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The Manifesto for Teaching and Learning in a Time of Generative AI: A Critical Collective Stance to Better Navigate the Future

EDITORIAL

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ABSTRACT

This manifesto critically examines the unfolding integration of Generative AI (GenAI), chatbots, and algorithms into higher education, using a collective and thoughtful approach to navigate the future of teaching and learning. GenAI, while celebrated for its potential to personalize learning, enhance efficiency, and expand educational accessibility, is far from a neutral tool. Algorithms now shape human interaction, communication, and content creation, raising profound questions about human agency and biases and values embedded in their designs. As GenAI continues to evolve, we face critical challenges in maintaining human oversight, safeguarding equity, and facilitating meaningful, authentic learning experiences. This manifesto emphasizes that GenAI is not ideologically and culturally neutral. Instead, it reflects worldviews that can reinforce existing biases and marginalize diverse voices. Furthermore, as the use of GenAI reshapes education, it risks eroding essential human elements—creativity, critical thinking, and empathy—and could displace meaningful human interactions with algorithmic solutions. This manifesto calls for robust, evidence-based research and conscious decision-making to ensure that GenAI enhances, rather than diminishes, human agency and ethical responsibility in education.

INTRODUCTION

> *Key metaphors help determine what and how we perceive and how we think about our perceptions."* — M. H. Abrams

The future is filled with unknowns, mysteries, and alternative possibilities. When faced with uncertainty, humans write stories, create myths, or use metaphors to better comprehend emerging phenomena. These stories become reified in the tools and practices we invent (Sharples & Pérez y Pérez, 2022). They allow us to cope with the unknown by connecting it to what is already familiar. In this context, metaphors serve as powerful mechanisms for understanding complex ideas, conveying meaning and helping us to conceptualize events and concepts through analogies (Saban et al., 2007). Metaphors also serve as valuable onboarding tools, offering an initial framework for understanding complex concepts. While these metaphors may break down upon deeper examination, they play a critical role in scaffolding early comprehension. As understanding develops, more subtle structures and insights emerge and gradually replace the function of the initial metaphor. Metaphors are culturally and contextually loaded, acting as models that influence how we perceive reality and structure our thinking. Linguistically, they help us explain one thing by comparing it to another, often revealing deeper layers of our cognitive processes, including both conscious thoughts and subconscious feelings.

> *"Our language is the reflection of ourselves."* — Cesar Chavez.

Moreover, the language we use to describe technology shapes our perception and interaction with it (Xiao et al., 2025). This is particularly evident in how generative AI (GenAI) is described using a wide range of metaphors. Some emphasize its positive potential as a supportive and empowering tool, likening it to a copilot (Risteff, 2023), a sorcerer's apprentice (Liu & Helmer, 2024), a form of co-intelligence (Mollick & Mollick, 2024), or an external brain (Yan et al., 2024). Others adopt a more cautious view that acknowledges both its promise and potential risks, describing GenAI as a double-edged sword (Furze, 2024), a kind of magic (Furze, 2024), a JedAI (Bozkurt & Bae, 2024), or a powerful dragon (Bozkurt, 2024a). On the critical side, some have regarded GenAI as a demon (Elon Musk as cited by Mack, 2014), a bullshit generator (Costello, 2024; Hicks et al., 2024; McQuillan, 2023), autotune for knowledge (Cormier, 2023), a colonizing loudspeaker (Gupta et al., 2024), a stochastic parrot (Bender et al., 2021), a dangerous "alien" decision maker (Harari, 2024) or even a weapon of mass destruction (Maas, 2023).

The wide range of metaphors used for GenAI reflects the varying perceptions and emotional responses surrounding it. This diversity signals the need for collective responsibility in critically positioning GenAI within the educational ecosystem. As we explore the future of GenAI, we must manifest our position and ask critical questions such as:

- How well do we truly understand GenAI technology that can lead human beings to believe that it is capable of seemingly emulating human behavior, training itself, and learning algorithmically?

And, more importantly;

- How can we ensure that the design and development of GenAI align with our values, fostering care, equity, and inclusivity in education and beyond?

WHY A MANIFESTO?

> *"Making explicit (that is, manifest) a subtle but radical transformation in the definition of what it means to progress, that is, to process forward and meet new prospects."* — Bruno Latour

At this point in history, it is difficult to argue whether GenAI will ultimately be a disruptive or sustaining technology, a catalyst or blocker, or something else that we cannot foresee. However, its public emergence at the end of 2022 undeniably sparked substantial speculation, hype, and even hope. In such uncertain and speculative times, it is crucial to adopt a collective stance to effectively navigate the future; a goal the authors seek to achieve with this collective work. With this manifesto, we resist the uncritical acceptance of GenAI and instead seek to establish a balanced perspective by critically analyzing both its challenges and affordances.

A manifesto, by definition, serves as both a warning and a call to attention, urging us to reconsider past approaches as we move forward (Latour, 2010). Committing to this manifesto offers a way to break free from the constraints of formalized and institutionalized writing modes typically used in academic settings (Bayne & Ross, 2016; Bayne et al., 2020). Rather than repeating clichéd narratives about the educational landscape, we crafted this manifesto to deepen our understanding of GenAI, raise awareness, and encourage critical, thought-provoking discourse to help us navigate its evolving role in shaping the future.

GENERATIVE AI: HERE TO STAY

> *"Any sufficiently advanced technology is indistinguishable from magic."* — Arthur C. Clarke

We are advancing toward a future defined by radical changes brought about by the emergence of GenAI. The introduction of GenAI technologies, which utilize large language models (LLMs) and leverage natural language processing (NLP), most notably exemplified by ChatGPT released by OpenAI on November 30, 2022, has ushered in a new era characterized by a blend of excitement, hype, hope, and speculation, particularly within the context of education (Ansari et al., 2024; Bozkurt et al., 2023a; Dwivedi et al., 2023).

By employing a Generative Pre-training Transformer (GPT) model, ChatGPT and similar GenAI technologies can analyze the complex patterns and structures of human language and generate human-like text and multimedia content. Recent literature on GenAI exhibits a mix of enthusiasm and apprehension (Lim et al., 2023; Stracke et al., 2024), stemming from its seeming capacity to process and produce text comparable to human capabilities (Floridi, 2023; Lim et al., 2023; Teubner et al., 2023) and perhaps rendering the Turing test obsolete. Although still in its embryonic stage (Harari, 2024), how educators integrate these technologies into our daily routines, along with the frequency and intensity of their use, not only demonstrates the significant impact of GenAI within the educational landscape but also signals the necessity for their effective and critical utilization (Bozkurt, 2023a; Tlili et al., 2023). Amidst the excitement, fear, and uncertainty surrounding GenAI, the purpose of this manifesto is to revisit the two contrastive sides of the GenAI continuum and to encourage intellectual and critical discourse, thereby advancing our thinking and research.

METHODOLOGY

RESEARCH PARADIGM AND DESIGN

> *"I don't believe in collective guilt, but I do believe in collective responsibility."* — Audrey Hepburn

This manifesto follows a qualitative research paradigm, using collective writing as a method of inquiry (Gale & Bowstead, 2013). Collective writing allows diverse ideas to merge into a coherent whole (Jandrić et al., 2023; Peters et al., 2021) and promotes knowledge creation through collaborative discourse (Burns et al., 2023).

Bringing creative minds together in collective studies leads to innovative solutions that can surpass individual capacities (Huijser et al., 2024). Crowdsourced and co-created discourses minimize individual limitations and amplify collective strengths through critical perspectives. Collective writing not only fosters collective wisdom but also empowers us to shape the future and set agendas in critical situations by providing multiple perspectives. Previous examples of collective writing as a method of inquiry include articles on online learning (MacKenzie et al., 2022), networked learning (Gourlay et al., 2021), open learning (Bozkurt et al., 2023b), and the COVID-19 pandemic (Bozkurt et al., 2020; Jandrić et al., 2020; Peters et al., 2022; Stracke et al., 2022a; Stracke et al., 2022b), as well as studies on social media (Koutropoulos et al., 2024) and GenAI (Bozkurt et al., 2023a), all of which have adopted this approach with success.

DATA COLLECTION AND ANALYSIS PROCEDURES

To identify emerging themes, this collective writing project further employs the Delphi technique. The Delphi technique posits that the informed, collective judgment of a group of experts is more accurate and reliable than individual judgments (Clayton, 1997; Ziglio, 1996). Based on this premise, we adopted a modified Delphi technique (see Pelletier et al., 2021), which involves a structured process for collecting and distilling knowledge from a group of experts through a series of questionnaires and discussion processes. A modified Delphi study maintains the fundamental assumption of achieving consensus through the iterative data analysis process (Slagter van Tryon & Bishop, 2006).

