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How Do Thinking Styles and STEM Attitudes Have Effects on Computational Thinking? A Structural Equation Modeling Analysis

Haozhe Jiang, A.Y.M. Atiquil Islam, Xiaoqing Gu, Jia Guan

OVERVIEW: Students' thinking styles and STEM attitudes directly predicted their computational thinking skills and thinking styles mediated the relationship between STEM attitudes and computational thinking skills.

AUDIENCE: STEM educators; Curriculum designers; University students

KEY POINTS

- Students' thinking styles and STEM attitudes directly and significantly impacted their computational thinking skills.
- The two important concepts of computational thinking and STEM attitudes significantly interacted with each other.
- Thinking styles mediated the relationship between STEM attitudes and computational thinking skills.
- The conceptualization of computational thinking can be broadened to reflect its trans-disciplinary nature within the context of STEM education.

INTRODUCTION: In response to the constantly evolving needs for computationally literate workforces, computational thinking (CT) has been integrated into the curricula, especially the STEM curricula of many countries. However, prior studies have indicated that students' CT skills are not as high as expected. To better develop students' CT skills in practice, it is necessary to explore the predictors of CT theoretically in advance. Our research focuses on two factors, namely thinking styles and STEM attitudes. Specifically, the construct of thinking styles is developed based on the Theory of Mental Self-Government, and it can be understood as an individual's preferred ways of processing information. Notably, three thinking styles are especially important in educational settings, namely legislative style (preference for doing things in one's own way), executive style (preference for implementing tasks with set guidelines), and judicial style (preference for evaluating people or products).

FINDINGS This study successfully validates a theoretical model where the effects of thinking styles and STEM attitudes on CT skills in higher education are articulated. Adopting this model, 38% of the variance in CT skills can be explained, indicating thinking styles and STEM attitudes are two of the most powerful CT-predictors. More importantly, for the first time, we demonstrate that thinking styles play a mediating role in the effect of STEM attitudes on CT skills. Another apparently novel finding of this study is our detection that judicial style is the most important subdimension of thinking styles and the construct of attitudes toward 21st century skills are the most important subdimension of STEM attitudes in the development of CT skills. In addition, attitudes toward 21st-century skills have greater effects on cooperativity than that of other subdimensions of CT skills.

TAKEAWAYS

This study indicated that the conceptualization of CT should be broadened to reflect its trans-disciplinary nature within the context of STEM education. The close associations between CT and STEM encourage more interdisciplinary or trans-disciplinary interpretations based on integrated STEM education on the theoretical concept of CT, which is still in its infancy.