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Editorial

Computational Thinking in Nordic Teacher Education and Schools

Mads Middelboe Rehder[1]
University College Copenhagen
mamr@kp.dk

Kalle Juuti
University of Helsinki
kalle.juuti@helsinki.fi

Katarina Pajchel
Oslo Metropolitan University
kapaj@oslomet.no

Thomas Frågåt
Norway Inland University of Applied Sciences
thomas.fragat@inn.no

Louise Mifsud
Oslo Metropolitan University
lomi@oslomet.no

As societies worldwide become increasingly reliant on digital technologies, computational thinking (CT) has emerged as a politically prioritised element in education (Andersen et al., 2023; Bocconi et al., 2022). The inclusion of CT in education aims to equip future generations with the competences necessary to navigate

[1] Corresponding author

and contribute to the rapidly evolving digital landscape (Fraillon & Rožman, 2025).

CT's integration into curricula, schools and teacher education presents unique challenges and opportunities. This special issue explores the current state and future directions of CT in Nordic teacher education and schools, aiming to gain a deeper understanding and new knowledge about these countries' specific approaches, and their implications. Furthermore, this issue points towards potential ways the Nordic countries can benefit from each other's distinctive approaches by exploring the various aspects of locally and nationally situated educational CT practices.

This special issue originates from the *Mathematics, Science, and Computational Thinking (MASCOT)*[2] project, funded by the Norwegian Research Council. The project aimed to investigate the teaching, learning, and assessment processes of CT in teacher education and schools. Its focus was to generate systematic knowledge about research and policy on CT, as well as insights into educational practices and assessment methods in Nordic teacher education programs and schools. The overarching goal was to provide a nuanced understanding of how CT is integrated into educational systems and to inform both research and practice in this evolving field.

This special issue focuses on three key aspects: the framing of CT in national curricula and implications for teaching and learning, pedagogical practices supporting CT in teacher education and the integration of computational literacy (CL) in non-STEM subjects[3].

In the first paper in this special issue, Pajchel et al. (2024) examine how CT is conceptualised and implemented in curricula across three Nordic countries, raising the question of whether the inclusion of CT in curricula is a sign of current times. Their study reveals both explicit and implicit approaches to CT, with Denmark having clear and specified objectives and goals, Finland adopting a more implicit integration through transversal competences, and Norway balancing explicit goals with implicit opportunities. The paper highlights the interplay of algorithmic, problem-solving, and transversal practices in shaping CT in education, underscoring the importance of aligning curriculum design with pedagogical strategies to support learning and societal engagement.

Sundtjønn et al.'s (2024) review characterises the pedagogical practices for CT in teacher education. Their findings highlight the emerging nature of CT in teacher education, particularly within STEM contexts. By systematically reviewing 31 studies, the authors identify a significant gap in research exploring how pre-service teachers learn to teach CT. While literature emphasises CT skills and attitudes, it lacks a cohesive framework for understanding and supporting pedagogical practices. Notably, the Nordic region remains

[2] https://uni.oslomet.no/mascot/
[3] STEM subjects are Science, Technology, Engineering and Mathematics.

underrepresented in the global discourse, signalling a need for localised research to inform a mature and inclusive pedagogical framework for CT in education.

Rehder et al. (2024) explore the role of unplugged activities in teaching CT within Danish teacher education, with a focus on their impact on student learning, self-efficacy, and the concept of *be-greifbarkeit* – the tangible grasp of abstract concepts. Through the analysis of three diverse cases the paper highlights the nuanced challenges and opportunities of using both unplugged and plugged approaches. This paper challenges the binary categorisation of these methods, advocating for a fluid understanding that emphasises alignment with students' prior knowledge and thoughtful pedagogical design. Additionally, it underscores the importance of fostering self-efficacy and designing activities that bridge abstract CT principles with tangible experiences, ultimately preparing and empowering future educators to effectively integrate CT into their teaching practices.

Finally, Hachmann and Slot's (2024) paper views CT from broad perspective in language education. The authors emphasize a shift from CT to CL, embedding computational tools and methodologies into traditional literacy practices such as reading, writing, and text analysis. Through a Danish classroom case study, this paper demonstrates how notion of CL can transform first language (L1) education, fostering critical analysis and creative expressions. By proposing subject-specific assessment principles, the authors pave the way for cross-disciplinary approaches to integrating computational skills into diverse educational contexts.

Together, these papers offer valuable insight into the landscape of CT in education, particularly within Nordic contexts, addressing its theoretical, practical, and policy dimensions. Across the papers, a tension emerges regarding differing understandings and assessments of CT – both as educational content in its own right, and as methodologies designed to support learning in existing subjects, such as language and STEAM[4]. This dual perspective underscores the complexity of integrating CT within educational frameworks. It also initiates a discussion about the challenges and tensions faced by students, student teachers, and educators alike, fostering a more nuanced understanding of CT in Nordic educational practices, from conceptual frameworks and curriculum design to practical implementation across disciplines.

After almost two decades with a focus on CT in education, the papers in this special issue point to the complexity in establishing a common understanding of what CT is and how it should be integrated into education. The rise of artificial intelligence (AI) has redefined the digital landscape, amplifying the relevance of CT in education as they operate as "black boxes", making it critical for future citizens to grasp the

[4] STEAM subjects are Science, Technology, Engineering, Arts and Mathematics.

processes behind these technologies, even if at a basic level. Education for CT is not a static body of knowledge, but an evolving and forming combination of knowledge, practices and pedagogical strategies.

This special issue underscores the importance of CT as a foundational element of education, preparing students to engage meaningfully and responsibly with the technologies shaping their lives. As such, this special issue not only reflects the current landscape of CT but also provides valuable insights for educators, researchers, and policymakers while setting a research agenda for the continued development of CT in Nordic education and beyond.

Acknowledgments

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