In this study, the panel consisted of worldwide educators at higher education institutions who are also researchers studying or specializing in the use of GenAI in educational settings. In the first phase, to elicit creative, innovative, and authentic ideas, experts who voluntarily agreed to participate were asked semi-structured, open-ended questions based on their own experiences, while maintaining anonymity. In the second phase, the collected data were coded, and themes were identified using the constant comparative method (Merriam, 2001). At this stage, a second researcher analyzed the coded data, and themes were reported by consensus. In the third phase, the emerging themes were collectively and transparently edited until they reached their final form with a collective effort. The third phase also employed member checking (Birt et al., 2016) to ensure agreement of the findings with those involved.

STRENGTHS AND LIMITATIONS

This manifesto recognizes the strengths and limitations of its content. The primary strength lies in the opportunity to collectively reflect upon and critically analyze the subject matter. However, it is recognized that this study may not lead to generalizable findings, provide an exhaustive understanding, or reach a fixed conclusion. Rather, the aim is to offer a critical perspective on the use of GenAI in the educational landscape and to provoke thoughtful discourse on the topic. Lastly, due to the nature of collective studies involving a large number of participants, achieving complete consensus may be challenging and the arguments presented in this manifesto represent the aggregated understandings of the co-authors. Through this collaborative process, we realized that some of the concepts are intertwined and difficult to separate with sharp boundaries without losing context in some cases. As a result, some sections may contain some repetition. In addition, due to the nature of the methodology, positive and negative aspects may inherently contradict each other or reveal tensions; for instance, while GenAI may broaden access to information, it may simultaneously exacerbate digital divides. Similarly, GenAI may streamline tasks by automating processes, yet it may also generate additional work by necessitating thorough fact-checking of its outputs.

FINDINGS

This section presents AI positive and negative manifesto statements that came to the fore due to the synthesis of the data collected from the co-authors. All statements were explained with brief justifications and critical reflections.

AI POSITIVE

Drawing from the provided inputs, several key themes emerged, each reflecting the potential benefits and critical considerations for integrating GenAI into educational contexts. Each theme (Figure 1) is accompanied by critical insights to foster a comprehensive understanding of these issues.

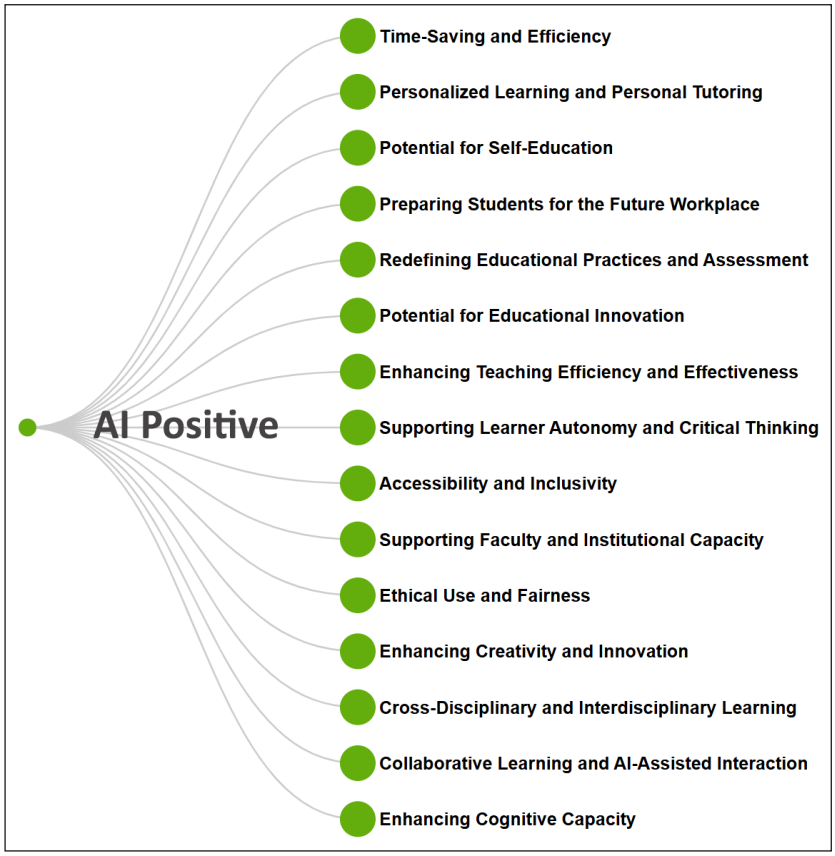

Figure 1 AI Positive themes.

1. Time-Saving and Efficiency

GenAI might enhance productivity by:

- Automating Time-Consuming Tasks: Allowing educators and students to focus on more meaningful activities.
- Enhancing Workplace Efficiency: Streamlining processes across educational institutions.
- Conducting Complex Analyses: Processing large data sets to handle tasks beyond human capacity.

Critical Insight: While GenAI potentially offers significant efficiency gains by automating routine tasks and enabling complex analyses, it is important to ensure these advancements do not undermine the depth of learning or the quality of human interactions in education. Automating some administrative tasks like grading or data analysis may save time without impacting core pedagogy. However, over-reliance on automation in instructional areas may risk reducing meaningful engagement between students and educators and may lead to additional supervision workloads. In addition, while automation may free up time, there's a risk that other 'busy work' may quickly fill the new space and make real time-saving benefits elusive. In resource-constrained settings, the burden of introducing and managing new GenAI systems often falls on users (e.g., lecturers and students), which can impact adoption and sustainability. Institutions with rigid, industrial teaching models may find themselves both well-positioned to benefit from GenAI efficiencies and at risk of slower adoption. As such, institutions need to carefully manage the pace of GenAI integration. Efficiency should serve to enhance education, not to diminish the role of personal connection, mentorship, and critical thinking. As institutions embrace GenAI to streamline workflows, there should be a careful balance between efficiency and maintaining the richness of human-guided learning experiences.

2. Personalized Learning and Personal Tutoring

GenAI holds significant promise for delivering personalized learning experiences tailored to individual student needs and learning preferences. By acting as adaptive personal tutors available at any time, GenAI may provide:

- Customized Instruction: Adjusting content complexity to match students' cognitive levels and learning pace.
- Adaptive Learning Paths: Creating individualized learning trajectories that respond to student performance.
- Immediate Feedback: Offering prompt responses to student inquiries and assessments, facilitating timely understanding and correction of misconceptions.

Critical Insight: First of all, it should be stated that personalized learning has often been overhyped with past technologies, raising expectations that fail to align with educational realities. Therefore, GenAI's potential should be critically evaluated to ensure it delivers meaningful, evidence-based advancements rather than idealized promises. While personalized learning through GenAI holds promise, caution is necessary. Customized instruction may unintentionally reinforce biases if based on skewed datasets, limiting diverse perspectives, particularly in culturally sensitive areas. Similarly, adaptive learning paths, while helpful, risk narrowing the educational experience if overly prescriptive, restricting students to the content they already find manageable and skipping over steps that help learners develop metacognition and agency over their own learning. Instead, the application of GenAI should challenge learners to think critically and explore new ideas. Immediate feedback, though valuable for correcting misconceptions, can encourage superficial understanding or introduce different misconceptions if not paired with deeper engagement and critical reflective thinking. Additionally, feedback may overemphasize objective correctness, neglecting the nuanced insights provided by human educators.

3. Potential for Self-Education, Informal and Lifelong Learning

The accessibility of GenAI tools may support lifelong learning by:

- Empowering Independent Learners: Offering resources and guidance outside formal educational structures.
- Facilitating Knowledge Acquisition: Assisting with information retrieval and comprehension across diverse subjects.
- Supporting Skills Development: Enabling learners to acquire and practice new competencies, such as coding or data analysis, without extensive prior experience.

Critical Insight: While GenAI may open new ways to access, interact with, and even understand data, learners may require guidance to navigate the vast array of available content and GenAI technologies effectively. The possibilities and potential that GenAI holds for informal learning are open and boundless. Beyond its role in formal education, such as academic courses and programs, GenAI has a promising potential in non-formal and informal learning. If used ethically and effectively, it may lower barriers and lift limits on learning by supporting self-determined learning pursuits and enhancing learner agency. However, the high volume and speed of information may overwhelm learners, leading to surface-level understanding or misinformation if not critically engaged with. Furthermore, learners risk becoming over-reliant on GenAI tools, which would potentially stifle deeper critical thinking and problem-solving skills and further undermine pedagogical benefits. To fully realize the potential benefits of GenAI in informal learning, frameworks that promote reflective practice, self-regulation, and critical assessment of AI-generated content are necessary. The quality of informal education might vary without established pedagogical oversight, emphasizing the need for curated and quality-driven learning pathways to complement independent exploration.

