In the Shadows of Burgeoning Colossi: The Whiteness of AI in Mathematics Teacher Education

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Artificial intelligence (AI) has begun to infiltrate many aspects of our professional lives. Companies like Microsoft and Google have been chastised for choosing "speed over caution" in their development and incorporation of AI-based products and services (Grant & Weise, 2023). Prioritization of quick-before-careful AI implementation is especially concerning given equity-oriented issues of past technological innovations and their development. For example, Daniels (2015) argued that technological innovations often perpetuate color-averse norms of the dominant culture. Researchers have already begun to question AI's messaging that is biased with respect to race, ability, or sexual orientation (Queer in AI, 2023). AI has brought to the forefront other social issues like its impact on climate. AI stands to propagate dominant (white) narratives because AI is trained on specified data (Fancher, 2016). So, without sufficient safeguards, dominant whiteness in is likely to result in dominant whiteness out (Vorsino, 2021).

It is important for mathematics teacher educators (MTEs) to consider AI in our practices. Without caution, MTEs may also be following (and leading the teachers they support) along a dangerous path. In this brief discussion, the authors question a speed-without-caution approach to implementing AI in mathematics teacher education. Inspired by Milner (2007), the authors explore field-specific dangers seen, unseen, and unforeseen regarding AI in our field. Our intention is to begin a conversation about ethical considerations and possible impacts of AI within our mathematics teacher education programs.

Positionality

Gómez Marchant and Hardison came together to discuss issues of AI in mathematics teacher education as both were considering how to incorporate AI into their courses for prospective teachers. The two authors engaged in purposeful dialogue in consideration of their theoretical perspectives and acknowledged their perspectives are limited. Hardison considers himself a radical constructivist. Gómez Marchant's theoretical foundations align with critical race theory. Both authors recognize the benefits from their adjacency to dominant whiteness. Like Orozco Marín (2022), the authors conceptualize white as the collection of privileges bestowed by policies, laws, regulations, and social norms due to not being racialized; being seen as a person before a racialized person. This paper emerged as the authors continue to make sense of their responsibilities as MTEs.

Dangers Seen, Unseen, and Unforeseen

Milner (2007), speaking particularly on studies of race, described the importance of researchers' decisions and three types of associated dangers: seen, unseen, and unforeseen.

> By seen dangers, I mean the dangers that can explicitly emerge as a result of the decisions researchers make in their studies. Unseen dangers are those that are hidden, covert, implicit, or invisible in the research process…. Unforeseen dangers are those that are unanticipated or unpredicted in a research project based on the decisions that researchers make in the research process. (Milner, 2007, p. 388)

Milner pushes on the importance of researchers considering these dangers, but we apply these dangers to our teaching practices regarding AI. Not unlike Milner, the authors hope this conversation can "guide and assist researchers [and MTEs] in working through these dangers" (p. 388). In conversations about AI and mathematics teacher education, we considered the dangers of whiteness (seen, unseen, and unforeseen) relative to MTEs' practices. We foreground illustrative, but not exhaustive, dangers of each type: First, the seen dangers of equity issues identified and the race-neutral policy discourse by professional organizations; Second, the unseen dangers of AI as perpetuating a (white) status quo; Third, the unforeseen dangers within the legal landscapes of AI in mathematics teacher education.

The Seen: Equity Issues and Race Neutral Policy Discourse

Here, we consider seen dangers explicitly emerging from MTE's decisions involving AI. As AI has increased in society's purview, the National Council of Teachers of Mathematics (NCTM) and Association of Mathematics Teacher Educators (AMTE) released position statements about the roles of technology within mathematics education. NCTM's statement specifically discusses AI's potential in mathematics teaching and learning, pointing explicitly to teachers' responsibility toward the inequities and bias of AI: "Teachers must tell students to be very skeptical about AI results, especially about the unique challenges of using tools that may have been trained on biased datasets" (NCTM, 2023). This recognition aligns with AMTE's emphasis on the possibilities technology provides in general to teach more equitably: "Technology can play an integral part in promoting equitable teaching practices" (AMTE, 2023). Thereby, recognizing the explicitly seen dangers of AI not being used intentionally with equity in mind—particularly with minoritized and marginalized learners. Both these statements identify important dangers; however identifying dangers cannot be taken as a stopping point. MTEs have a responsibility to proactively address these issues. As Urrieta (2006) warns: "as long as we continue to advocate for colorblind educational policies in a white supremacist system, we will continue to promote unequal treatment of people of colour in U.S. schools" (p. 472). To those with whiteness, neutral color-averse language offers avenues of avoidance and complacency. Anti-Blackness, anti-fatness, racial and ethnic injustices, and the heteronormativity of our spaces can only be effectively disrupted if named explicitly.

