CRITICAL MAKING IN STEM TEACHER EDUCATION: CONCEPTUAL FOUNDATIONS AND INSIGHTS FROM PROFESSIONAL DEVELOPMENT

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The spread of misinformation and manipulated digital content highlights the need to strengthen critical thinking in education. Policy initiatives and empirical work emphasize that improving media literacy and critical analysis skills is essential for building societal resilience against disinformation and enabling decision-making [1,2]. At the same time, maker education has gained attention as an experiential approach fostering creativity, collaboration, and problem-solving. Critical Making [3] provides a pedagogical bridge between these perspectives by linking hands-on technological design with structured critical reflection on socio-technical systems. The concept connects material engagement with technologies to critical reflection on the societal implications of innovations. Despite this growing interest, the conceptual foundations and implications of Critical Making for teacher education remain insufficiently defined.

Our study addresses two questions: (1) How can Critical Making be conceptualized for STEM teacher education? (2) What insights emerge from the formative evaluation of teacher professional development implementing this approach? To address these questions, a two-round Delphi study with European experts from education and STEM fields was conducted, combining semi-structured interviews and a structured questionnaire. In addition, formative evaluation data from an iterative teacher program on Critical Making were analyzed using survey data and qualitative feedback.

Experts show strong agreement on key principles of Critical Making: iterative design processes, self-determined learning, and structured reflection linking making activities to societal and technological implications. The findings suggest that Critical Making extends maker education by embedding critical inquiry within design processes. Evaluation results indicate that teachers perceive the approach as promising, while challenges remain regarding curricular integration and assessment.

At the conference, we would like to discuss initial insights for conceptualizing Critical Making in teacher education and the need for further research.

[1] European Commission: Directorate-General for Education, Youth, Sport and Culture, Guidelines for teachers and educators on tackling disinformation and promoting digital literacy through education and training, Publications Office of the European Union, 2026. https://data.europa.eu/doi/10.2766/5220136

[2] G. Huang, W. Jia, & W. Yu (2024). Media Literacy Interventions Improve Resilience to Misinformation: A Meta-Analytic Investigation of Overall Effect and Moderating Factors. Communication Research, 0(0). https://doi.org/10.1177/00936502241288103

[3] R. Sipos, & M. Åkerman (2023). Introducing the Critical Making Responsibility framework for analyzing responsible innovation processes in grassroots practices. Innovation: The European Journal of Social Science Research, 36(4), 652–672. https://doi.org/10.1080/13511610.2023.2195583