4. Preparing Students for the Future Workplace

As GenAI becomes ubiquitous, it can:

- Foster GenAI Competences: Teaching students how to use GenAI responsibly and effectively as a component of digital competences.

- Develop In-Demand Skills: Equipping students with competencies that align with emerging industry needs.
- Promote Ethical Awareness: Embedding considerations of ethics and decision-making in the use of GenAI technologies.

Critical Insight: Preparing students for the future may involve not only technical proficiency but also a critical perspective on the societal implications of GenAI. If technical GenAI skills become essential, the broader ability to navigate ethical dilemmas, biases, and GenAI's evolving role in the workplace will be indispensable in an increasingly GenAI-integrated world. Students must be prepared for a future in which GenAI technologies may increasingly shape workflows, decision-making, and even interpersonal relationships in professional settings. This will necessitate a dual focus: teaching students how to leverage GenAI for productivity and innovation, while also fostering a subtle appreciation of its impact on privacy, job displacement, equity, and broader societal norms. Additionally, the ability to critically assess GenAI-generated outputs will likely be key in maintaining human oversight and preventing over-reliance on GenAI-driven automation. Educators must ensure that students are equipped with both the hard and soft skills necessary to thrive in a workplace where GenAI serves as a partner or assistant, not a replacement.

5. Redefining Educational Practices and Assessment

GenAI is the latest in a series of technologies that prompts a re-examination of traditional educational models by:

- Focusing on Learning Processes: Emphasizing the importance of how students learn over merely obtaining correct responses.
- Challenging Assessment Methods: Encouraging assessments that value critical thinking and creativity.
- Highlighting Educational System Failings: Uncovering areas where current practices may be outdated or ineffective.

Critical Insight: When it comes to GenAI in education, educators must thoughtfully redesign their learning processes, curricula, and assessments while preserving academic integrity. GenAI pushes us to confront long-established weaknesses in educational systems, from concerns about plagiarism to deeper questions about the role of educators. Its rapid development has triggered much-needed reflection on what value teachers bring and what kind of learning outcomes are most meaningful. This re-evaluation is not just about improving efficiency but about re-focusing the purpose of education. Moreover, GenAI may finally initiate reflections by educators, educational organizations and policy makers to improve their education moving beyond a deterministic approach to knowledge, where the focus is on delivering 'correct answers.' Instead, we should emphasize the learning process itself and support students as they engage with complex problems and use GenAI and other technologies to achieve innovative outcomes. The challenge now is to design assessments resilient to GenAI misuse, while promoting higher-order thinking skills, creativity, and ethical understanding. This shift from output-based education to a reflexive, process-oriented one fosters critical thinking, problem-solving, and creativity. Integral to this is helping students generate 'inner feedback'—the process of comparing their current knowledge against reference points from teacher feedback, interactions, resources, or prior performances. By formalizing these natural comparisons, students may better self-regulate their learning which might create meaningful feedback loops that deepen understanding and adaptability.

6. Potential for Educational Innovation

The emergence of GenAI opens avenues for:

- Educational Innovation: Experimenting with new teaching methods and learning models.
- Impact Research: Investigating the impacts of GenAI on learning outcomes and pedagogical practices.
- Research-informed practices: Building a robust body of research to inform effective GenAI integration.

Critical Insight: Ongoing research is essential to fully grasp the long-term implications of GenAI in education and refine its application. While GenAI may promise significant educational innovations, strategies must be grounded in rigorous, evidence-based research. Without careful evaluation, we risk adopting GenAI-driven practices that could negatively impact learning, engagement, or equity. Research into GenAI's effect on critical thinking, problem-solving, and cognitive development is still in its infancy, and much remains to be explored, particularly regarding its impact on diverse learner populations. To prevent widening educational disparities and ensure inclusive and equitable learning environments, it is critically important to study how GenAI supports underserved groups. As GenAI evolves, evidence-based practices must guide its integration, supported by collaboration among educators, researchers, and developers. Educational research must remain reflective, balancing innovation with ethical considerations and the preservation or enhancement of the human elements of education.

7. Enhancing Teaching Efficiency and Effectiveness

Educators may leverage GenAI to streamline administrative and pedagogical tasks to focus more on high-level instructional activities. GenAI may assist with:

- Automating Routine and Administrative Tasks: Handling desk jobs, scheduling, and record-keeping to reduce educator workload.
- Lesson Planning and Educational Material Creation: Generating initial drafts of lesson plans, course outlines, and educational materials.
- Formative Assessment: Providing personalized feedback on assignments, enabling educators to address student needs more effectively.

Critical Insight: While GenAI may enhance teaching efficiency by automating tasks like desk jobs, scheduling, and record-keeping, efficiency should not reduce teachers to mere overseers. Over-reliance on automation risks depersonalizing education and diminishing the role of educators in critical decision-making. Similarly, while GenAI could aid lesson planning and content creation, the quality and relevance of AI-generated materials require careful scrutiny to avoid generic or biased content that fails to meet diverse student needs and fails to reflect teachers' unique positionalities and intersectional identities. Finally, automated, GenAI-driven formative assessments, though potentially useful for personalized feedback, may risk oversimplification. It is crucial that such tools promote deep learning and critical thinking, rather than focusing solely on correctness or surface-level feedback.

8. Supporting Learner Autonomy and Critical Thinking

GenAI may empower students to take ownership of their learning by:

- Developing Decision-Making Skills: Encouraging students to critically evaluate the use of GenAI in their work and make informed choices.
- Enhancing Critical Reasoning: Fostering higher-order thinking skills by prompting students to analyze, question, and synthesize information.
- Facilitating Independent Learning: Acting as a scaffold within the Zone of Proximal Development and supporting learners just beyond their current capabilities.

Critical Insight: While GenAI may enhance learner autonomy and critical thinking, important caveats remain. In promoting decision-making, students must critically assess GenAI outputs to avoid over-reliance on AI-generated content. Without proper guidance, learners may trust GenAI uncritically and compromise their independent judgment. Although GenAI may promote critical reasoning by encouraging analysis and synthesis, its use alone does not guarantee deep thinking. Structured tasks and reflective practices are essential to ensure meaningful engagement. Lastly, while GenAI may scaffold learning within a student's Zone of Proximal Development, there is a risk of over-scaffolding, reducing cognitive challenges. To foster genuine autonomy, students need to be challenged beyond what GenAI can provide, balancing support with opportunities for intellectual growth.

9. Accessibility and Inclusivity

GenAI could potentially be used to make education more inclusive by:

- Assisting Learners with Disabilities: Providing support for students with learning disabilities or language barriers through customized assistance.
- Bridging Educational Gaps: Offering resources and tutoring to students in remote or underserved areas, enhancing equity in education.
- Facilitating Multilingual Education: Enabling real-time translation and language support to overcome linguistic challenges.

Critical Insight: To truly promote inclusivity, GenAI tools must be designed with diverse populations in mind, avoiding biases and ensuring accessibility for all learners, particularly those with special needs. GenAI should be inclusive by design. While GenAI offers significant potential in providing personalized support for students with disabilities or language barriers, there is a danger that it may unintentionally reinforce existing inequalities if not carefully implemented. For instance, GenAI systems trained on biased data could perpetuate stereotypes or provide less effective support to marginalized groups. Additionally, ensuring accessibility means designing GenAI tools that can adapt to the unique needs of individuals, from screen readers and speech-to-text for visually impaired learners to advanced language support for non-native speakers. Moreover, GenAI's capacity to bridge educational gaps—offering resources to underserved or remote areas—holds promise, but it also requires significant infrastructure and digital competency support to be effective. Simply providing access to GenAI tools is not enough; the necessary technological infrastructure and training must accompany these tools to support equitable outcomes. In terms of multilingual education, GenAI's ability to offer real-time translation and language support may dramatically improve inclusivity in global and multicultural classrooms. However, this requires continual attentiveness to ensure accuracy and cultural sensitivity, and to mitigate misunderstandings or miscommunications.

10. Supporting Faculty and Institutional Capacity

GenAI has the potential to facilitate:

- Professional Development: Offering training for educators to effectively incorporate GenAI into their teaching.
- Institutional Capacity-Building: Developing policies and infrastructures that support GenAI integration.
- Establishing Collaborative Communities: Encouraging sharing of practices and collective problem-solving among educators.

