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Three Technoskeptical Design Tools for the Development of Mixed-Reality Simulations in Teacher Education

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Abstract

This paper introduces technoskeptical design, a framework combining equityXdesign and technoskepticism to guide equitable and critical development of mixed-reality simulations (MRS) in teacher education. Through a spring 2025 codesign project on systemic ableism, five diverse participants applied three new design tools (i.e., technoskeptical design hats, a historical context sheet on ableism in extended reality (XR)/Special Education, and design workshop exit surveys). These tools helped surface hidden assumptions, redistribute design authority, and foreground equity and critical reflection throughout the process. Findings highlight how technoskeptical design tools can help teacher educators and designers interrogate technologies' values, contexts, and implications to better design just learning experiences. This paper surveys the tools used in technoskeptical design while challenging readers to constantly ask themselves: what if all educational technology were created using elements of technoskeptical design?

Keywords: equityXdesign, technoskepticism, mixed-reality simulations, technoskeptical design

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Introduction

TeachLivE and Mursion are some of the most frequently used mixed-reality simulation (MRS) platforms in teacher training programs (Ireland, 2021). During a TeachLivE MRS training, pre-service teachers can practice pedagogies in a variety of virtual settings (e.g., elementary circle time, inclusive high school class, college lab, etc.) by either standing in front of a large screen or on Zoom. One human interactor can simultaneously digitally puppeteer the virtual avatars to increase bidirectional conversational flow (Nagendran et al., 2014). However, some have called these MRS trainings, where an interactor of one race/ethnicity controls avatars of varying ethnicity and neurodivergence "digital blackface" (Baker-White, 2021, para. 18), while others have found evidence that MRS training perpetuates racial stereotypes (Bondurant & Reinholz, 2023). Thus, to build a bridge between proponents and critics of MRS in teacher training, this paper describes the application of three technoskeptical design tools and the lessons learned from them, along with a deeper exploration of the equityXdesign beliefs/principles embedded in technoskeptical design.

Design Framework: EquityXdesign + Technoskepticism = Technoskeptical Design

Technoskeptical design combines equityXdesign (Ortiz Guzman, 2017) with technoskepticism (Pleasants et al., 2023) to help designers equitably and critically craft technologically-mediated learning experiences. EquityXdesign has three core beliefs (i.e., historical context matters, radical inclusion, process as product) and uses five design principles (i.e., design at the margins, start with yourself, cede power, make the invisible visible, speak to the future) to help designers deeply wrestle with problems before developing solutions (Ortiz, n.d.-a). Designers start designing at the margins by including marginalized stakeholders in the design team and using design tools (e.g., active listening, meta-empathy maps, design hats, the *7 Problem with Problems* rubric, etc.) to ground the work in historical contexts while embedding equity throughout the design work (Ortiz, n.d.-a).

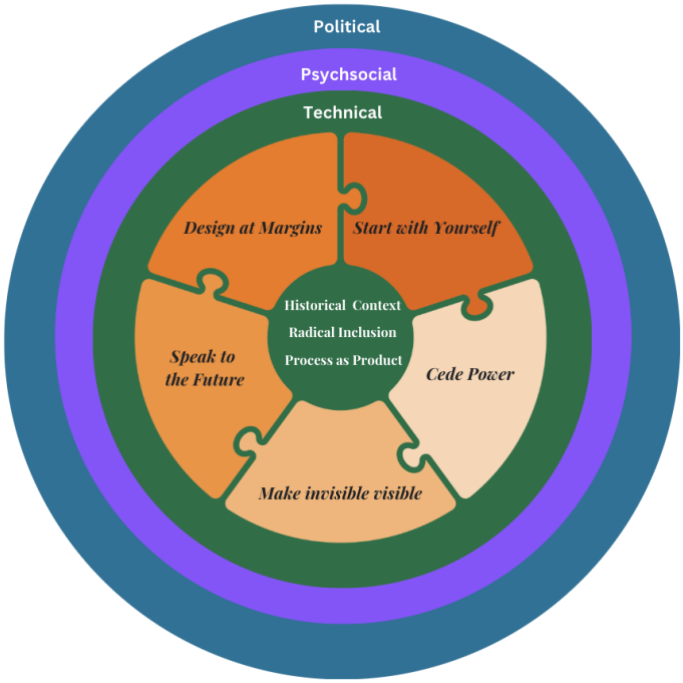
While equityXdesign infuses equity throughout the design process, technoskepticism, on the other hand, adds criticality, forcing designers to interrogate traditionally underexamined aspects of technology, such as its systems and values (Pleasants et al., 2023). Technoskepticism is rooted in media theorist Neil Postman's (1995) "vision for technology education that emphasizes critically examining technology's effects on humans" (Pleasants et al., 2023, p. 487). Technoskepticism draws attention to various dimensions overlooked in the development and application of technology, highlighting the technical, psychosocial, and political dimensions as well as the values and systems in which tools are used. Thus, combining these design (See Figure 1) frameworks to create technoskeptical design is meant to ensure equity and criticality align with all aspects of the MRS design work.

