by innovations in large language models and diffusion-based image generation. This paper investigates how GenAI's emergence affects education and research in computer science and related fields. Through White's cultural model—examining technological, societal, and institutional dimensions—we analyse how GenAI's capabilities diverge from traditional CS approaches in both theory and practice. Our research reveals specific challenges for higher education, including the need to teach contextual reasoning, handle emergent behaviors, and develop adaptive problem-solving skills. We propose educational strategies such as project-based learning with GenAI tools and cross-disciplinary integration. These recommendations aim to establish GenAI as a distinct academic discipline while preparing students and researchers for its increasing role in scientific and professional practices.*

Keywords: *Generative AI; information society; cultural studies, higher education; scientific research; epistemological shift.*

How to cite: Levin, I., Bukhshtaber, N., & Minyar-Beloruchev, K. (2025). Generative AI in the Information Society: Implications for Higher Education and Research *BRAIN. Broad Research in Artificial Intelligence and Neuroscience*, *16*(1), 10-21. https://doi.org/10.70594/brain/16.1/1

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1. Introduction

The emergence of Generative Artificial Intelligence (GenAI) represents an unprecedented technological shift that fundamentally reshapes how we interact with and create digital systems. Its immense potential and numerous applications have drawn considerable attention from both the academic community and the public. Active discussions about its capabilities, ethical aspects, and social consequences are ongoing. This interest stems from GenAI's unprecedented functionality, the enigmatic nature of its advanced human-like behaviour, personalised interactions with people, and its wide accessibility (Pearce et al., 2023).

This revolutionary technology raises fundamental questions about how to teach both the principles behind GenAI and the transformative developments it has introduced, including new approaches to creativity, problem-solving, and human-AI collaboration. Yet, current approaches treat GenAI primarily as an assistive tool within traditional Computer Science (CS) education, focusing mainly on integrating GenAI tools into programming instruction for tasks like code completion and debugging. While these approaches enhance students' learning experience and make programming more accessible, they do not fundamentally address the unique challenges of teaching GenAI as a distinct field. Research on how to effectively teach GenAI principles and equip students with the novel skills required to design and develop such systems remains crucial for advancing both education and the field itself.

Moreover, curricula development emphasising the underlying concepts of GenAI models—such as probabilistic reasoning, non-linear dynamics, and contextual adaptability—remains sparse. Traditional CS education, with its strong emphasis on algorithmic thinking and deterministic problem-solving, provides a solid foundation. However, it does not fully address the new principles introduced by GenAI, which call for additional educational approaches to equip learners with the ability to conceptualise, design, and manage systems that generate content and adapt to contextual variations.

Our paper intends to address this gap by focusing on key issues essential for developing comprehensive educational models that incorporate both the theoretical foundations of GenAI and the practical skills needed to build and refine these systems. It adopts an interdisciplinary approach to provide a holistic understanding of GenAI's capabilities and limitations. Recognising the inherently multidisciplinary nature of this field—which spans conceptual frameworks, scientific foundations, and professional practice—this paper proposes to examine CS and GenAI as distinct cultural phenomena.

The primary aim of this paper is to critically evaluate the distinct characteristics of GenAI in comparison to traditional CS, assessing whether these differences justify the development of a specialised curriculum. To achieve this, we will systematically examine GenAI and CS through three complementary perspectives aligned with planes within White's cultural space model. While the analysis will focus primarily on GenAI as an emerging field, it will also include a thorough examination of CS to establish a solid comparative basis.

The current study is grounded in the following considerations. First, we propose that significant conceptual and theoretical differences exist between the approaches of GenAI and CS, both as scientific fields and as areas of practice. These differences go beyond technical distinctions, encompassing unique epistemological frameworks and methodologies, thereby positioning GenAI as a distinct paradigm with specific principles and applications.

