Developing a Teaching Compass in the Age of AI

A Concept Paper Focusing on Teacher Competencies

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Introduction

Generative artificial intelligence (AI) has the potential to transform societies, economies, and education systems worldwide. Recent breakthroughs in natural language processing have enabled new tools like ChatGPT that can generate unexpectedly human-like text. These emerging technologies have the potential to benefit both educators and learners. However, their rapid development and deployment are outpacing policy-making and regulation. As educational policymakers consider harnessing generative AI's advantages while mitigating risks, they face complex ethical and pedagogical questions. This paper offers an introductory overview of generative AI capabilities, emerging applications in education, key perspectives that may inform educational policymaking and the first steps towards developing a Teaching Compass framework, to parallel the Learning Compass framework (OECE, 2019).

While artificial intelligence has been developing since the logic-based "expert systems" of the 1960s and 70s (Wooldridge, 2021), more recent advances in deep learning and neural networks have accelerated progress, enabling modern innovations that have entered almost every aspect of our lives, from YouTube recommendation algorithms to voice activated devices like Alexa or Siri; from navigation software such as Google Maps or Waze to facial recognition systems in many photography apps. More recently, the training of these neural networks on immense amounts of textual and image data, scraped from the Internet, have allowed the development of generative AI tools such as ChatGPT, Bard, DALL-E, Midjourney, and Stable Diffusion, which can create from scratch, text and images from mere verbal prompts.

The speed at which these natural language processing tools have entered our world, and through that the world of education, is striking. Commercial companies are marketing AI assistants to support teachers in planning and assessment, such as MagicSchool and Eduaide based on OpenAI's technology (Extance, 2023). Moreover, academic researchers have produced tools like PyrEval to analyze student essays (Extance, 2023). Organizations are also engaging directly with students, with Khan Academy's new LLM-based tutor Khanmigo being piloted in over 30 US school districts this year (Extance, 2023). At universities like East China Normal, dedicated education-focused LLMs such as EduChat are being developed and shared as open source (Extance, 2023).

As these powerful generative AI applications rapidly proliferate, it is critical for policymakers to have an awareness of what these technologies are and how they work. *Artificial intelligence (AI) is a*

field of computer science focused on creating intelligent systems that can perform tasks like decision-making and pattern recognition (Ruiz & Fusco, 2023). A recent AI innovation has been large language models (LLMs). *Large language models (LLMs)* rely on neural networks called transformers trained on massive datasets (UNESCO et al., 2023). One widely known example of an LLM is ChatGPT. *ChatGPT* is a conversational LLM pre-trained on vast amounts of text, allowing it to generate human-like responses (Ruiz & Fusco, 2023). *Generative AI,* including ChatGPT, can create original text, images, videos, music, code, and other content in response to prompts by analyzing and imitating patterns in training data from online sources (UNESCO et al., 2023). Importantly, the *training data* used shapes what AI systems learn, and these systems reflect biases in data and creators (Ruiz & Fusco, 2023).

Generative AI in education

The integration of generative AI into education evokes opportunities and risks that demand mindful deliberation. Some benefits include the potential to summarize texts, enable more time for learning discussions, and provide personalized conversational tutoring (Extance, 2023). However, challenges arise regarding student privacy, accuracy, and AI's impacts on inclusion and equity (Extance, 2023; UNESCO et al., 2023). Additional concerns are inequities in access that could exacerbate digital divides, the perpetuation of biases from training data, and the reduction of human agency in learning (UNESCO et al., 2023). Experts recommend measures to address these risks, such as human monitoring of AI, alignment to educational goals, ensuring data privacy, informing and involving educators, developing specialized guidelines, and research on context, trust, and safety (Cardona et al., 2023; UNESCO et al., 2023).

The OECD AI Principles, adopted in May 2019, "promote use of AI that is innovative and trustworthy and that respects human rights and democratic values" and may be useful when considering issues related to generative AI (AI-Principles Overview, n.d.). First, the OECD outlined key values-based principles. These include inclusive growth, sustainable development and well-being, human-centered values and fairness, transparency and explainability, robustness, security and safety, and accountability (AI-Principles Overview, n.d.). Moreover, the OECD provides a set of recommendations for policy makers. These include investing in AI research and development, fostering a digital ecosystem for AI, providing an enabling policy environment for AI, building human capacity and preparing for labor market transition, and international co-operation for trustworthy AI (AI-Principles Overview, n.d.). While many of these principles remain relevant,

policy-makers may want to revisit these periodically and with an intentionally critical lens given the speed of how AI has continued to evolve. These dramatic changes necessitate educators and education policy makers to respond, intentionally, thoughtfully and comprehensively to these opportunities and challenges. Given the rapid rate of evolution of these technologies, it is important that we focus not on current technologies, because they will change, but rather on developing a "compass" a way of thinking and working with these technologies that depend on deeper, humanistic principles and ideas.