Application of Technoskeptical Design in Spring 2025: Participants and Context

The design tools examined in this paper were developed for the application of technoskeptical design in spring 2025 to make an MRS training on systemic ableism. Funding from the Kapor Foundation allowed a diverse group of five codesigners (i.e., an artificial intelligence ethicist, an education technologist, a pre-service special education teacher, a pre-service Deaf education teacher, and an in-service computer science teacher) to come together to critically develop an MRS teacher training. Four were full-time students in different universities in the Southeast. Four also identified as having a disability. The spring technoskeptical design work started in

Figure 1

Technoskeptical Design = EquityXdesign + Technoskepticism



February with an in-person orientation dinner followed by five weekly two-hour design workshops. Each designer completed asynchronous activities adapted from equityXdesign tools between design sessions. Each was compensated $1250 USD for their time.

Technoskeptical Design Tools for MRS Learning Experience Design

While equityXdesign provides many free tools located within the online equityXdesign modules (Ortiz, n.d.-a, n.d.-b, n.d.-c, n.d.-d), three design tools were specifically created to better align equityXdesign with technoskepticism for technoskeptical design:

Technoskeptical Design Hats

Four design hats (see Table 1) were created using language from technoskepticism and equityXdesign to help designers critically conceptualize their efforts and design products. Designers could choose one hat to become an expert in, wearing it repeatedly throughout the design cycle, or they could take turns wearing different design hats to experience different epistemic perspectives. The *Universal Design for Learning Expert* hat asks designers to constantly interrogate whether the designed MRS product allows multiple means of representation, multiple means of action or expression, and multiple means of engagement. The *Technoskepticist* hat pushes designers to look for hidden assumptions embedded within the design and account for any unintended consequences. The *Designer at the Margins* hat encourages designers to consider how their designs impact marginalized users. Finally, the *Historical Contextualizer of Content* hat asked designers to examine how the designed MRS training actually develops the targeted outcome (i.e., pedagogical competency), in relation to more traditional instructional methods.

Table 1

Technoskeptical Design Hats

Hat	Things to Do/Think About
Universal Design for Learning Expert	• Multiple means of representation (e.g., visuals/audio have captions, visually/hearing impaired people can participate, adjust the size of text, changing color contrast) • Multiple means of action/expression (e.g., variety of ways for participants to demonstrate their skills, such as through physical gestures or selecting options, step-by-step guidance, visual cues, and pause-and-replay) • Multiple means of engagement (e.g., participants set their own learning goals based on their own interest, the scenario has varying levels of difficulty based on experience and confidence, storyline aligns with different teaching contexts—urban, rural, inclusive classrooms)
Technoskepticist	• Assumptions embedded into our MRS design? • Edtech/AI laws impact these simulations? • Is this a just/democratic training? • Unintended/unobvious problems? • Problems from automating this experience? • Problems with using this training to test/certify teachers?
Designer at the Margins	• Does the interactor's performance perpetuate any stereotypes? • Can neurodivergent users participate? • Can users with disabilities participate? • Is this culturally relevant and culturally sustainable? • Can non-binary users participate? • Can different social classes participate?
Historical Contextualizer of Content	• Does training develop a targeted objective? • Does training contextualize skill amid competing socio-cultural forces? • Is this an authentic application of the objective? • Is this application of the targeted skill culturally relevant to participants?