Critical Insight: When GenAI is to be adopted in formal education, institutional support will be essential to ensure its sustainable and ethical use. Professional development should go beyond technical skills to include ethical considerations and strategies for enhancing learning. Institutions should endeavor to develop clear policies on GenAI use for a wide range of audiences, addressing issues like academic integrity and data privacy, while providing the necessary infrastructure. Collaborative communities will be vital for educators to share experiences and innovate collectively to enable GenAI's effective and meaningful integration. It would be desirable to achieve open and public infrastructure at international level as many institutions cannot afford on-premise GenAI provision on their own and our global community and society should not be dependent on a few hyperscalers.

11. Ethical Use and Fairness

Responsible deployment of GenAI may help:

- Address Bias and Fairness: Actively working to prevent biased outcomes in GenAI-generated content.
- Maintain Trust: Being transparent about GenAI use and limitations to preserve stakeholder confidence.
- Promote Inclusivity: Designing GenAI applications that serve diverse populations equitably.

Critical Insight: Ethical considerations must be at the forefront to prevent exacerbating existing inequalities and to foster a just environment if GenAI is to be deployed in education. One

of the major concerns in the deployment of GenAI is the potential for bias. GenAI systems are often trained on data sets that reflect historical and societal biases, which can lead to unintended discriminatory outcomes, especially when used in educational settings. Ensuring fairness requires a proactive approach—identifying, mitigating, and correcting biases within AI algorithms, and training students in appropriate critical digital literacies before GenAI is likely to negatively affect students from underrepresented groups. Transparency is another critical factor in maintaining trust among stakeholders—students, educators, and institutions alike. To maintain confidence in the system, it is essential to be clear about how GenAI operates, its limitations, and the decisions it influences. If stakeholders feel that AI is being used in an opaque or unchecked manner, trust in educational processes may erode. Educational institutions should strive to ensure that AI applications are explainable as much as possible and that their use is communicated openly to students and faculty, fostering informed engagement rather than passive reliance on technology. Promoting inclusivity through GenAI is equally important. If GenAI systems are integrated into educational practices, they must be designed to promote equitable access and support for all learners. This includes considering diverse cultural, linguistic, and socioeconomic backgrounds, as well as learners with accessibility requirements. GenAI has the potential to break down barriers and provide customized support to individuals, but this cannot be achieved unless it is purposefully designed.

12. Enhancing Creativity and Innovation

By serving as a catalyst for creativity, GenAI may:

- Unlock Creative Potential: Assisting students and educators in generating diverse ideas beyond individual perspectives through new media, like multimedia content and digital art.
- Encourage Innovative Pedagogies: Enabling the exploration of novel teaching methods that integrate generative processes.
- Expand Cognitive Horizons: Allowing individuals to perform complex tasks without extensive prior learning, thus broadening the scope of achievable projects.

Critical Insight: While GenAI might stimulate creativity, there is a risk of homogenization if overused. Educators should balance GenAI assistance with opportunities for original thought and expression. Additionally, there is a need to ensure that reliance on GenAI does not lead to a reduction in meaningful learning, as students may become passive consumers of GenAI-generated content. The distinction between augmenting human capacity through machine-processed versus machine-generated information presents unique considerations. Human wisdom may now be influenced not only by human-generated organic information but also by GenAI-generated synthetic information, as GenAI technologies become active stakeholders in the data-to-wisdom continuum. Additionally, while GenAI may broaden cognitive horizons by enabling complex tasks, there is a fine line between support and over-dependence. Educators need to ensure that GenAI enhances, rather than replaces, students' cognitive and creative efforts, promoting true human-GenAI collaboration that drives innovation without sidelining independent intellectual growth.

13. Cross-Disciplinary and Interdisciplinary Learning

GenAI may contribute to holistic education by:

- Meshing Knowledge Domains: Linking content that spans multiple disciplines.
- Facilitating Interdisciplinary Research: Assisting in literature searches and idea generation across fields.
- Encouraging Systems Thinking: Helping students make connections between diverse subjects.

Critical Insight: While GenAI offers the potential to revolutionize interdisciplinary learning by integrating knowledge across fields, educators must ensure that students engage in critical synthesis rather than passively consuming GenAI created outputs. GenAI can output information from diverse disciplines, but students must be guided to question and meaningfully integrate these insights. Without thoughtful and critical reflection, learners risk accepting AI-generated connections at face value, missing the deeper understanding essential for interdisciplinary learning. Moreover, interdisciplinary learning requires critical evaluation of complex information

systems. Students may be taught to discern quality, relevance, and bias as an antidote or counterweight to the efficiency of GenAI in providing ready-to-use but potentially misleading or inaccurate information. Educators play a crucial role in fostering systems thinking, which goes beyond compartmentalized knowledge to appreciate interconnectedness. By encouraging deep critical reflection, creativity, and ethical consideration, educators ensure that GenAI remains a tool for exploration and not a shortcut to conclusions.

14. Collaborative Learning and GenAI Assisted Interaction

GenAI may facilitate new forms of collaboration by:

- Acting as a Peer or Collaborator: Participating in group work to stimulate ideas and provide feedback.
- Supporting Group Dynamics: Enhancing problem-solving through AI-generated suggestions and validation.
- Acting as a Mediator between Learners: Helping to connect learners who may help one another's learning, assisting in resolving conflicts, summarizing conversations, and so on.

Critical Insight: The integration of GenAI into collaborative settings should be carefully considered to ensure it complements or enhances existing pathways, or creates new pathways for connection and interaction. While GenAI may enhance collaborative learning by acting as a virtual peer, providing diverse perspectives, and generating feedback, as well as by actively promoting connections and interactions between individuals, it is critical that these interactions foster rather than detract from authentic human engagement. Humans should be aware that the activities of GenAI are not self-driven but depend on programmed and pre-trained activities developed by GenAI providers. Over-reliance on GenAI could diminish the value of peer-to-peer exchanges, where emotional intelligence, empathy, and social cues are crucial. Human-GenAI interaction should aim to amplify collective problem-solving and innovation instead of creating a dependency on GenAI as the primary contributor to group work. In terms of social interaction, GenAI presents a novel dynamic where learners engage not only with one another but also with intelligent systems. These GenAI-driven agents might provide personalized support and collaboration, but the social dimension of learning—shared understanding, mutual support, and interpersonal negotiation—need not be undermined. The human element in communication, creativity, and emotional exchange remains irreplaceable. Educators must design collaborative activities where GenAI enriches but does not overshadow social aspects of learning. Balancing the efficiency and cognitive support offered by GenAI with opportunities for organic human interaction will be essential to cultivating well-rounded, socially adept learners.

15. Enhancing Cognitive Capacity

By supporting cognitive processes, GenAI may:

- Reduce Cognitive Tasks: Handling extraneous tasks to allow learners to focus on essential learning activities.
- Support Schema Development: Facilitating the construction of mental models crucial for problem-solving.
- Augment Human Intelligence: Extending cognitive capabilities through GenAI support.

Critical Insight: While GenAI offers the potential to reduce cognitive load and aid in the development of mental models, educators must carefully manage its integration to prevent learners from becoming passive participants in their own education. The risk lies in GenAI becoming a technology that reduces students' independent problem-solving skills and critical thinking. Instead of fostering deep engagement with learning material, over-reliance on GenAI could lead to surface-level understanding and a reduction in effort, with learners bypassing challenging cognitive tasks that are essential for developing expertise and long-term retention. Moreover, the promise of cognitive augmentation must be tempered by the awareness that not all tasks should be outsourced to GenAI. While GenAI may assist in complex analysis or information processing, human judgment, intuition, and creativity remain irreplaceable. The line between augmentation and dependency is thin, and educators must design learning experiences that encourage active cognitive engagement, using GenAI as a scaffold rather than a replacement for intellectual effort. Additionally, there is a broader concern that GenAI,

while reducing immediate cognitive load, might inadvertently suppress learners' ability to handle complexity on their own. Cognitive strain is part of the learning process - essential for developing resilience, critical thinking, and the ability to adapt to new situations. If GenAI shields learners from this necessary struggle, we risk producing graduates who are adept at using tools but lack the cognitive depth to navigate novel challenges independently.

AI NEGATIVE

GenAI presents several challenges and concerns within the educational landscape. Drawing from the provided inputs, we identify key themes that highlight the potential negative implications of integrating GenAI into education. Each theme (Figure 2) is accompanied by critical insights to foster a comprehensive understanding of these issues.

