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TURNING COMPUTATIONAL THINKING RIGHT SIDE UP

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ABSTRACT
Computational thinking (CT) is a thought process that includes a set of cognitive and practical skills used for problem-solving, derived from the computer science discipline. CT has evolved rapidly since 2006, when the concept was revisited by Jeannette Wing (2006), bringing it to the forefront of educational approaches and research communities. CT is considered to become a foundational skill at the core of every modern education system, just like mathematics and the humanities, because it empowers children to make sense of the world around them and acquire agency (Abelson & Kong, 2024).

Considering that CT is expected to evolve rather than remain in its present state to become a central component of the education system, there are different future landscapes for CT. These include becoming an advanced educational skill, an essential competence for new-age citizens, and a mental enhancer, making CT a fundamental part of the broader educational agenda that nurtures innovative and critical thinkers. CT will likely expand beyond traditional digital and programming skills to encompass a wider range of competencies, including ethical reasoning, data literacy, and interdisciplinary problem-solving (Dolgopolovas & Dagiene, 2021).

Different theories and models have been proposed and used to develop and implement CT into educational contexts and curricula. The diversity of approaches, combined with advancing technologies—particularly digital technologies and more recently artificial intelligence—makes CT education grow faster but also increasingly complex. This necessitates a systems thinking approach when dealing with CT education to embrace the complexity of CT integration into education. This theoretical lens, which is scarce in the CT literature, considers the ongoing dynamics in the development of CT from different perspectives, both theoretically and practically. We adopt this approach in our research on CT, using a systems thinking lens to integrate CT into educational approaches and yield a comprehensive understanding (Hamidi et al., 2023).

Such a systems thinking approach leads us to go one step further and ask questions about the prospects of CT education. What happens if the current approaches continue? What failures could be happen if current trends persist? For example, one failure is already seen in the Swedish education system, where there is a debate about reverting to traditional pedagogical methods of teaching and learning rather than digital ones (Forsler & Guyard, 2023). Answering such questions requires the articulation of a vision of what the CT system ought to be, which could be envisioned through the application of a systems thinking framework called idealized design

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(Ackoff, 2001). This involves redesigning a system that its designers would replace the existing system with right now if they were free to replace it with any system they wanted. We believe that such knowledge is essential if the education system wants to set meaningful goals for the future of CT education. Note that this perspective aims to create an ideal-seeking system that strives for continuous improvement rather than achieving an ideal state. This extended abstract outlines the approach we are taking to envision an ideal CT education based on systems thinking theoretical perspectives. Our research aims to envision the ideal situation for avoiding failures and ensuring meaningful advancements. Applying systems thinking modeling techniques within an idealized design approach, this process consists of two steps: idealization and realization, as described by Ackoff (2001). We begin by formulating the mess and end with the design of implementation and controls. While the entire process requires extensive research, our current research focuses on some stages of the idealization phase.

Keywords: Computational thinking, systems thinking, idealized design

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