Historical Context Sheet: Ableism and Racism in XR and Special Education

The second design tool was inspired by the historical context sheet in the equityXdesign module, which focused specifically on desegregation efforts and their impact on Black teachers (Ortiz, n.d.-a). To align this tool with technoskepticism and MRS design, a Google Sheet was created containing links to journal and newspaper articles, as well as videos and podcasts on ableism/racism in extended reality (XR) and special education. This sheet started with a link to Baker-White's (2021) article on mixed-reality simulations and digital blackface to frame the design work. The following sections included links on ableism/racism in extended reality and Special Education. This sheet was created to foreground problems with MRS, helping designers better mitigate them throughout the design process. During the first workshop, designers selected articles to read and summarize to the group, while also adding one or two additional links they had researched.

Design Workshop Exit Survey

Finally, language from equityXdesign and technoskepticism was used to create design workshop exit surveys to help ensure that the process attends to issues of equity and criticality while offering suggestions for better implementing future workshops (Table 2). The first nine

Table 2

Mean Scores from Design Workshop Exit Surveys for Spring Technoskeptical Design Context

Question	1st W	2nd W	3rd W
(1) How well does our current design process provide space for diverse perspectives and lived experiences of team members?	4	4.25	4.75
(2) To what extent does the design process actively seek to challenge and disrupt power imbalances among team members and participants?	4.25	3.75	4.75
(3) To what extent does the design process reflect critical conversations about the impact of educational technology on historically marginalized communities?	4.5	4	5
(4) To what extent have accessibility features (e.g., captions, text adjustments, visual/audio aids) been prioritized and integrated to ensure equitable access for all participants?	3.25	3.25	4
(5) How has the design team addressed potential negative impacts (e.g., data privacy, automation, biased algorithms) of integrating AI or educational technology into the MRS scenario?	3.75	4	3.75
(6) How well does the design reflect the diverse needs and identities (e.g., neurodivergent, non-binary, low-income) of potential users, including accommodations and culturally relevant content?	2.75	3.5	3.75
(7) To what extent does the scenario incorporate an understanding of historical and socio-cultural contexts that may influence how the targeted teaching practice is perceived and implemented?	2.75	3	3.25
(8) How effectively did the design team attend to assumptions embedded in the design that could perpetuate inequities or reinforce stereotypes?	3.25	4.25	4.5
(9) How effectively have team meeting structures (e.g., scheduling, agenda setting) supported equitable participation and contribution from all team members?	4	4.5	5
(10) In what ways could the design process evolve to better attend to equity, criticality, and justice? What changes could be made to address any gaps or oversights?			

Note. 5 = extremely well, 4 = very well, 3 = moderately well, 2 = slightly well, 1 = not well at all. W = workshop.

questions were on a five-point Likert scale (1 = not well / 5 = extremely well), anonymously gauging how well technoskeptical design principles were being upheld, while the last question offered designers an opportunity to make suggestions. Designer ratings mostly improved across indicators. Interestingly, one area of stagnation was in their attention to AI-related harms (e.g., automation, biased algorithms), which rose early but plateaued by Workshop 3. This may reflect gaps in prior knowledge or the need for additional scaffolding on this issue.

Implications and Conclusion

The technoskeptical design tools (e.g., design hats, historical contextualizer sheet, design workshop exit surveys) helped designers surface assumptions, redistribute authority, and center equity and criticality throughout the design process. For designers and teacher educators, these design tools can help contextualize the technology, rotate reflective roles, and use feedback tools to gauge participation. Future work should extend this study by examining how technoskeptical design practices evolve across contexts and influence participants' understanding of educational technology. Ongoing research aims to better examine how these tools can support the development of a more robust framework for technoskeptical design in the learning sciences, linking tool use, participant learning, and systemic critique to better design through and against existing systems of inequity.

Author's Contributions

Both authors were responsible for overseeing the coding of the data and the creation and review of the manuscript.

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Ethics Statement

This work was approved by the institutional review board at Georgia State University #H25207.

Conflict of Interest

The authors do not declare any conflict of interest.

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