

## Introduction to the Computing Education Minitrack

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### 1. Introduction

The role of Computing Education (CE) transcends the boundaries of academia, with implications and social responsibilities. While we have seen considerable progress in this area, we are aware of the challenges and there seems to be a lack of research focusing on how computing programs should address the multiple dimensions of ethical dilemmas as they are embedded in different cultural, philosophical, and governance systems, as well as religious beliefs and linguistic contexts (Wong-Villacres et al., 2023).

Studying Computing students' motivation, resilience and self-regulation strategies is an integral part of the educational journey. Understanding the cognitive, emotional, and social aspects of learning and teaching is crucial for designing effective educational experiences that facilitate the acquisition of knowledge. We proposed this minitrack with the aim of bringing together research on different topics related to computing education. The papers presented in this minitrack offer a collection of insightful reflections. We hope that these papers will engage the community.

### 2. Minitrack Details

In this first edition of the Computing Education minitrack, a total of 10 papers were initially submitted for this minitrack, and one additional paper from another minitrack was included (due to the topic of the paper being more related to this minitrack). All papers were reviewed anonymously by at least three external reviewers and then carefully analyzed and summarized by the minitrack chairs. Six were accepted because they were thought-provoking and had a strong framework with both academic and practical relevance. Thus, the acceptance rate was 54.5%. Two papers focused on aspects that explore some of the complexities that arise with respect to ethics and AI literacy. Four other papers focused on studying human aspects of teaching and learning on several topics in Computer Science.

### 3. Accepted Papers

The paper **Role-Play Case Studies to Teach Computing Ethics: Theoretical Foundations and Practical Guidelines**, by *Ashish Hingle and Aditya Johri*, discusses the importance of teaching university students about the ethical and responsible use of algorithms and computing. Using a situated learning approach based on case studies and role-playing, students were encouraged to think about current and increasingly everyday issues. The authors mention benefits in terms of ethical reasoning, perspective thinking, and awareness of ethical elements.

The paper **Building MetaKnowledge in AI Literacy – The Effect of Gamified vs. Text-based Learning on AI Literacy Metaknowledge**, by *Marc Pinski, Miguel-José Haas, and Alexander Benlian* discusses the importance and complexity of developing meta-knowledge for AI literacy. In an experiment, they compared participants' AI literacy and AI literacy meta-knowledge across a gamified and a text-based learning experience and identified gamification as a potential strategy for fostering this competency. Given the relevance of the concept of metaknowledge, it could emerge as a significant avenue for research in the near future.

The paper **A Framework of Contextualized Social Regulation Strategies in Introductory Programming**, by *Deller Ferreira, Dirson Campos, and Anderson Gonçalves* states that social regulation in learning lies in its ability to enhance students' programming skills through the use of collaborative resources and the development of more effective group-working skills. The research makes a substantial contribution by introducing a clearly defined taxonomy that can be easily put into practice. This taxonomy provides a structured and efficient method for enhancing students' self-regulation in the domain of programming, offering a tangible route to skill improvement.

The paper **Unveiling Resilience: Exploring Key Components of Resilience Among Undergraduate**

**Computer Science Students in Introductory Programming Courses**, by *Udayangi Perera Muthupoltotage*, presents a compelling interpretive qualitative study that explores the relationship between resilience and academic performance among freshman computer science students enrolled in a coding course. As findings, the authors mention that factors associated with resilience, including positive self-dialogue, self-efficacy, intrinsic motivation, goal setting, self-management, and self-regulation.

The paper **ArchiMate Modeling Mistakes: A Comparative Analysis of Student Assignments and Prior Research on EA Modeling Mistakes**, by *Ville Seppänen and Jarkko Nurmi* presents common mistakes that students make when modeling enterprise architecture (EA) are identified. Instructors and educators can not only gain a deeper understanding of the areas where students commonly struggle but also identify recurring patterns of errors. Using data from previous research on EA modeling errors provides valuable insight into typical difficulties in this domain. The paper identifies the major problems encountered in nearly 300 models, which are categorized into areas such as the appropriate use of language, mismatch between the derived model and the correct model, level of abstraction used by students, and the readability and clarity of the models.

The paper **Gamified scaffolding in formal education: A scoping review**, by *Bernice Beukes, Ana Carolina Tome Klock, Nikolettia-Zampeta Legaki, and Juho Hamari* provides an up-to-date overview of gamified scaffolding through a comprehensive review of the existing literature. According to them, the primary techniques for scaffolding information include providing feedback and segmenting the learning process into progressively more challenging levels. It is also shown that motivation is often the main driving force behind the integration of scaffolding.

#### 4. Papers Session

The papers were presented at the conference following the sequence presented next:

1. Role-Play Case Studies to Teach Computing Ethics: Theoretical Foundations and Practical Guidelines
2. Building MetaKnowledge in AI Literacy – The Effect of Gamified vs. Text-based Learning on AI Literacy Metaknowledge
3. A Framework of Contextualized Social Regulation Strategies in Introductory Programming

4. Unveiling Resilience: Exploring Key Components of Resilience Among Undergraduate Computer Science Students in Introductory Programming Courses
5. ArchiMate Modeling Mistakes: A Comparative Analysis of Student Assignments and Prior Research on EA Modeling Mistakes
6. Gamified scaffolding in formal education: A scoping review

#### 5. Challenges for the Future

The accepted papers in the first edition of minitrack brought to light some important advances, but they also brought to light some important challenges that can be considered in future studies. There is an urgent need to integrate ethics into Computing Education. This includes addressing ethical issues in the curriculum, promoting responsible use of technology, and fostering ethical decision-making among students. Some of the papers in this minitrack addressed these issues.

Increasing diversity and inclusivity in Computing Education is another major challenge. Encouraging underrepresented groups, such as women and minorities, to pursue computing and ensuring that they have a welcoming and supportive learning environment is essential. Addressing the mental health and well-being of students, especially given the pressures and stress that can be associated with the field, can be also perceived as an emerging challenge. Incorporating strategies to support students' emotional and psychological health is critical. These challenges reflect the dynamic nature of the Computing Education research field and the need for continuous adaptation and innovation to meet the evolving needs of students and industry.

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#### References

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