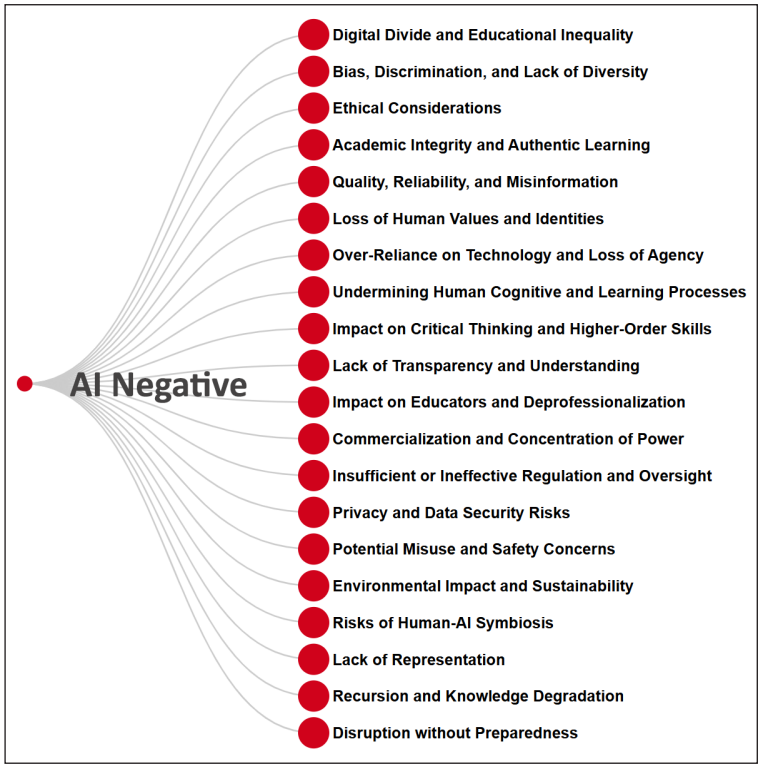

Figure 2 AI negative themes.

1. Digital Divide and Educational Inequality

GenAI may exacerbate existing inequalities within education:

- Unequal Access: High costs of advanced GenAI tools along with infrastructure requirements limit accessibility for underprivileged students and institutions.
- Widening the Gap: Those with access to premium GenAI services may gain advantages that increase the disparity between wealthy and disadvantaged learners.
- Global Inequities: Developing countries may lack the infrastructure to support GenAI, hindering educational progress.

Critical Insight: While GenAI has the potential to transform education, it risks deepening the digital divide and exacerbating inequalities. Unequal access to AI-powered tools is a major concern, as advanced GenAI technologies are often costly and inaccessible to underprivileged students, particularly in low-income or rural areas. This economic barrier leaves many without access to GenAI's personalized learning and academic support, further disadvantaging them. As well-resourced institutions adopt premium, rather than freemium, GenAI services, their students gain a competitive edge, deepening social and educational hierarchies. In contrast, underfunded schools rely on outdated resources, widening the gap between wealthy and disadvantaged learners. This disparity undermines education's role in promoting equal opportunity. Global inequities in AI accessibility are also pressing, as many developing nations lack the infrastructure to support GenAI integration. In resource-constrained settings, where access to GenAI tools often comes at the cost of increased surveillance, marginalized communities may face difficult

trade-offs, such as sacrificing privacy for technological access. This cost-benefit balance varies widely across institutions and regions, impacting the extent to which GenAI can be integrated in an equitable and autonomous manner. Without addressing these access and ethical concerns, GenAI risks reinforcing, rather than bridging, existing educational disparities.

2. Bias, Discrimination, and Lack of Diversity

GenAI models may perpetuate and amplify existing biases present in their training data, leading to:

- Reinforcement of Stereotypes: Biased outputs that reflect societal prejudices, affecting diversity and equality in educational opportunities.
- Marginalization of Voices: Underrepresentation of minority groups in training data results in GenAI that does not cater to diverse populations.
- Algorithmic Bias: there is a risk that GenAI and other emerging LLMs may perpetuate or amplify existing biases in the training data they are built on.

Critical Insight: GenAI models often inherit and amplify biases present in their training data, posing challenges for fairness and equity. These biases can reinforce harmful stereotypes, shaping user perceptions and perpetuating societal inequalities, especially in education. When GenAI replicates biased content, it risks reinforcing prejudices related to race, gender, or socio-economic status, potentially influencing students and maintaining existing disparities in access to opportunities. Additionally, the marginalization of minority voices in training data results in GenAI outputs that fail to address the needs of diverse populations or that privilege the values of those who manage the training process, risking further disadvantage for underrepresented groups. This lack of inclusivity perpetuates systemic inequities, particularly in education. Moreover, algorithmic bias might emerge from historical inequalities, social prejudices, or skewed data sources, affecting the fairness and objectivity of GenAI outputs. When embedded in educational settings, this could inadvertently reinforce systemic inequalities and perpetuate biased viewpoints.

3. Ethical Considerations

GenAI designs, datasets and implementations raise significant ethical questions related to the unauthorized use of data and intellectual property rights. Concerns include but are not limited to:

- Unethical Data Usage: GenAI models are often trained on data scraped from the internet without permission or consent, leading to the exploitation of creators' work without acknowledgment.
- Intellectual Property Theft: Authors and artists may find their work used to train GenAI without compensation, undermining their rights and livelihoods.
- Lack of Informed Consent: The erosion of data rights and personal agency occurs as individuals are unaware of how their data is utilized by GenAI systems.

Critical Insight: The rise of GenAI has revealed critical gaps in handling intellectual property and personal data. Many GenAI systems rely on large datasets scraped from publicly available content without creator consent, raising ethical concerns about profiting from others' creative labor without acknowledgment or compensation. As GenAI blurs the line between original and AI-generated content, this leads to intellectual property disputes and potential legal challenges. Moreover, repurposing creators' work without consent threatens the sustainability of creative industries and erodes trust in AI. Beyond the creative sector, GenAI's ability to process vast amounts of personal data without users' knowledge raises serious privacy concerns. Individuals often lack control over how their data is used, which highlights the need for transparency and stronger regulations. Robust policies and legal regulations based on global human rights are needed to protect data rights, ensure creators are fairly compensated, and give individuals control over their personal information in AI-driven systems.

4. Academic Integrity and Authentic Learning

The use of GenAI poses challenges to maintaining academic standards:

- Plagiarism and Cheating: Students may use GenAI to do their homework, which may undermine the authenticity of their work.

- Erosion of Critical Skills: Over-reliance on GenAI might impede the development of critical thinking and problem-solving abilities.
- Superficial Learning: Dependence on GenAI-generated answers may lead to surface-level understanding rather than deep learning.

Critical Insight: GenAI raises significant concerns for academic integrity, as students increasingly use AI-generated content for assignments and essays. The ease of generating sophisticated responses heightens the risk of plagiarism and cheating, undermining both academic standards and the authenticity of learning. Traditional plagiarism detection methods may struggle to keep pace with GenAI, requiring new approaches to uphold ethical academic practices. Additionally, reliance on GenAI risks eroding critical skills like problem-solving, writing, and analysis. Superficial learning also becomes a concern, as students may accept AI-generated answers without critical reflection, leading to a shallow understanding of subjects. While GenAI provides quick information, it lacks the depth necessary for long-term knowledge retention and the ability to apply concepts in unfamiliar contexts.

5. Quality, Reliability, and Misinformation

GenAI outputs may lack accuracy and reliability, leading to:

- Hallucinations and Errors: GenAI models might mislead users by producing incorrect or nonsensical information.
- Spread of Misinformation: AI-generated content might contribute to the proliferation of false information online.
- Inability to Verify: Users, especially novices, may struggle to discern the validity of AI-generated output due to the opaque nature of GenAI processing.

Critical Insight: One major challenge with GenAI is the quality and reliability of its outputs. GenAI models can produce errors or "hallucinations," generating factually incorrect or nonsensical content. This is particularly risky in educational, medical, or professional settings where accuracy is essential. Trusting AI-generated content without question might lead to decisions based on flawed data, compounded by the opacity of AI processing, which makes it difficult for users to verify accuracy. Additionally, GenAI can contribute to the spread of misinformation, especially online; as AI-generated content becomes more widespread, distinguishing fact from fiction becomes more difficult, threatening information literacy and trust in digital content.

6. Loss of Human Values and Identities

GenAI lacks the human attributes essential to education:

- Absence of Empathy: GenAI cannot replicate the emotional intelligence and compassion of human educators.
- Erosion of Human Connection: Overreliance on GenAI may weaken the social and interpersonal relationships that foster personal growth.
- Corporate Values Over Human Values: GenAI systems may reflect the priorities of their creators rather than universal human values.