Developing a Teaching Compass

The development of the Teaching Compass is inspired by previous work on developing the *Learning Compass* (OECD, 2019). The *Learning Compass* presents an vision for the future of education, outlining the essential competencies that students will need to flourish in 2030 and beyond. This framework, metaphorically represented as a compass, highlights the necessity for students to independently navigate through new and unfamiliar situations, guiding themselves towards meaningful and responsible paths. Developed through an inclusive and collaborative process, engaging government representatives, academic experts, school leaders, teachers, students, and social partners globally, the primary objective of the compass is to align education with broader goals, providing clear directions towards a future that prioritizes both individual and collective well-being.

In a similar vein, we suggest that the *OECD Teaching Compass* can serve as a valuable, flexible, context-sensitive guide when formulating policies to address the emerging technology of generative AI in education. We argue that it can be structured similar to the OECD Learning Compass, around three key pillars: *teacher agency (co-agency and collective agency), teacher wellbeing, and teacher competencies (knowledge, skills, and, attitudes and values)*. We describe each of these briefly, inspired by their learner equivalents in the OECD *Learner Compass* (2019).

- *Teacher agency, co-agency, and collective agency*, can be defined as the capacity of educators to act autonomously and make informed, ethical decisions. It emphasizes the teacher's ability to shape the educational environment and curriculum, rather than passively delivering predetermined content. It involves educators taking a proactive role in their own continuous professional development, collaborating with colleagues, students, and the wider community. It underscores the importance of teachers as key decision-makers and innovators in education, who can adapt and respond to new technologies (such as generative AI) and the evolving needs of their students and the broader educational landscape.

- T*eacher wellbeing,* can be described as the state of being happy, healthy, and prosperous for educators both individually and within the broader educational community. It is influenced by a combination of professional knowledge, skills, attitudes, and values, along with the transformative competencies that teachers develop through a cyclical process of anticipation, action, and reflection that teachers engage in to navigate and enhance their teaching practices, contributing to their personal and professional growth and fulfillment.
- T*eacher competencies* define the essential knowledge, skills, attitudes, and values needed for educators in the evolving educational landscape. There are 3 key dimensions to this. *Knowledge* which includes a deep understanding of subject matter across various domains as well as awareness of critical global and local issues such as sustainability, and diversity along with pedagogical knowledge tailored to these themes. *Skills* which are their ability to apply their knowledge in diverse educational contexts. These include cognitive and meta-cognitive skills, social and emotional skills, and practical skills. *Attitudes and Values* which involve the personal beliefs and dispositions that shape an educator's approach to teaching and interactions with students and colleagues such as curiosity, openness, respect, compassion, integrity, and a commitment to lifelong learning and ethical practice.

Given this, it is important to ask as to what do these three pillars look like in a world of generative AI? If we focus specifically on the third pillar, *Teacher Competencies* (including *knowledge, skills, and attitudes and values)* how do they change in this new world? To answer these and similar questions we need to dig deeper into what generative AI is and what it means both for teacher knowledge for its effective integration in teaching; the kinds of skills teachers need to develop; and finally the deeper values and attitudes teachers need to inculcate. We base our discussion of these ideas on two recent publications that have explored the idea of teaching in the age of generative AI, albeit from two different directions. The first, *TPACK in the age of ChatGPT and GenAI*, (Mishra, Wart & Islam, 2023) focuses on the nature of teacher knowledge in a world of generative AI, with a specific focus on pedagogical, content, technological, and contextual knowledge that educators need to leverage generative AI effectively. The second, *The (Neil) Postman Always Rings Twice: 5 Questions on AI and Education* (Mishra & Heath, in press), uses a wider frame to focus on the broader societal impacts of generative specifically generative AI's potential cultural and ethical consequences that can have an impact on education.

Both the articles are available in their entirety, but for the sake of this manuscript we provide next, shorter (2-3 page) executive summaries that highlight the key ideas in these articles. We believe this provides a good foundation for a deeper discussion that will culminate in the development of a *Teacher Compass*. After the two executive summaries, we conclude with a series of questions that are important for us to consider as we move forward.

