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Computer Science in the school curriculum: issues and challenges

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Aims

The aims of this study have been to:

1. Identify the differences in approach and the importance of various factors that affect curriculum design and implementation across nations:
2. Identify an internationally agreed range of skills and understanding that should be taught and developed in the computer science curriculum:
3. Identify the issues emerging from different national priorities and approaches to the teaching of computer science

Methods and Analysis

Methods

The method has involved an on-going review over the past two years of:

a) a wide range of published national and international studies of the issues regarding the teaching of computer science and the needs of society as influenced by IT;

b) the national curricula for Computer Science and Informatics in a range of countries;

c) Expert group discussions at Edusummit2015, at subsequent IFIP meetings and on-going email debates to interpret and synthesize the findings.

Analysis

The ongoing analysis of policy and research documents has been conducted to identify the challenges and consequent recommendations which face all countries in the successful adoption and implementation of Computer science in the curriculum

Results

The results of this two year study have identified a range of approaches to teaching Computer Science in Schools from teaching it as a separate subject to attempting to teach it as an integral part of other curriculum subjects.

Analysis of the core components of the Computer science curricula by the international team identified **Computational Thinking** as a foundation for Computer science learning and additionally as a significant component across many traditional curricula subjects as shown in Figure 1.

The review of national policy priorities and the impact of industry needs confirmed the indisputable requirement for the Computer Science Curriculum in any country that it should be taught as a separate subject as shown in Table 1.

One of the constraints for curriculum design identified by the review] is the need to introduce, early in the curriculum, all three major types of knowledge: concepts, propositions and know-how because these knowledge types are dependent on each other.

There is as yet no consensus about the importance of more general intellectual practices such as persistence in working through problems and tolerance for ambiguity as well as the importance of collaborative learning and group work.

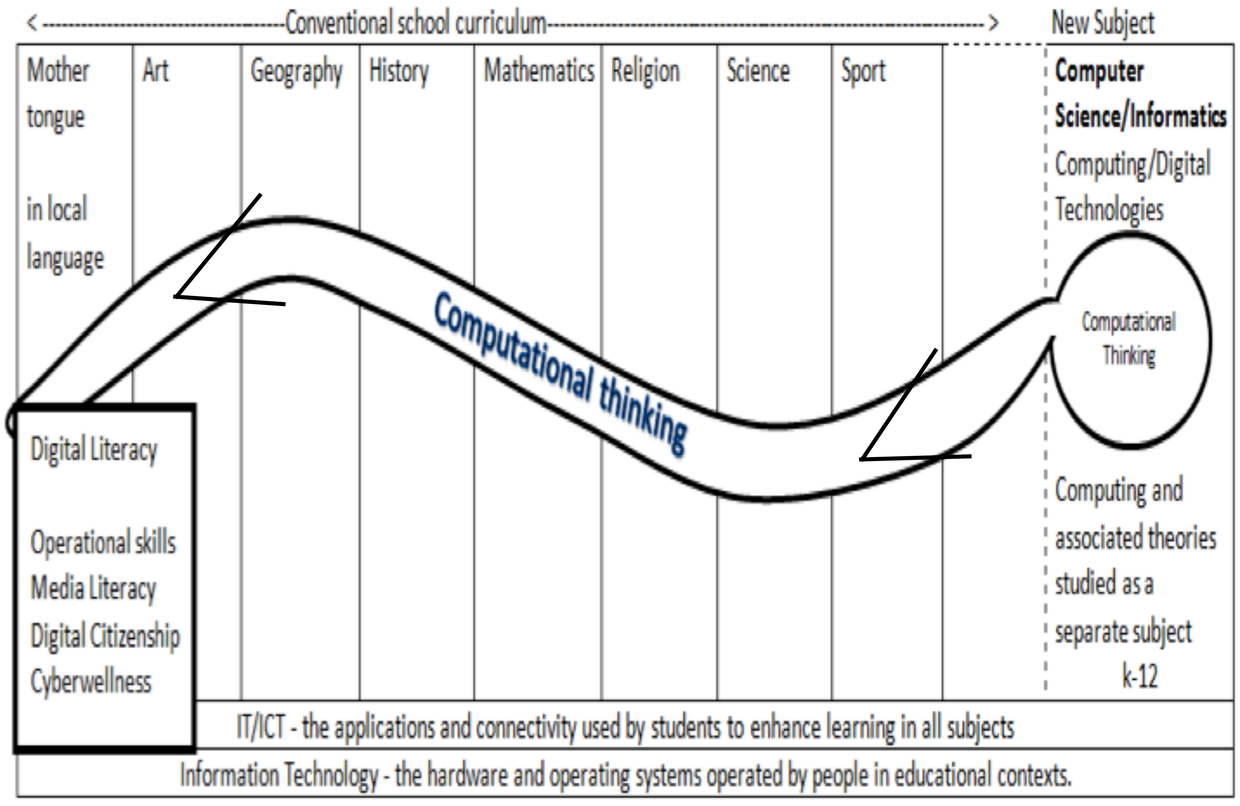

Figure 1: Computational thinking across the curriculum

Table 1 Challenges and Solutions for Advancing Understanding of the Roles of Computer Science / Informatics in the Curriculum

Challenge	Recommendations
1. Lack of clear understanding (outside the field of Computer Science) of CS as an academic discipline.	• (a) Adopt a globally agreed statement of Computer Science as a discipline in its own right (P, I, R, E). • (b) Articulate the nature, importance and relevance of Computer Science to society and education (P, I, R & E).
2. The need for Computer Science as a distinct subject in school curricula is controversial and poorly understood.	• Disseminate and communicate a clear rationale to different stakeholders about the need to have Computer Science as a distinct subject in school curricula (P, I, R & E).
3. Computational thinking, a core component of CS/I, is considered to be an important 21st **century** skill, but due to its complexity, it is difficult to implement in schools.	• Promote computational thinking through the means of a Computer Science curriculum, which aims at making computational thinking common place (P, R & E).

Key: Influences on the curriculum: P = Policy; I = Industry; R = Research; E = Education

Conclusions

The results of this two year study have identified key questions which policy makers, researchers and practitioners need to consider when designing a Computer Science Curriculum for future generations of learners in a technological world.

- What is the range of skills and understanding that should be developed in Computer Science?
- Are such skills and understanding necessary for everyone?
- At what age should Computer Science education commence?
- What pedagogical approaches are likely to be appropriate?

References

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