Critical Insight: As GenAI becomes more embedded in education, there is a risk of losing essential human values. One key limitation of GenAI is its lack of empathy and sense of care. Education involves more than knowledge transfer—it includes mentoring, emotional support, and understanding individual needs. GenAI, regardless of its sophistication, cannot replicate the emotional work that human educators provide, especially in addressing students' social and emotional challenges. The erosion of human connection is also concerning. The relationship between students and teachers fosters trust, motivation, and holistic growth, which GenAI tools cannot replace. As GenAI increasingly dominates classrooms, these critical relationships may weaken, reducing education to a transactional exchange. Additionally, AI systems, often developed by large tech companies, may prioritize corporate values over humanistic ones, promoting efficiency or profit over principles like equity and inclusivity. This could shift education's focus away from holistic development towards performance metrics or commercially valuable outcomes.

7. Over-Reliance on Technology and Loss of Agency

Dependence on GenAI may diminish human connection and autonomy through:

- Technological Dependency: Excessive reliance on GenAI may render educational systems vulnerable to technical failures.
- Reduced Critical Faculties: Students and educators might become passive recipients of information rather than active learners.
- Erosion of Creativity: Automated solutions might stifle creative problem-solving and innovation.

Critical Insight: Over-reliance on GenAI in education risks undermining human agency by fostering dependence on technology for learning and decision-making. As educational systems increasingly integrate GenAI, they may become overly reliant on these tools, which would make them vulnerable to technical failures and malfunctions. This highlights the need for maintaining human oversight and alternative educational methods. Additionally, over-reliance on GenAI may reduce critical thinking. When GenAI provides instant solutions, students and educators may engage less deeply with the material, leading to passive learning and diminished development of essential skills like problem-solving and independent decision-making. Creativity is another concern; while we may become increasingly skilled at directing GenAI to perform tasks, and thus expand our capabilities beyond what we could achieve on our own, this reliance on GenAI also risks undermining our core creative processes and shifting focus away from the creative skills we currently value, such as programming, drawing, or writing. As GenAI becomes more sophisticated and pervasive, we may face a future in which the raw cognitive 'stuff'—the core skills we use to think and innovate—diminishes, and it becomes harder to sustain our own creative frameworks over time.

8. Undermining Human Cognitive and Learning Processes

GenAI may negatively impact the way individuals engage with and process information:

- Intellectual Distance: Relying on GenAI-created content may disconnect learners from the cognitive processes involved in knowledge construction.
- Shallow Engagement: GenAI may encourage quick answers over deep cognitive engagement.
- Stunted Epistemological Development: The surface use of GenAI in learning tasks may bypass the deeper cognitive activities essential for developing critical thinking skills.

Critical Insight: The increasing reliance on GenAI in education raises concerns about its impact on human cognitive processes. One major issue is the risk of creating intellectual distance, where students rely on AI-generated content for quick answers, prioritizing speed over reflective learning and bypassing deeper cognitive processes involved in synthesizing and digesting knowledge. This might lead to superficial understanding and hinder the development of critical thinking and problem-solving skills essential for long-term success if learners accept GenAI outputs without critically engaging with the underlying concepts. Moreover, passive consumption of AI-generated content could reduce memory retention and comprehension. Active learning strategies, such as discussion and analysis, are critical for building a solid knowledge foundation. Without active engagement, students may struggle to retain information or develop the advanced skills needed for academic growth.

9. Impact on Critical Thinking and Higher-Order Skills

GenAI may hinder the development of essential cognitive skills:

- Suppression of Critical Thinking: Easy access to answers might discourage analytical thinking and problem-solving.
- Deficits in Higher-Order Skills: Overuse of GenAI may impede the development of synthesis, evaluation, and creation skills.
- Stifling Innovation: Dependence on AI-generated solutions may reduce opportunities for original thought.

Critical Insight: The increasing reliance on GenAI raises concerns about its impact on critical thinking and evaluation competences for higher-order cognitive skills. As GenAI provides polished, instant, and seemingly accurate answers, students may become less inclined to engage deeply with problems or challenge assumptions. This undermines critical thinking, which is vital for developing strong problem-solving abilities. Furthermore, when students accept GenAI outputs without reflection and rely on GenAI for ready-made answers, they may miss opportunities to sharpen their critical faculties and practice unconventional or exploratory problem-solving. Thus, in addition to the risk of weakening higher-order skills like synthesis, evaluation, and creation, over-reliance on GenAI may hinder students' ability to innovate and think independently. This overuse of GenAI risks diminishing original thought and creativity, which are crucial skills in a rapidly evolving world.

10. Lack of Transparency and Understanding

The opaque nature of GenAI poses challenges:

- Black Box Algorithms: The decision-making processes of GenAI models are often not transparent, making it difficult to understand how outputs are generated.
- Misconceptions about GenAI: Widespread misunderstandings might lead to misuse and misplaced trust in GenAI systems.
- Insufficient AI Literacy and competences: Without proper education, users may anthropomorphize AI or overestimate its capabilities.

Critical Insight: The lack of transparency in GenAI systems, often called "black box algorithms," poses significant challenges in education and beyond. These systems do not provide clear explanations of how they reach conclusions, leaving users—both educators and students—without insight into the logic behind GenAI-created outputs. This opacity is particularly problematic in high-stakes areas like education, where understanding the rationale behind decisions is crucial. Misconceptions about GenAI can further complicate the issue. Many users mistakenly believe AI is objective or infallible, ignoring that it is trained on biased human data. Others distrust GenAI due to a lack of understanding. This highlights the need for continuously defining and refining AI literacy and competences, like recognizing hallucinations and understanding where and how GenAI content is sourced. Without these, users may anthropomorphize GenAI or misunderstand its abilities and overestimate the credence in GenAI output. In education, this could cause educators and learners to rely too heavily on GenAI, diminishing critical engagement and the overall learning experience.

11. Impact on Educators and Deprofessionalization

GenAI could adversely affect the teaching profession through:

- Job Displacement: Automation of teaching tasks may threaten educators' job security.
- Devaluation of Human Expertise: Reliance on GenAI may undermine the importance of human judgment and pedagogical skills.
- Impersonal Learning Experiences: The educational experience may become impersonal, lacking the empathy and mentorship provided by human teachers.

Critical Insight: The rise of GenAI in education raises concerns about the future role of educators and the potential deprofessionalization of teaching. GenAI tools increasingly automate tasks like grading, tutoring, and content delivery, which, while streamlining processes, could lead to job displacement and reduced opportunities for educators. Beyond job loss, there's a risk of devaluing human expertise. As GenAI takes on more teaching roles, the unique skills of educators—such as adapting lessons, exercising judgment, exhibiting empathy, and fostering critical thinking—may be overshadowed. GenAI further lacks the understanding and emotional intelligence that experienced teachers bring to the classroom.

12. Commercialization and Concentration of Power

The development and control of GenAI are dominated by a few large corporations, which poses several concerns:

- Profiteering by Big Tech: Companies may prioritize profit over ethical considerations, impacting education negatively.
- Limited Collaboration with Academia: Lack of partnership between tech companies and educational institutions hinders innovation and transparency.
- Monopolization of Knowledge: Concentration of GenAI development within corporations can lead to control over information and educational content.

Critical Insight: The commercialization of GenAI by a few powerful tech companies raises ethical concerns, especially in education. These corporations are likely to prioritize profit over educational outcomes, designing AI tools for revenue rather than enhancing learning. Limited collaboration between academia and industry exacerbates this issue. Additionally, the lack of transparency about how GenAI systems work and on what data they are trained make independent audits impossible. Auditors do not have the necessary information to understand or review the processes and decisions of these systems. Similarly, monopolizing GenAI knowledge also threatens diversity and openness, as control by a few companies risks excluding marginalized or non-Western perspectives, leading to a homogenization of information and limiting educational diversity.

13. Insufficient or Ineffective Regulation and Oversight

The rapid advancement of GenAI outpaces existing regulations:

- Lack of Governance: Insufficient legal regulations and policies to guide ethical GenAI use in education.
- Regulatory Gaps: National and institutional frameworks may not adequately address the complexities of GenAI integration.
- Ethical Oversight: Without oversight, unethical practices may proliferate.