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Executive Summary I: TPACK in the age of ChatGPT and GenAI

Complete citation: Mishra, P, Warr, M, & Islam, R. (2023): TPACK in the age of ChatGPT and Generative AI. *Journal of Digital Learning in Teacher Education*, DOI: 10.1080/21532974.2023.224748

Note: This executive summary was collaboratively created by Claude.AI and Punya Mishra. Claude.AI created two drafts of the summary and these two drafts were combined and edited by Punya Mishra to create this document.

Generative AI (GenAI) technologies like ChatGPT have sparked much discussion about their potential impact on education. In this paper titled "TPACK in the Age of ChatGPT and Generative AI," the authors argue that the rise of generative AI (GenAI) technologies like ChatGPT requires reimagining aspects of the Technological Pedagogical Content Knowledge (TPACK) framework. TPACK describes the types of knowledge teachers need to effectively integrate technology into teaching.

The paper first provides background on GenAI, defining it as AI that can generate new content like text, images, or music in response to user input, learning patterns from large datasets rather than being explicitly programmed. It summarizes current educational discourse, including concerns about cheating and biases as well as optimism about benefits like personalized learning.

It then dives deeper into the unique properties of GenAI that comprise Technological Knowledge (TK) in TPACK. Like other digital technologies, GenAI is protean, opaque, and unstable. However, its protean nature is magnified by its ability to fluidly interact with diverse digital media through natural language and its wide applicability for creative and analytical tasks. Its opacity results from the complexity of its neural networks being incomprehensible even to creators. Its instability stems not just from errors but from its tendency to "hallucinate" or generate untethered outputs.

Uniquely, GenAI is also generative, creating original, unanticipated content on the fly rather than retrieving pre-existing information. Its developers have been surprised by innovative capabilities it developed independently. GenAI is also social, encouraging anthropomorphism and dialogue due to its

conversational nature. The paper argues that we must recognize GenAI as a generative, social "psychological other" rather than simply a productivity tool. Teachers should approach it as an expert yet unreliable collaborator who can assist with complex conceptual tasks but whose proclivity for falsehood requires vigilance.

Most significantly, GenAI requires a philosophical shift in TPACK from viewing technology as a tool to recognizing the emergent, reciprocal dance between users and technologies like GenAI. Rather than passive objects, these social, generative technologies actively shape interactions. The learning space now includes a non-human, alien intelligence.

Thus, the nature of teacher knowledge, TPACK, must adapt. Technological Pedagogical Knowledge (TPK) could involve utilizing GenAI for formative assessment while focusing summative assessment on higher-order skills. Technological Content Knowledge (TCK) should prepare students for AI-transformed careers. Further, given GenAI's potential to transform society, Contextual Knowledge (XK) must expand in scope. While XK traditionally focuses on constraints within school systems, it must now also consider broader personal, cultural, political, and ethical implications of AI over decades-long timescales. These include impacts on notions of truth, trust in institutions, mental health, and workforce disruption that schools will need to address.

The authors make an important analogy about the impact of social media in describing the potential impact of generative AI on education. They suggest that while initially focusing on incorporating social media in the classroom, educators did not consider how these technologies could negatively impact society by exacerbating polarization, eroding trust in institutions, and harming mental health - consequences now evident and are challenges that schools must now address. The authors warn that a similar dynamic could unfold with GenAI, where educators would be left to contend with adverse societal impacts they did not anticipate as technology companies rapidly develop and deploy these tools.

The authors argue that the rise of generative AI necessitates reimagining aspects of the TPACK framework to empower teachers to ethically integrate this technology. Updating Technological Knowledge will require recognizing these tools as collaborators rather than mere productivity aids. Expanding Contextual Knowledge involves developing foresight about long-term societal impacts. Overall, TPACK must shift from a toolset view to one recognizing the emergent relationships between users and technologies like AI. With vigilance, creativity, and proactive perspective, educators can lead students in constructing a just society alongside increasingly capable AI. Rather than reactive response, this paper calls for teachers to proactively build capacity to mitigate adverse consequences and harness benefits of this transformative technology as it continues evolving within and shaping culture.

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Executive Summary II: The (Neil) Postman Always Rings Twice: 5 Questions on AI and Education

Complete Citation: Mishra, P., & Heath, M. K. (in press). The (Neil) Postman Always Rings Twice: 5 Questions on AI and Education. In M. Searson, L, Langran, J. Trumble (Eds.) *Generative AI in Teacher Education: Opportunities, Challenges and Visions for the Future.* AACE.