Second, we suggest that the rise of GenAI has introduced new requirements for professional and research-related competencies and skills. It has redefined the required professional knowledge, reshaped human-technology interactions, and transformed professional roles. GenAI has introduced new research methodologies, enhancing traditional scientific approaches grounded in generalisation with capabilities for context-aware analysis and content generation. It enables researchers to identify and explore previously overlooked 'gray' areas—domains of knowledge that were previously inaccessible due to human cognitive limitations, bounded rationality, or computational constraints. By revealing patterns, correlations, and insights that might otherwise remain unnoticed,

GenAI expands the scope of scientific discovery. However, leveraging these new capabilities requires the development of specialised research skills, including the ability to critically assess AI-generated insights, integrate them with established knowledge, and navigate the epistemological challenges they present. Testing this premise is crucial, as the specialised skill sets demanded by GenAI directly influence both the learning outcomes in IT education and the evolving methodologies for conducting research, ultimately informing the design of training programs for future professionals in this field.

Third, these conceptual and theoretical distinctions, together with evolving competencies and skill sets, make it worthwhile to establish GenAI as a separate academic discipline with dedicated content, teaching and research methodologies, and educational processes. This new discipline, with its own foundational knowledge and learning outcomes, requires an approach distinct from traditional CS, fostering unique reasoning, problem-solving, and ethical decision-making skills. Given GenAI's interdisciplinary nature and its ethical and societal implications, the educational approach must also address the expanded role of IT specialists in AI-integrated environments, preparing students to navigate the complex challenges and responsibilities in a rapidly advancing technological landscape.

2. Theoretical Framework: Three-Dimensional Model of Culture

Our study adopts White's (1949/2005) three-dimensional model of cultural space as its theoretical framework. Widely validated in previous research, this model has demonstrated its analytical utility across diverse academic domains (Levin & Mamlok, 2021; Levin & Minyar-Beloruchev, 2024; Levin, Minyar-Beloruchev, & Marom, 2025). Applying White's framework enables a systematic examination of the fundamental differences between CS and GenAI, thereby supporting their conceptualisation as distinct cultural phenomena.

The theoretical framework conceptualises cultural space as a three-dimensional construct defined by intersecting axes of *knowledge, values, and regulatives.* Within this framework, each pair of axes forms a distinct plane representing a fundamental aspect of cultural space: the knowledge-values plane constitutes the *ideational culture,* the values-regulative plane defines the *social culture,* and the regulative-knowledge plane represents the *scientific culture* (Figure 1). This tripartite structure provides a comprehensive analytical framework for examining the complex interrelationships that characterise CS and GenAI as cultural phenomena.

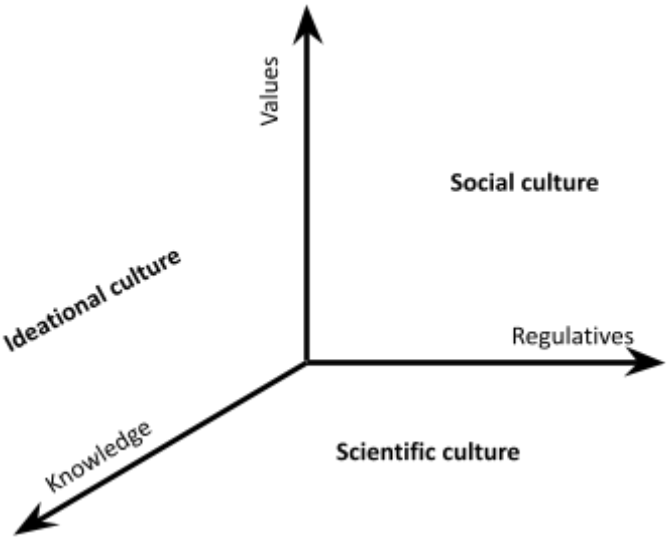

Figure 1. Three-dimensional model of culture.

Our study builds upon previous research by our team, particularly our investigations into Digital Culture and GenAI as cultural phenomena. We analysed these phenomena—understanding culture as a constellation of symbols, expressive forms, and beliefs shared across societies and human groups, representing human-made constructs distinct from the natural world—and their roles within education.

White's three-dimensional cultural model has been applied in several recent studies on Digital Society and GenAI. Levin and Mamlok (2021) identified global cultural trends in the digital society: the individualisation of spiritual culture, the transparisation of social culture, and the cognification of technological culture. These trends suggest that individuals in the digital world cultivate unique cultures while engaging with and contributing to a shared cultural heritage. Meanwhile, scientific culture is transformed through cognification, radically reshaping our world perception.

