Chapter 11
The Rise of the Digital Polymath:
Switzerland Is Crossing the Computer Science Education Chasm Through Mandatory Elementary Pre-Service Teacher Education

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ABSTRACT

A difficult challenge to computer science education is the systemic professional development of teachers. K-12 computer science education models limited to voluntary in-service teacher professional development may not reach a critical majority of teachers who are skeptical towards information technology, computer science, programming and computational thinking. The inclusion of computer science in a national K-12 education standard in Switzerland has made it possible to move beyond voluntary K-12 computer science education for in-service teachers to mandatory pre-service teacher education for all elementary teachers. This chapter describes the vision of the Digital Polymath as a digitally enabled person empowered by computational thinking to connect computer science with other disciplines. The course design, combining game design activities, computational thinking tools and the 7 big ideas from the computer science principles framework is outlined and experiences are reported.

DOI: 10.4018/978-1-7998-1479-5.ch011

INTRODUCTION

Contemporary educational methods, strongly flavored by notions of efficiency popularized by the rise of public education during the industrial revolution, still tend to value discipline specialization over discipline integration. But the 21st century workforce is likely to benefit from an educational transformation shifting from discipline specialization to discipline integration. The notion of a Digital Polymath is a vision revisiting the ideals of disciplinary integration found in the renaissance polymath and projecting it into the digital future. This notion of a Polymath has nothing to do with math but with the competency to think and act interdisciplinary. Leonardo da Vinci, or Hildegard of Bingen were two exemplary polymaths capable to solve hard problems by drawing on complex bodies of knowledge from different disciplines. Similarly, our vision of the Digital Polymath is to employ digitalization as tools to enable humans with interdisciplinary thinking and acting. The shift from the Renaissance Polymath to the Digital Polymath, outlined in Table 1, is not trying to turn people into Leonardo da Vinci, or Hildegard of Bingen, but to create a digital learning enabled 21st century society willing and capable to deepen as well as to connect knowledge from different disciplines.

The ability to connect knowledge from different disciplines, i.e., the transformation of education models from narrowly specialized disciplines, popularized in the industrial revolution (Johns, Laubscher, and Malone 2011), to deeply integrated disciplines, is key in building a knowledgeable 21st century digital society. There are two main challenges that prevent interdisciplinarity within the K-12 education level. The first one is the lack of self-guided learning skills. The second is the lack of ability to connect disciplines. Computer Science Education (CSed) will play a pivotal role in the making or breaking of the digital polymath. Much depends upon how successfully the two main challenges that prevent CSed integration to other disciplines in the K-12 educational level will be addressed. If CSed is set up to promote the development of a mindset that can learn without input from a teacher and is focused in teaching Computational Thinking (CT), the Digital Polymath could become a reality.

However, before CSed can offer a way to the digital polymath, it has to find a place into the K-12 curriculum. The main challenge preventing K–12 CSed to advance from teachers who are technology enthusiasts to pragmatists is perhaps best characterized by Crossing the Chasm, a notion anchored in

Table 1. The shift from the Renaissance Polymath to the Digital Polymath

	Renaissance Polymath 	Digital Polymath 
Competencies	Has expert level competencies in many disciplines	Meta-Competency: The competency to acquire new competencies: Peripheral perspectives of many disciplines including the attitude and ability to deepen knowledge just in time through the use of digital tools (e.g. Google, Wikipedia)
Problem Solving	Draws on complex bodies of knowledge from different disciplines to solve problems	Computational Thinker: Person able to think with a computer, combining human abilities with computer affordance (Figure 2), to connect complex bodies of knowledge from different disciplines.