Note: This executive summary was collaboratively created by Claude.AI, Punya Mishra, Nicole Oster & Marie Heath. Claude.AI created multiple drafts which were combined and closely edited to create this final version.

The history of educational technology is littered with hype, hope, and disappointment. New technologies are often introduced into classrooms with great fanfare and promises of transformation, yet they rarely fundamentally alter educational practices as predicted. Educational systems are often pejoratively described as being fossilized, inertial systems, unable to change to meet the needs of a changing world and to take advantage of the powers of new technologies

We take a somewhat more nuanced view in that we see the role of technology in education as being complicated by broader factors such as the nature of the technology and larger social, economic, and institutional constraints. Furthermore, while particular technologies may not directly enter classrooms or dramatically change classroom activities, their broader societal impacts often necessitate changes in educational priorities, curricula, and approaches. For instance, while the advent of television did not displace classroom lectures and textbooks, its rise as a dominant entertainment and communication medium reshaped every aspect of society. Similarly, social media have transformed politics and the social emotional lives of teenagers across the world, not always for the better.

The rapid development of generative AI, given their unique capabilities, will transform industries and the world of work in profound ways. Large language models can communicate with humans using language across modalities like text, voice, and image. Their extensive knowledge, amassed from ingesting massive datasets, and conceptual flexibility allow them to successfully complete higher-order tasks which, till recently, could only be done by humans. These attributes, (undermined somewhat by their ability to hallucinate) endow generative AI with a perception of independent thought and personality, making them feel like genuine social participants in our lives.

Educational systems will need to equip students with the cognitive, social, and emotional tools to healthily navigate this escalating phenomenon of AI encroachment into social domains previously exclusive to humans. This will require researchers and educators to look beyond classroom interventions and consider approaches that prepare students to live and prosper in an AI-saturated world. It is here that philosophers and historians of technology can provide guidance, given their ability to look beyond the immediate to broader narratives and societal implications. In this chapter, we focus on 5 key ideas media theorist Neil Postman raised in his 1998 talk, *Five Things We Need to Know About Technological*

Change.

1. We always pay a price for technology.
2. When it comes to technology, there are always winners and losers.
3. Embedded in every technology, there are one or more powerful ideas—and biases.
4. Technological change is not additive, it is ecological.
5. Technologies are fictions.

We always pay a price for technology. Postman contended that technological change always involves a trade-off in which technology both gives and takes away. With AI key trade-offs may involve balancing personalization and human connection, over-reliance on data versus teacher expertise, and valuing the struggle of learning versus easy knowledge generation. We must ponder if in using AI tools, we become more artificial in our intelligence and less authentically human in our learning processes and connection to each other. Educators must thoughtfully strike a balance between leveraging the efficiencies of AI systems and preserving human-centered, socio-emotional pedagogy.

When it comes to technology, there are always winners and losers. The benefits of technology are never equally distributed, often exacerbating existing inequities in access to technology, resources, and quality instruction. AI risks widening digital divides and achievement gaps based on socioeconomics, geography, and other factors, potentially creating two tiers of learners. It may also advantage certain subjects and skills over others. Interestingly current versions of AI seem to have capabilities which traditionally have been uniquely human capabilities (such as the arts). As educators we must teach students to critically assess how AI models can perpetuate biases so they can work toward more equitable futures.

Embedded in every technology, there are one or more powerful ideas—and biases. Technologies inherently convey concealed biases shaping thought and experience. AI systems reflect existing societal biases in their training data and may further introduce or amplify new biases through unchecked algorithms. Generative AI's vast knowledge and unique social capabilities have the potential to influence people and could intensify mistrust in institutions and information sources, exacerbate confusion about truth, and complicate developing identities. As corporations prioritize profits over prudence with generative models, educators again may bear the burden of addressing unforeseen consequences, requiring vigilance of AI's prejudices and proactive efforts to develop critical thinking.

Technological change is not additive, it is ecological. New technologies transform society wholesale rather than merely supplementing it, evident in how print, television, and social media fundamentally reshaped our world. The societal impacts of AI are vast, unpredictable, and irreversible. These technologies' social nature makes them potent tools of persuasion that could exploit our cognitive biases to spread misinformation and erode epistemic trust. While AI's cultural impacts are speculative, students must be prepared for an AI-transformed world that may differ profoundly from today's, necessitating

educators develop students' critical thinking to navigate this complex future suffused with synthetic media.