Critical Insight: The rapid integration of GenAI in education highlights the urgent need for regulation and oversight. Currently, there is a significant lack of governance regarding the ethical use of AI, increasing the risk of unintended consequences such as data privacy violations, bias, and inequity. Without clear policies, educators and institutions may lack official forms of guidance on how to ethically and effectively implement AI technologies, heightening the risk of misuse. Regulatory gaps exist at both national and institutional levels, with many frameworks outdated and unable to address key issues like intellectual property, data security, and AI's long-term impact on learning. Additionally, the uneven state of regulation across countries creates inconsistencies which makes it challenging to establish cohesive standards for AI in education. Ethical oversight is crucial to prevent profit-driven motives from overshadowing student-centered outcomes. Without proper accountability, AI use could lead to further commodification of education and exploitation of student data. Therefore, clear guidelines are essential to ensure that AI technologies serve educational rather than commercial interests.

14. Privacy and Data Security Risks

GenAI's reliance on data raises privacy concerns:

- Data Misuse: Personal information may be collected and used without consent, infringing on privacy rights.
- Surveillance Risks: GenAI tools could enable increased monitoring of students and educators, leading to a loss of privacy.
- Vulnerabilities to Data Breaches: The accumulation of sensitive data makes AI systems attractive targets for extraction-attacks.

Critical Insight: The increasing reliance on GenAI in education raises significant privacy and data security concerns. A key issue is the potential misuse of personal data, where information is collected, stored, shared, or sold without informed consent. This poses ethical concerns, particularly for students, whose learning behaviors and emotional responses could be exploited by third parties. Stronger data protection regulations are essential, but fostering public digital literacy and critical awareness is equally crucial to ensure informed consent in data collection. Additionally, GenAI use in education can lead to intrusive surveillance. While analytic data may improve learning, excessive tracking of student activities risks creating an environment

of constant and intrusive surveillance, negatively affecting privacy, creativity, and autonomy. GenAI systems that store large amounts of sensitive data are also prime targets for cyber-attacks. Educational institutions must implement robust security measures, such as encryption and regular audits, to protect against potential data breaches, identity theft, and fraud. In the context of GenAI, there is an additional risk of data leaks through GenAI's potential to memorize training data. Beyond basic security measures, institutions need clear guidelines on data suitability, which ensures that sensitive information, such as student papers that address personal experiences or private discussions, is never used as training material for GenAI models, regardless of anonymization claims.

15. Potential Misuse and Safety Concerns

GenAI can be exploited to cause harm:

- Academic Dishonesty: GenAI tools may facilitate cheating and undermine the fairness of assessments.
- Security Threats: GenAI-generated content might be used for phishing, impersonation, and spreading disinformation.
- Safety Concerns: Vulnerabilities in AI systems may expose users to risks.

Critical Insight: The rapid advancement of GenAI introduces significant risks, particularly in undermining the fairness of assessments and devaluing learning if some students misuse GenAI tools to complete assignments without genuine effort. As GenAI becomes more sophisticated, detecting cheating becomes increasingly difficult, which can undermine academic integrity. For educational institutions, GenAI also poses additional security threats when used maliciously. GenAI-created phishing scams and impersonation schemes may deceive individuals, while GenAI might also be weaponized to spread disinformation, eroding trust and complicating efforts to combat false information. Additionally, AI systems face vulnerabilities that attract cybercriminals. Hackers may target AI infrastructures to extract personal data or disrupt operations, leading to identity theft, fraud, and privacy breaches. The complexity of securing AI systems presents ongoing challenges with potentially far-reaching consequences.

16. Environmental Impact and Sustainability

The operation of GenAI systems has substantial environmental repercussions:

- High Energy Consumption: Training and running large AI models consume significant amounts of electricity and contribute to carbon emissions.
- Water Usage: Data centers require vast amounts of water for cooling and can strain local resources.
- Unsustainable Practices: The environmental costs of AI development are often overlooked or hidden from users.

Critical Insight: The rapid development of GenAI technologies poses significant environmental concerns, often overlooked in the rush to innovate. A primary issue is the high energy consumption needed to train and run large GenAI models, which rely in part on data centers powered by non-renewable energy. This contributes to substantial carbon emissions, worsening the global climate crisis. Without efforts to reduce AI's energy demands, its environmental footprint will continue to grow. Additionally, AI data centers consume immense amounts of water for cooling, straining local water resources, especially in regions facing scarcity. These environmental costs are often hidden and rarely discussed alongside GenAI's benefits. The lack of transparency around the unsustainable practices of AI development disconnects decision-makers and users from the real-world impacts. As GenAI models and their use continue to grow in scale, addressing these sustainability issues will become increasingly urgent to balance technological progress with environmental responsibility.

17. Risks of Human-AI Symbiosis

GenAI, while often presented as a collaborative tool, threatens to blur the boundaries between human agency and machine control, raising critical ethical concerns.

- Erosion of Human Judgment: As we increasingly rely on GenAI for intellectual tasks, there is a danger that human judgment may be sidelined, with GenAI becoming the de facto decision-maker.
- Dependence over Autonomy: While GenAI is meant to assist, over-reliance could reduce human autonomy. The more we integrate AI into critical decisions, the more we risk relinquishing control over outcomes that require human empathy, intuition, and moral responsibility.
- Loss of Creative Agency: As GenAI takes on more cognitive and creative roles, human intellectual growth may be stifled. The promise of AI-driven efficiency could inadvertently replace the very processes of deep thinking and creativity that define human progress.

Critical Insight: While GenAI is often framed as a collaborative tool, the erosion of human judgment, autonomy, and creative agency poses significant concerns. Over-reliance on GenAI for decision-making may undermine the human capacity for ethical reflection and nuanced problem-solving. If we continually delegate critical tasks to GenAI, we risk becoming passive participants in decisions that require deep moral and emotional intelligence. Additionally, GenAI dependence threatens autonomy; the more we rely on GenAI outputs, the more we relinquish control over complex outcomes that should remain in human hands. Finally, GenAI's role in creative processes could stifle human innovation, replacing the messy, iterative nature of creativity with probabilistically generated solutions.

18. Lack of Representation

GenAI may reflect and perpetuate societal biases through:

- Western-Centric Perspectives: GenAI models trained predominantly on Western data may not adequately represent global diversity.
- Linguistic Limitations: Disparities between high- and low-resource languages may disadvantage non-English speakers.
- Cultural Homogenization: GenAI may promote a narrow worldview, suppressing cultural differences.

Critical Insight: GenAI systems, predominantly trained on Western data, risk reinforcing algorithmic bias and marginalizing non-Western perspectives. This Western-centric approach embeds specific knowledge and values, leaving educational and informational content disconnected from the cultural and historical realities of non-Western users. Such biases not only skew knowledge representation but also reinforce existing power dynamics, which limits inclusivity in AI applications. Additionally, many GenAI systems' focus on English further excludes non-English speakers, creating barriers to equitable access to educational resources. This linguistic gap widens global inequalities, hindering meaningful engagement with GenAI technologies. Cultural homogenization is another concern. As AI-generated content reflects a narrow set of values and perspectives, it risks suppressing cultural diversity. Over time, this could lead to a loss of rich, nuanced worldviews, diminishing global cultural diversity and limiting the innovation that comes from diverse ideas and experiences.

19. Recursion and Knowledge Degradation

GenAI may contribute to the decline of knowledge quality:

- Self-Referential Data: GenAI models trained on AI-generated content may lead to a recursive degradation of information.
- Dilution of Quality: Over time, the reliance on GenAI outputs may reduce the richness and accuracy of knowledge bases.
- Echo Chambers: As GenAI systems replicate and reinforce the same content, diverse perspectives and new ideas may be overshadowed by repetitive or homogenized information.

Critical Insight: One major risk of GenAI is the potential for recursion that leads to model collapse, where GenAI systems are trained on outputs from other AI models, creating a feedback loop that could amplify errors, biases, and oversimplifications. As AI-generated content becomes

more prevalent, new models may increasingly rely on this synthetic data, leading to a gradual degradation of information quality and loss of intellectual diversity. Over-reliance on GenAI outputs also risks diluting the richness and diversity of human knowledge. GenAI models that simplify complex topics might erode depth and critical insight over time, thus reducing the educational value of AI-generated materials. Additionally, GenAI systems may create echo chambers by repeatedly perpetuating common, dominant perspectives while marginalizing alternative viewpoints. As algorithms prioritize efficiency, intellectual diversity and creativity may suffer which limits learners' exposure to fresh ideas and critical challenges to dominant narratives. This homogenization of knowledge threatens intellectual progress, which thrives on debate and complexity.

20. Disruption without Preparedness

The rapid integration of GenAI into education may cause unanticipated challenges:

- Lack of Staff Development: Educators may be unprepared to effectively incorporate GenAI into their teaching.
- Unrealistic Expectations: Pressures to adopt GenAI without sufficient support might lead to ineffective implementation.
- Resistance to Change: Sudden disruptions may cause anxiety and pushback from educators and students alike.