With GenAI, these transformations extend to cognitive and epistemological shifts in human consciousness through cognification, enhancing objects and systems with artificial intelligence. Levin and Minyar-Beloruchev (2024) studied GenAI not merely as a tool but as a cultural transformative innovation, enabling new forms of human partnership, reimagining societal interactions with intelligence and creativity, and redefining cultural norms to extend human potential. As Levin and Minyar-Beloruchev (2024) discussed, GenAI, from an ideational perspective, amplifies creativity, fosters human-AI collaboration, and personalises cultural experiences. Viewed from a social standpoint, it democratises creativity, influences social interactions, and raises ethical questions. From a scientific standpoint, GenAI represents a new cognitive form, advancing epistemological insights and reshaping how humans understand knowledge creation.

Levin, Minyar-Beloruchev, & Marom (2025) explored the impact of GenAI on education. Traditionally centered on social culture and societal norms, education in the GenAI era must now balance these with spiritual and technological dimensions. In this context, the spiritual culture of education, framed as 'Existential Self-Awareness', fosters creative freedom, enabling learners to explore their identities and values. Social culture evolves through 'Generative Socialisation', as AI agents facilitate novel teacher-student interactions and foster new forms of collaboration. Meanwhile, education's technological culture shifts from being purely instrumental to epistemological, generating knowledge through human-AI interactions, a shift described as 'Epistemological Technological Culture'.

Building on this foundation, the next section extends White's three-dimensional model by applying it to analyse GenAI and CS as distinct cultural paradigms. By examining their manifestations across ideational, scientific, and social-cultural dimensions, we aim to highlight their fundamental differences in principles and practices, setting the stage for a discussion of their implications for education and research in the following section.

3. Generative AI and Computer Science as Distinct Cultural Paradigms: A Three-Dimensional Analysis

Applying the three-dimensional model of culture, we examine CS and GenAI as distinct cultural phenomena through their manifestation in three stances: the conceptual stance, which encompasses their main ideas; the theoretical stance, which addresses their theoretical foundations; and the professional stance, which reflects professional norms and practices. Our framework aligns these stances with the planes of White's cultural model: the conceptual stance corresponds to ideational culture, defined by the plane of knowledge and values; the theoretical stance aligns with scientific culture, shaped by the plane of knowledge and regulatives; and the professional stance maps onto social culture, situated within the plane of values and regulatives.

The following offers a more in-depth exploration of each stance.

3.1. Conceptual stance: Generative AI vs. Computer Science

Over the past half-century, the digital transformation of society was driven by computational technologies, that automate and optimise a vast range of human activities. In response to this computerisation, the educational system structured and advanced the field of CS. However, with the rise of GenAI, society has entered a new phase of digital evolution where AI emphasises cognitive functions, with computing now playing a supportive role. This transition, often described as 'cognification', reflects the move toward technologies that emulate human understanding over traditional computation, and the associated changes in education require deep reflection (Kelly, 2016).

One of the initial insights that motivated our research is that, from a conceptual stance, the emergence of GenAI marks a profound shift from computing-centered to cognition-centered technologies (Rapaport, 2023).

The conceptual stance corresponding to an ideational culture of CS revolves around the concept of *computing*, which serves as its fundamental essence. Rapaport (2023) broadly defines computing as the systematic manipulation of symbols or data according to well-defined rules or algorithms to achieve specific outcomes or solve problems. This process involves the manipulation of abstract symbols through finite, algorithmic procedures, relying on abstraction and representation to simplify complex systems into manageable models. Importantly, computing is primarily suited for solving structured problems, where human intelligence plays a critical role in framing the problem, defining its structure, and determining the purpose of computation. Drawing on Turing's foundational contributions, computing is framed as a universal, mechanistic process that underpins problem-solving and interaction in the digital world, transcending specific domains and finding applications in fields ranging from mathematics to art.