The Unseen: Perpetuation of a (white) Status Quo

The use of AI in our practices brings about various hidden, unseen dangers. We consider unseen dangers along these lines for MTEs. In particular, we highlight unseen dangers that fall under the umbrella of perpetuating a (white) status quo. For example, Adobe's Firefly, which is a text-to-image generative AI, was trained on Adobe's stock

photo collections (see Figure 1). Investigations have shown these collections perpetuate negative racial imagery (Chichester et al., 2023) and anti-fatness stigma (Atanasova, 2023). MTEs must carefully consider how AI tools are trained and what potential myths about mathematics doing and learning (e.g., neutrality, emotionless) may be perpetuated through using them. See, for example, the images generated from the prompt "mathematics teacher." Each generated image features a glasses-wearing individual standing by a chalkboard of symbols. What potential myths might be conveyed from these images?

Figure 1: Screenshot of Adobe Firefly FAQ on training

So, what content does Adobe Firefly train on?

Adobe Firefly trains on Adobe Stock imagery in accordance with the Stock Contributor License agreement, openly licensed content, and public domain content with an expired copyright. This means that Firefly is designed to be safe for commercial use and Firefly outputs are now available to be used for commercial purposes.

Figure 2: Images from Adobe Firefly with prompt "mathematics teacher"

In classrooms, Gómez Marchant and colleagues have seen the erasure of learners' lived experiences through the use of AI-generated word problems (See Figure 3; Field notes Oct. 2023). In these field notes, the research group documented how all ten problems generated were partitive division problems with arguably haphazard number choices. Number choice is an important facet of developing elementary learners' numeracy (see Carpenter et al., 2015). Additionally, the problems lacked specific connections to the learners' lived experiences, and in this regard, the AI-generated problems perpetuated the myth of mathematics as disconnected from learners' reality. The AI generated problems disconnect mathematics teachers from learners' lived experiences. Some learners may be aware that AI does not take who they are nor what they know into consideration. These examples, therefore, demonstrate a dangerous surface-level approach to culturally relevant pedagogy (see Neri et al., 2019).

Figure 3: Word Problems Generated by AI System in 5th Grade Classroom

1. Kara is organizing her books into boxes. She has 160 books in total and wants to divide them equally into 4 boxes. How many books will be in each box?

3. Emma has 1,224 colored pencils. She wants to share them equally among her 4 friends. How many colored pencils will each friend get?

The Unforeseen: The Upcoming Legal Landscape and Who Profits?

Unforeseen considerations regarding AI can be examined within a chaotic, in-flux system of possibilities. For example, the legal landscape is unpredictable and filled with unforeseeable dangers (Milner, 2007). Each AI platform has terms of use. Figure 4 below shows a portion of Adobe Firefly's terms indicating differences in how the input and output data is handled based on users' paid subscription statuses. In particular, free users' inputs and outputs are not protected and are subject to further public use, whereas paid users have additional protections and relative privacy. What this means for the protection of teacher educators, learners, and teachers who use AI systems is largely unclear and hence these dangers are unforeseen. Although we are hopeful that appropriate laws, policies, and regulations regarding AI protections for educators and learners are emerging quickly, we are confident such efforts will be outpaced by more rapidly evolving AIs and the unforeseen issues that rise in their wake. To protect educators and learners, there must be caution regarding the legal aspects of AI including user privacy, ownership of intellectual property, what data is scraped, how data might be used, who data might be sold to, etc. Ultimately, the security and confidentiality of our partners/participants are at stake when their stories and data are run through AI systems. Thereby, MTEs need to maintain their vigilance of how data and the mathematics of the algorithms are being considered in legal spaces. Quantification in policy making spaces has a history of flattening social issues to mathematical solutions (Espeland & Sauder, 2016; Tate et al., 1993). Flattening through mathematical actions often erases the experiences of minoritized groups (Gómez Marchant et al., 2023).

Figure 4: Section 4.1 of Adobe Firefly User Agreement

4.1. **Text-based Inputs by Free Users**. If you do not currently have a paid subscription to Services and Software and submit a text-based Input (including any design settings, such as style) to a generative AI feature, you grant us a non-exclusive, perpetual, irrevocable, worldwide, royalty-free license to use, reproduce, distribute, modify, sublicense, create derivative works based on, publicly display, publicly perform, or translate both the submitted Input and any corresponding Outputs for any purpose. For example, we could make your Inputs and Outputs publicly available to other users and allow those users to use the Inputs or Outputs to create their own content. This license survives termination or expiration of the Terms. If you do not want to grant us this license, you should purchase a paid subscription to Services and Software.

Conclusion: Futurity of Inclusion

AI and other developing technologies provide opportunities for co-constructing speculative futures. This futurity, however, needs to be created with care. As a field, we have made considerable strides with respect to equity and inclusion. We must encourage those who have the temporary illusion of control over these burgeoning Colossi to take our field's expertise seriously. Following NCTM and AMTE, at the

classroom level, there is a need to encourage the use of AI to help in forming resistance to dominant narratives and developing teachers' and teacher educators' critical consciousness. Teachers are well-positioned to push back against problematic, artificial ways of reasoning and push towards more productive ones; indeed, that is the work they do on a daily basis. MTEs cannot stand by and watch these giants from a distance.

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