Critical Insight: The rapid integration of GenAI into education risks creating disruption without adequate preparation. A key challenge is the lack of proper training for educators, many of whom are expected to use GenAI without sufficient guidance. Without proper training, educators may struggle to use GenAI tools effectively, leading to suboptimal teaching outcomes and increased stress. Furthermore, the rush to adopt AI often comes with unrealistic or oversold expectations. Institutions may push for GenAI integration without fully understanding the complexities or providing necessary support, resulting in ineffective use and frustration for both educators and students. Resistance to change is another challenge; educators may feel that AI threatens their autonomy and teaching methods, while students may view GenAI tools as impersonal and diminishing their sense of agency. This anxiety and pushback might slow the effective implementation of GenAI and undermine its potential to improve educational outcomes and the educational experience itself.

CONCLUSIONS AND IMPLICATIONS: A CALL TO ACTION AND INQUIRY

> *"We create machines in our own image, and they, in turn, recreate us in theirs."* — David Lochhead

Perhaps it would be wise to say the last words at the outset. First of all, this manifesto does not call for a conclusion. Instead, it marks the initial steps of an inquiry, endeavors not to be lured by clichéd discourses, aims to raise awareness, suggests a cautious approach, encourages critical perspectives and delivers a wake-up call with the introduction of GenAI into our lives.

Although discussions about the pros and cons of GenAI are widespread, there are still important points to emphasize. First, GenAI is not just a tool; it is often treated as an agent with capabilities to communicate, interact, and create content on demand, despite differences with human-to-human processes. This positioning requires a shift not only in our attitude toward GenAI but also in the way we discuss it. As an influencing participant that we cannot ignore in the educational ecosystem, GenAI presents a potential symbiotic relationship between humans and machines that necessitates critical reflection on how we engage with it.

Second, no technology, including GenAI, is ideologically and culturally neutral. It reflects certain worldviews and ways of thinking that present both opportunities and challenges. While GenAI might appear to offer neutral and objective answers, it is not capable of true reasoning and produces output through predictive algorithms. This can create the illusion of all-knowing responses, which is far from reality. It is, therefore, essential that we address the side effects and unintended consequences of GenAI, ensuring that we critically examine its outputs and remain cautious about its impact on knowledge generation.

Furthermore, we must rethink the very nature of education, teaching, learning, and assessment in light of GenAI. GenAI could provide opportunities to move beyond a deterministic view of knowledge if, rather than expecting students to provide 'right answers', the focus shifts to the learning process, where GenAI may support personalized educational experiences. Moreover, knowledge is no longer confined to traditional classroom settings; it is accessible everywhere.

In the context of increasing GenAI use, the role of educators, administrators, and policymakers becomes critical. Continuing with 'business as usual' is no longer an option as GenAI rapidly infiltrates education. The impacts of GenAI are already being felt, and the future will probably depend on how we respond to these changes. As GenAI systems become more powerful, there is a growing need for a re-evaluation of extant and future practices.

Additionally, it's important to acknowledge that GenAI is not a silver bullet. It cannot single-handedly transform education overnight, but it does offer the potential for significant change. Embracing GenAI encourages educators to step out of their comfort zones and engage in transformation. As learning extends beyond formal settings to include life-long, life-deep, and life-wide learning, the need for GenAI literacy and competences becomes critical. Understanding the underlying mechanics of GenAI can help users navigate the technology responsibly and mitigate the potential harm caused by hallucinations, biases, and misinformation.

Moreover, GenAI might deepen intellectual and creative distance. For instance, writing may be seen as a product by some; for others, it is a process of intellectual and creative growth. When GenAI is used to bypass crucial processes in developing ideas, we risk losing a sense of ownership over our ideas and how we communicate them. This raises existential questions about the nature of knowledge and our relationship to it when we no longer engage deeply with our own intellectual development.

One of the biggest risks in using GenAI in education is its potential to replace meaningful interpersonal engagement. If students rely on GenAI to generate response sets and educators use the same technology for evaluation, we risk bypassing critical processes like interaction and active participation. This diminishes the role of human agency and undermines authentic learning experiences, leading to a system where GenAI trains itself on human inputs, rather than fostering human growth.

Another critical issue to consider is the role of values and human identity. We learn to be human from those who teach us, whether formally or informally. But what happens when these 'teachers' are not human? GenAI lacks values, or worse, has its values determined by the corporations that own it. This poses significant questions about how AI shapes our understanding of ourselves and the world.

At a more fundamental level, GenAI reuses knowledge rather than creating new knowledge, which is a key function of the academic enterprise. Since GenAI is trained on existing material, its outputs depend on the quality of the input. The large, web-crawled data sets often used in GenAI training act as a 'distorted mirror' of the internet, amplifying dominant worldviews and potentially reinforcing harmful biases. Such a view highlights the importance of critically examining GenAI outputs and understanding the limitations of its knowledge.

Another important issue is that we must remain aware and alert of the hidden interests behind AI development. AI systems are often designed to serve the interests of for-profit corporations, much like social media algorithms that steer users toward content that increases engagement, regardless of the costs of fueling rage, political division, and mental health issues, especially among young people. Big tech companies are now investing billions in AI, aiming to increase profits. In educational settings, it is vital to be cautious of how corporate interests might influence AI-generated information. If AI systems are driven by revenue or political agendas, they could shape the responses that students receive, hence impacting their learning and critical thinking.

Technologies do not move at a pace that is deliberative, cautious, and wise. Instead, they are brought to market relentlessly, often outpacing our ability to reflect on their implications. Nevertheless, we do not have to follow in lockstep with this technological momentum. We have the power to collectively and consciously decide how, when, and with whom we engage with AI, as well as the resources we allocate to its integration. The urgency of this moment is why we need robust, evidence-based research to guide our decisions. We must deeply understand this phenomenon, critically evaluate its impacts, and position AI wisely within the educational ecosystem. The future of learning and human development depends on our collective ability to

make these decisions with foresight and care; not as passive consumers, but as active shapers of technology's role in our lives. The choices we make now will determine whether we shape AI for the collective good or allow it to reshape us in unintended, and perhaps harmful, ways.

All in all, this is not a moment for passive acceptance but one for collective, conscious effort and action. We stand at a critical crossroads, where our decision is not just about adopting a technology but about choosing the future of human agency, knowledge, wisdom, and ethics.

As final remarks, we would like to ask: Do we follow the white rabbit blindly into a world dominated by GenAI, or do we approach it with wisdom, caution, and purpose? As in the case of the red and blue pill dilemma, should we choose whether to be informed and deliberate or to surrender to a pre-scripted path shaped by intelligent (!) technologies or should we forsake these binary options and adopt a critical, collective stance to co-create the future?

SUSTAINABLE DEVELOPMENT GOALS (SDGs)

This study is linked to the following SDGs: Quality education (SDG 4: Target 4.6) and Partnerships for the goals (SDG 17: Target 17.6).

DATA ACCESSIBILITY STATEMENT

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

ETHICS AND CONSENT

Because the researchers in this study reported their own opinions and used their own intellectual experiences as data sources and were involved as co-authors in the study, ethical review was waived in this collective study.

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COMPETING INTERESTS

The authors have no competing interests to declare.

AUTHOR NOTES

Based on *Academic Integrity and Transparency in AI-assisted Research and Specification Framework* (Bozkurt, 2024b), the authors of this manifesto acknowledge that this manifesto

was reviewed, edited, and refined with the assistance of DeepL and OpenAI's ChatGPT (Versions as of September 2024), complementing the human editorial process. The human authors critically assessed and validated the content to maintain academic rigor. The authors also assessed and addressed potential biases inherent in the AI-generated content. The final version of the manifesto is the sole responsibility of the human authors.

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A.B.; Conceptualization, methodology, formal analysis, investigation, data curation, visualization, writing—original draft preparation, writing—review and editing.; J.X.; R.F.; J.Y.H.B.; C.N.; S.M.; J.D.; C.M.S.; L.S.; H.C.; A.K.; E.T.; A.P.; M.N.; A.S.; E.C.; S.W.; D.M.; S.H.; C.B.H.; M.S.; A.S.; I.F.; A.T.; P.J.S.v.T.; M.B.; M.B.; J.L.; K.Z.; M.C.; T.K.F.C.; K.L.; S.H.; M.G.; R.C.S.; B.A.; O.Z.R.; H.H.; P.J.; C.Z.; P.S.; J.M.D.; C.T.; A.V.; S.S.B.; R.L.M.; T.I.A.: Conceptualization, writing—original draft preparation, writing—review and editing. All authors have read and agreed to the published version of the manuscript.

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