In contrast, GenAI transcends the structured, algorithmic approach of traditional computing by centering on cognitive understanding and perception. While computing relies on predefined structures and human-guided problem framing, GenAI addresses weakly structured or even unstructured problems, requiring less predefined input and expanding the boundaries of problem-solving. GenAI's primary goal is to process information and create adaptive models capable of interpreting and learning within new contexts. This positions GenAI as a cognitive technology focused on generating meanings and engaging in complex, context-dependent data interactions. The ideational culture of GenAI reflects a profound shift toward *machine-mediated cognition*, enabling not only computation but also conceptualisation and innovation.

Unlike other types of AI, GenAI distinguishes itself by generating content that often rivals human creations in quality. While GenAI does encroach upon the uniquely human domain of creativity, it ultimately complements it, serving as a transformative tool that enhances the creative process and introduces new avenues for cultural production. By learning patterns from vast amounts of data, GenAI synthesises and transforms existing knowledge into original works, uncovering insights and possibilities that may have been overlooked due to human cognitive limitations or bounded rationality (Levin & Minyar-Beloruchev, 2024; Levin, Minyar-Beloruchev, & Marom, 2025). This capacity to reveal and address 'gray areas' in knowledge demonstrates GenAI's ability to expand the horizons of both human creativity and problem-solving, marking a significant departure from the traditional frameworks of CS. This shift toward machine-mediated cognition underpins GenAI's transformative potential, distinguishing it from traditional computing and other forms of AI.

To fully understand GenAI's capabilities, it is essential to explore the foundational process of acquiring, processing, and applying knowledge to achieve goals, solve problems, and adapt to changing environments—commonly referred to as cognition. This dynamic phenomenon serves as the cornerstone of GenAI. It involves manipulating information through perception, memory, reasoning, and decision-making, supported by learning from experience and adapting to new contexts (Krauss, 2024). Cognition is purposeful and interactive, engaging with real-world conditions and influenced by the agent's physical and environmental context. In GenAI, cognition is

realised through digital systems that emulate or enhance human intelligence, bridging disciplines like neuroscience, psychology, and computer science to design systems capable of cognitive functions, learning, and adapting.

Such fundamental differences in ideational culture clearly shape both the understanding and perception of CS and GenAI as distinct fields. These differences were highlighted, for instance, in the research of Touretzky, Chen, & Pawar (2024), who identified the critical shifts required for teaching AI in schools in the modern era.

3.2. Theoretical stance: Generative AI vs. Computer Science

The theoretical stance corresponding to the scientific culture of CS is rooted in the concept of the *algorithm*, defined as a finite, step-by-step procedure for solving problems or achieving specific outcomes (Rapaport, 2023). Algorithms, grounded in mathematical principles, embody the essence of computation by providing a rigorous framework for formalising problem-solving processes. Turing's theoretical model of computation, based on algorithms, demonstrates their universality and mechanical nature, linking them to foundational questions in mathematics, such as decidability and computability. This top-down approach reflects a method where human intelligence structures problems in advance, and algorithmic processes execute solutions with logical precision. The scientific foundation of CS is thus heavily reliant on algorithmic knowledge, underpinned by formal systems and mathematical rigor.

In contrast, GenAI represents a paradigm shift toward a data-driven bottom-up approach. Instead of relying on predefined rules or hypotheses, GenAI models, such as Generative Adversarial Networks (GANs) and transformer architectures, learn through patterns extracted from vast datasets. This process departs from traditional algorithmic problem-solving by allowing the system to generalise and adapt dynamically, broadening the scope of discovery and innovation. Unlike CS's structured framework, GenAI thrives in addressing weakly structured or unstructured problems, making flexibility, adaptability, and data-centric heuristic reasoning its core scientific foundations.

The scientific foundation of GenAI is deeply interdisciplinary, requiring a shift in focus from algorithmic knowledge to advanced mathematical, statistical, and computational principles that underpin model development and use. This foundation includes linear algebra and tensor calculus, such as eigendecomposition and singular value decomposition, which are essential for understanding model structures. Multivariable calculus and optimisation play a critical role in training models, with techniques like gradients and partial derivatives enabling effective adjustments during learning processes. Probability and statistics, including concepts from measure theory, provide the tools needed to model uncertainty inherent in data-driven systems. Additionally, functional analysis and numerical methods address computational stability (Russell & Norvig, 2021; Nelson, 2023), ensuring that large-scale models can operate effectively in real-world applications. Together, these principles form the core of GenAI's scientific culture, reflecting its departure from traditional algorithmic approaches.

