Roles of CS/ Informatics in the curriculum – why, what, how?

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INTRODUCTION

In the light of a recent resurgence of interest in Computer Science or Informatics as a key academic discipline that is important in the education of all citizens, TC3 as the Education Committee of the International Federation of Information Processing (IFIP) has continued to take a lead in this important area by reviewing recent developments, identifying key issues and dilemmas and proposing ways forward. Discussions have taken place at a series of TC3 conferences and at EDUSummIT 2015 in Bangkok. Outcomes have included reports, policy briefings and articles (Angeli et al., 2016; Fluck et al., 2016; Webb, 2014; Webb et al., 2015; Webb et al., 2016)

This symposium will be led by members of the TC3 Task Force: *Curriculum- deeper understanding of roles of CS/ Informatics* and the EDUSummIT 2015 Thematic Working Group 9 *on "advancing understanding of the roles of computer science/Informatics in the curriculum".* A reconsideration of computer science as a separate subject both in primary and secondary education is suggested.

At EDUsummIT 2015 it was argued that the major rationales for including computer science as a subject in the K-12 curriculum are economic, social and cultural. It was also argued computer science is rapidly becoming critical for generating new knowledge, and should be included as a clear content area in curriculum and indentation in schools. The symposium will include papers emerging from this work and others that focus on answers to the following questions:

1. What is the range of skills and understanding that should be developed in computer science?
2. Are such skills and understanding necessary for everyone? Should it be and remain compulsory?
3. At what age should computer science education commence?
4. How many computing languages or frameworks should a student be expose to in the span of schooling from K-12?
5. How varied should these languages be? Should a variety of paradigms be explored?
6. How closely should the curriculum match computers available to schools and students?
7. What consideration in curriculum design should be given to emerging technologies such as quantum networks and computing?
8. What pedagogical approaches are likely to be appropriate, and how do they vary with age and other factors?

Arguing for Computer Science in the School Curriculum

Andrew Fluck, Mary Webb, Margaret Cox, Charoula Angeli-Valanides, Joyce Malyn-Smith, Joke Voogt, Jason Zagami

Computer Science has been a discipline for some years, and its position in the school curriculum has been contested differently in several countries. This paper looks at its role in three countries to illustrate these difference. A reconsideration of computer science as a separate subject both in primary and secondary education is suggested. At EDUsummIT 2015 it was argued that the major rationales for including computer science as a subject in the K-12 curriculum are economic, social and cultural. The paper explores these three rationales and also a beneficence matrix to assist curriculum designers. It also argues computer science is rapidly becoming critical for generating new knowledge, and should be taught organised as a discrete content area in the curriculum in schools. The paper concludes by looking at some of the key questions to be considered when implementing computer science in the school curriculum, and at ways its role might change in the future.

The Design of the Computer Science Curriculum and the Knowledge that Teachers Need to Teach Computer Science in K-12

Charoula Angeli-Valanides, Joke Voogt, Andrew Fluck, Mary Webb, Joyce Malyn---Smith, Jason Zagami, Margaret Cox

Adding computer science as a separate school subject to the core K-12 curriculum is a complex issue with educational challenges. The authors herein address two of them; first, the design of the computer science curriculum, and, second, how to best prepare teachers to teach the computer science curriculum. The first issue is discussed within a perspective of designing an authentic computer science curriculum with a focus on real-world problems. The second issue regarding teacher preparation is addressed within the frameworks of pedagogical content knowledge, technological pedagogical content knowledge, situative professional development, and learning by design. An example of how these ideas can be applied in practice is also given. While it is recognized there is a lack of adequate empirical evidence in terms of the effectiveness of the models proposed herein for the field of computer science, it is expected that our knowledge and research base will dramatically increase over the next several years as more countries around the world add computer science as a separate school subject to their K-12 curriculum.

Challenges for specifying structure and sequence in the Computer Science curriculum: the interrelations between resource issues and pedagogical approaches

Mary Webb, Jason Zagami, Charoula Angeli-Valanides, Andrew Fluck, Joke Voogt, Joyce Malyn-Smith, Margaret Cox

This paper addresses the questions: how do we decide on a structure and sequence for a computer science/Informatics curriculum? And what are the factors that affect these decisions in a range of different contexts? The paper draws on curriculum

theory, understanding of progression as well as evidence of ways in which students' learning are influenced by changing resources and pedagogical approaches

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