Technologies are fictions. Technologies become "mythic" and accepted uncritically unless we recognize their constructed, non-natural nature. They are designed by humans and can be redesigned by scrutinizing their contexts, questioning impacts, and asserting control over their development and deployment. Their ethical and responsible use depends on human moral awareness and agency. Students should investigate the design of AI and the manner in which it might (or has already) seemingly seamlessly embedded itself into our educational and social lives.   This helps learners and educators to develop critical perspectives and demand responsible educational applications.

In conclusion, we suggest that while generative AI's direct impacts on classrooms may be gradual and less dramatic than the hype imagines, its broader influences on culture, social patterns, and youth development will be significant. Regardless of whether AI tools directly enter classrooms, their cultural disruption necessitates educational responses. Educators must prepare students to navigate this transformation using individual and collective agency over their technological future.

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Bringing it all together

These two executive summaries highlight the transformative potential of generative AI technologies and the complex considerations they raise for education. A key theme is that while direct impacts on classrooms may be gradual, the broader influences of these AI systems on society and youth development will be significant and necessitate proactive educational responses.

Some of the major issues raised include reimagining aspects of the TPACK (teacher knowledge) framework to account for AI's unique properties as a generative, social "psychological other." This involves recognizing emergent relationships between users and AI rather than just viewing them as tools. The summaries also highlight how AI risks exacerbating societal divides and biases. Educators may need to address unforeseen consequences like intensified polarization, eroding epistemic trust, and confusion about truth and identity. A critical perspective is key to ensuring responsible integration.

These complex issues point to needs in several areas that warrant further discussion within the context of the *Teacher Compass* we had described earlier. In particular we focus on *Teacher Competencies,*

and on *Knowledge, Skills, and Attitudes and Values.* Below we provide a first-draft of questions under each of these categories that we believe are worthy of further discussion.

Questions for Discussion around Teacher Competencies (Knowledge, Skills, and Attitudes and Values)
Knowledge: What knowledge and understanding will teachers need to develop regarding AI systems, their capabilities, impacts, and ethical implications in order to effectively educate students in an AI-transformed world?

- What is the true nature of Generative AI? In what ways is it different from other technologies that have come in the past? And what does that mean for educators?
- What knowledge will teachers need to develop about the technical workings of AI systems (e.g. machine learning, neural networks) in order to gain Technological Knowledge (TK) to guide appropriate technology usage?
- How might generative AI like ChatGPT impact teachers' Technological Content Knowledge (TCK), given AI's ability to rapidly produce content across domains? How should TCK adapt in response?
- How might the nature of subject matter knowledge evolve given the ability of AI systems to generate content across disciplines and their potential impacts on industries and careers?
- What types of contextual knowledge will teachers need to develop to understand the broad societal impacts of AI over long time horizons, as the authors suggest with expanding Contextual Knowledge (XK)?

Skills: What new skills will teachers need to develop and impart to students in response to the emergence of generative AI technologies in order to promote critical thinking, emotional resilience, and ethical technology usage?

- What strategies can teachers employ to develop students' ability to evaluate the credibility and accuracy of AI-generated text, images, audio etc. to identify potential misinformation?
- How can teachers help students develop the critical thinking skills needed to identify potential biases and misinformation in generative AI outputs? What new evaluation skills might this require?
- How can teachers help students build resilience against possible influences from anthropomorphic AI on their self-concept, emotions, and relationships? What socio-emotional skills might this require?

- How do we build critical thinking to evaluate AI-generated content for validity and biases?
- What new pedagogical skills will teachers need to develop to effectively collaborate with AI tools as "partners" in the classroom, as the authors suggest these technologies require viewing them as collaborators rather than just productivity tools?

Attitudes and Values: How can teachers cultivate the attitudes, mindsets and values in themselves and students that prioritize human-centered educational experiences, socio-emotional development, and the ethical application of AI for social good?

- How can teachers model and instill an attitude of lifelong learning to continuously update their knowledge as AI technology rapidly evolves?
- What mindsets and values will help teachers maintain human-centered educational experiences and socio-emotional connections with students despite the encroachment of AI into social domains, as the authors warn?
- How do we balance utilizing AI capabilities while preserving human-centered pedagogy and socio-emotional development?
- How can teachers instill in students the sense of agency, capacity for questioning, and motivation to shape technology for social good that the authors argue is necessary? What attitudes and values underlie this?
- In what ways might teachers need to expand their concept of ethical practice to account for responsible use of AI technologies and preparing students to navigate an AI-transformed world?

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