These foundations highlight how data-driven approaches expand our ability to process and interpret large datasets. Within the GenAI domain, this scientific perspective evolves beyond traditional algorithmic understanding by integrating advanced structural analysis of data, enabling more nuanced and context-aware insights.

From a user perspective, GenAI's adaptability provides a new layer of interaction, shifting its use from deterministic computation to dynamic exploration and problem-solving. GenAI models serve as tools for augmenting human capabilities, enabling users to explore larger problem spaces, uncover 'gray areas' in knowledge, and dynamically adapt solutions to evolving contexts. This transformation underscores the shift in scientific culture from deterministic processes to probabilistic modeling and adaptability, offering opportunities for both deeper engagement and broader applications.

GenAI's scientific culture thus emphasises *big data and adaptability*, diverging from the rigid algorithmic foundations of CS. Transparency, interpretability and the ability to critically assess

AI-generated insights are key elements of this culture, making the use of GenAI models more accessible and meaningful. This perspective not only reshapes how specialists approach model development but also highlights the skills needed for effective interaction with GenAI tools. These include prompt engineering, critical assessment of outputs, and leveraging AI for heuristic problem-solving.

The transition from traditional algorithmic thinking to a data-driven paradigm presents challenges for education, necessitating a greater focus on interdisciplinary knowledge. This includes natural language processing for understanding human communication (Patrut & Boghian, 2012; Carrasco Ramírez, 2024), advanced mathematics for model tuning, and human-AI interaction design for user-friendly GenAI integration (Raees et al., 2024). These shifts demand a comprehensive rethinking of curricula to prepare specialists capable of both developing and effectively using GenAI, marking a significant departure from the educational approaches traditionally associated with CS.

3.3. Professional stance: Generative AI vs. Computer Science

The professional stance aligned with the social culture of CS is clearly reflected in the widespread practice of *programming*. This activity is closely tied to the development of computational thinking, an essential and widely recognised skill that has been established as a core competency for the 21st century (Wing, 2006).

The emergence of GenAI, however, has catalysed a significant shift from traditional CS programming to innovative approaches in system development. This new paradigm, known as *adaptive dialogic interaction*, prioritises LLM-based system interaction, fundamentally transforming software development practices and prompting a reevaluation of the role of traditional computational thinking as a core competency of our era.

GenAI automates code generation, design, and testing processes, enabling natural language interactions and supporting ‘low-code’ or ‘no-code’ environments. Systems like GPT can now manage workflows and configurations through natural language commands, reducing the need for extensive programming expertise.

While conventional programming relies on explicit rules and symbolic logic, adaptive dialogic interaction employs machine learning algorithms and large datasets to enable natural language interactions between users and AI systems. This approach allows GenAI to dynamically interpret and respond to human inputs, creating more intuitive user experiences. Prompt engineering has emerged as a critical skill for maximising GenAI’s potential, with developers becoming orchestrators of GenAI-driven processes rather than traditional programmers.

The transition to GenAI systems introduces a collaborative dynamic where developers and users become co-creators in shaping system behaviour. Through natural language interfaces and probabilistic models, systems interpret and approximate user intentions rather than implementing them as exact commands. This marks a departure from the traditional top-down approach of translating specifications into formal algorithms.

This evolution is inherently tied to the challenge of developing responsible AI (Dignum, 2019), which demands integrating social, ethical, and contextual considerations beyond purely technical imperatives. The developer’s role has evolved from designing deterministic algorithms to mediating between human intentions, ethical considerations, and AI capabilities. This includes managing uncertainty, ensuring ethical compliance, and balancing system autonomy with accountability.

The collaborative nature of *adaptive dialogic interaction* represents a profound redefinition of professional skills, where developers serve as orchestrators and co-participants in building intelligent, responsible, and context-aware systems.

A comparative vision of CS culture and GenAI culture based on a three-dimensional model is graphically summarised in Figure 2.

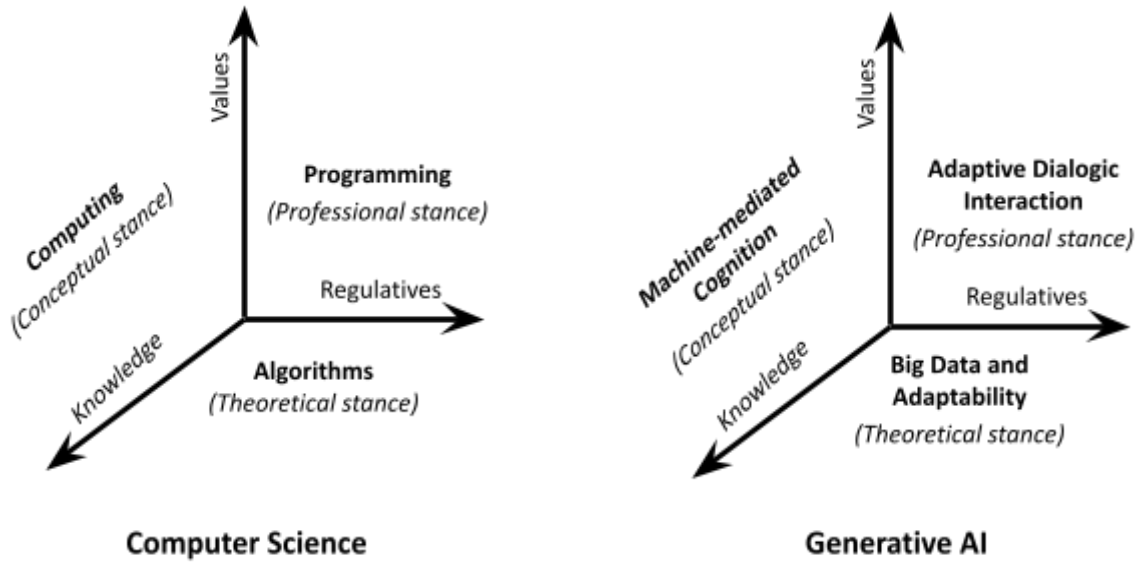

Figure 2. Three-dimensional model of culture (Computer Science vs. Generative AI).

These findings emphasise the transformative potential of GenAI as a distinct academic paradigm, underscoring the need for reimagined educational frameworks and research methodologies. The following section explores these implications further, focusing on how higher education and research must adapt to meet the challenges and opportunities presented by GenAI.

4. Discussion

The analysis in the preceding section highlights GenAI's emergence as a transformative cultural paradigm that diverges fundamentally from traditional frameworks of CS. This divergence spans ideational, scientific, and social dimensions, reflecting a broader paradigmatic shift. Central to this shift is an epistemological transformation that redefines how knowledge is created, disseminated, and applied. This section examines this transformation, first by analysing the epistemological implications of GenAI's emergence for CS and then by exploring its broader impact on higher education and research. Together, these discussions underscore how GenAI necessitates established educational frameworks rethinking and research practices to address the challenges and opportunities of the information society.

4.1. Generative AI and the Epistemological Shift in Computer Science

The cultural distinctions between GenAI and CS analysed through conceptual, theoretical, and professional stances, reveal a paradigmatic shift with profound epistemological implications. Driven by changes in how knowledge is conceptualised, structured, and applied, this transformation fundamentally redefines the foundations of CS. Expanding on the analyses from the previous section, we argue that these shifts across all three cultural dimensions collectively signify an epistemological turning point, positioning GenAI as a distinct academic paradigm. This foundational change challenges traditional knowledge frameworks, paving the way for methodologies that embrace complexity, generativity, and contextual adaptation.

This shift marks a departure from deterministic computational frameworks toward cognitively oriented, data-driven methodologies. In professional practice, this manifests as a transition from conventional algorithmic programming to interactive, natural language–based engagements with systems built on large language models and extensive datasets. A pivotal insight from examining these changes is the identification of an encompassing phenomenon accompanying GenAI adoption: the 'epistemological shift'.

Traditional CS, grounded in established epistemological principles, has emphasised universal truths through generalisation and abstraction. This classical approach distills phenomena into fundamental principles, building hierarchical structures of knowledge. GenAI disrupts this

paradigm by introducing an alternative framework—one that embraces complexity, specificity, and emergent knowledge.

At the heart of this shift lies the principle of generativity—GenAI's ability to produce novel, context-specific outputs. This capacity challenges the notion that knowledge must be reduced to abstractions to hold value. Instead, it demonstrates that understanding can emerge from the richness of details and diversity of possibilities. This transformation particularly manifests in the changing relationship between explanation and prediction. While classical methodologies emphasise explanatory theories and causal mechanisms, GenAI excels at producing accurate predictions without requiring explicit explanations of its processes.

GenAI introduces a participatory and dynamic model of knowledge formation, departing from the traditional view of knowledge as something to be discovered. By fostering active interactions between users and systems, it enables the collaborative construction of knowledge that evolves through specific contexts. This approach aligns with Wolfram's contemporary theory of inter-conceptual space, suggesting that the universe of knowledge should be viewed as a multidimensional realm of possibilities rather than a static set of fixed truths (Wolfram, 2023).

The epistemological shift driven by GenAI not only challenges traditional frameworks of CS but also necessitates a reevaluation of how knowledge is created, disseminated, and applied. By embracing generativity, context-specificity, and collaborative knowledge formation, GenAI redefines what it means to engage with and produce knowledge in the digital age. This transformation extends beyond theoretical considerations, directly influencing how education and research must adapt to equip learners and professionals with the skills to navigate this paradigm shift. The next section discusses the practical implications of this transition, focusing on the changes required in higher education and research to integrate the potential of GenAI.

4.2. Implications for Higher Education and Research

The rise of GenAI as an autonomous academic and cultural paradigm demands significant changes in higher education and research frameworks. Traditional approaches, which have long centered on standardised curricula and uniform learning objectives, are increasingly misaligned with GenAI's emergent, context-sensitive nature. To address the opportunities and challenges posed by GenAI, education systems must pivot toward personalised, adaptive, and interdisciplinary learning models that prepare students to navigate this rapidly evolving field.

In research, GenAI's exploratory capabilities enable the discovery of novel solutions and insights that transcend the limitations of traditional hypothesis-driven, deductive reasoning. This new form of inquiry blends creativity, exploration, and generativity with established analytical and deductive methods. By leveraging vast datasets and adaptive modelling, GenAI expands the boundaries of discovery, opening previously inaccessible 'gray areas' of knowledge.

The recognition that GenAI transforms not only how knowledge is accessed but also how it is generated and applied necessitates a systemic reimagining of teaching and learning, fundamentally altering the dynamics of social interaction between educators and students. Educators are no longer confined to the traditional role of transmitting standardised bodies of knowledge and assessing memorisation; instead, they are evolving into collaborators in the process of knowledge co-creation, actively participating in the generative process alongside learners. In this reimagined role, they guide students in leveraging GenAI's capabilities to explore new ideas, tackle complex problems, and develop innovative solutions.

This transformation makes the teaching process inherently collaborative, emphasising dynamic interaction and the continuous adaptation of educational content to address the evolving needs of learners. For students, learning becomes increasingly rooted in exploration and innovation, as they gain the ability to engage with complex datasets, experiment with generative tools, and personalise their educational journeys. GenAI opens opportunities for learners to uncover patterns, generate unique insights, and apply their creativity in previously inaccessible ways, fostering a more active and empowered role in their education.

To align with the epistemological transformations brought by GenAI, educational institutions must reinvent their pedagogical frameworks. Traditional curricula, with their strong emphasis on algorithmic thinking, provide a solid foundation but require expansion to meet the demands of data-driven and generative methodologies. Students must be equipped with a hybrid skill set that includes advanced mathematics (e.g. tensor calculus and optimisation), data science, and human-AI interaction design, coupled with critical thinking and ethical decision-making abilities to effectively assess and responsibly manage AI systems. These changes highlight the urgency of redefining educational goals and methods.

Several higher education institutions are already pioneering efforts to incorporate GenAI into their curricula. For example, advanced courses at leading universities like Stanford and MIT emphasise deep learning, neural networks, and generative models. However, such initiatives remain limited in scope. A broader adoption requires embedding GenAI concepts at multiple educational levels, from foundational courses to advanced interdisciplinary programs. Topics such as prompt engineering, probabilistic reasoning, and contextual modelling should become integral components of the academic experience, ensuring that students are equipped for practical engagement with GenAI systems.

Project-based and collaborative learning approaches are particularly effective in teaching GenAI principles. By engaging students in building and experimenting with generative models, these methods foster hands-on experience, critical thinking, and creative skills. Such approaches mirror real-world applications, preparing students for multidisciplinary teamwork and problem-solving in diverse professional contexts.

Research also plays a pivotal role in refining methodologies for teaching GenAI. By exploring how generative models can augment human creativity, optimise cognitive load, and support dynamic knowledge creation, researchers can offer valuable insights into designing effective educational practices. Moreover, fostering AI literacy as part of broader digital competencies empowers students to navigate the ethical, cognitive, and societal dimensions of GenAI, ensuring that they can engage with this transformative technology responsibly and effectively.

To sum up the discussion presented in this section, it should be noted that GenAI, as a newly emergent autonomous field, reshapes the foundations of education and research, challenging education institutions to adapt to its evolving possibilities. By fostering personalised, adaptive, and collaborative learning environments, higher education can unlock the full potential of GenAI, equipping learners to thrive in the information society. This transformation not only addresses the immediate demands of the digital era but also lays the groundwork for sustained innovation and growth in response to future technological advancements.

5. Conclusions

This paper aimed to explore GenAI as an academic discipline by contrasting it with traditional CS through White's three-dimensional cultural model. Our analysis uncovered fundamental differences: while CS emphasises structured problem-solving and algorithmic rigor, GenAI introduces a new paradigm rooted in machine-mediated cognition, adaptive dialogic interactions, and generative methodologies that produce new meanings and values. These cultural differences not only highlight GenAI's emergence as a distinct academic paradigm but also reveal its transformative potential for reshaping education and research.

Through this exploration, it became clear that the changes we observed in GenAI's ideational, theoretical, and professional dimensions signify something much larger—a profound epistemological shift. This shift redefines how knowledge is created, shared, and applied, challenging long-standing paradigms and demanding new approaches in both teaching and scientific inquiry. GenAI doesn't just offer tools for automation; it invites us to rethink the very nature of creativity, exploration, and problem-solving while acknowledging the weight of new responsibilities.

In education, this means moving away from standardised curricula and static knowledge transfer toward personalised, collaborative, and interdisciplinary learning experiences. Teachers are no longer mere content transmitters but collaborators in the process of co-creating knowledge with students in ways tailored to individual needs. At the same time, learners are empowered to explore complex datasets, uncover patterns, and engage in innovative thinking. Similarly, in research, GenAI enables us to venture into uncharted territories, revealing 'gray areas' of knowledge that were once inaccessible and sparking innovations that transcend traditional methodologies. However, these opportunities come with obligations. We must prepare both educators and students to use GenAI responsibly, ensuring that its transformative potential aligns with ethical, social, and cultural values. This calls for developing AI literacy, fostering critical thinking, and instilling the skills necessary to navigate the complexities of an AI-driven world.

As we look to the future, GenAI represents more than a technological tool. As a transformative cultural phenomenon, GenAI holds the potential to redefine the role of higher education and scientific discovery in the information society. Realising this potential requires more than adaptation—it calls for curiosity, creativity, and bold thinking. We must embrace GenAI not only as a new discipline but as a new lens through which to view our world. Yet, as we adopt this new paradigm, we must ensure that our exploration is guided by responsibility and a commitment to advancing GenAI's development and use in the service of humanity. We call on the academic community to deepen research in this area, to better understand how GenAI can be harnessed for scientific discovery, and to uncover new ways of teaching and learning responsibly in an era defined by its possibilities. The horizons are vast; it's time to explore them.

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