Computer Science for All in Swiss High Schools: Current State, Issues, and Perspectives

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Abstract. This poster discusses the main issues at stake in the task of determining a "computer science for all" curriculum in Swiss high schools. Such a task raises fundamental questions such as: what is CS exactly; what are its subtopics and its fundamental concepts; how should it be classified with respect to other sciences; who should teach it and with which required background; etc. In the poster, we graphically depict the discussion points and conclusions we have come to on such issues.

Keywords: computer science curriculum, computational thinking, field definition, concept map, high school

1 Context

There is an international trend to shift K–12 curricula towards a more technical education [1, 4]. The targeted topics are often referred to with the STEM acronym: **s**cience, **t**echnology, **e**ngineering, and **m**athematics. Switzerland is no exception, although it was certainly no pioneer. One of the prominent members of the STEM topics is computer science (CS). The teaching of CS in Swiss high schools is the focus of this poster.

In Switzerland, about 20% of all students complete the version of high school known as "maturity school" (MS), which is the one that traditionally leads to university [3]. Global, detailed nation-wide curricula do not exist: each of the 26 cantons is responsible for its own high school. However, a national reference document known as Framework for High School Curricula (FHSC) exists, which determines the basic list of topics and sets the bounds in which the cantons are free to operate.

This poster describes the current state of the FHSC and the ongoing efforts, to which the authors are contributing as members of SSIE (Swiss Association of CS Teachers), to make it change and include CS as a full-fledged topic for everyone.

2 Main Poster Points

When the current version of the FHSC document was published in 1995, it specifically mentioned CS as not being a field *per se*, but a collection of transdisciplinary

topics. In 2008, an addendum to the 1995 FHSC was published, introducing CS as an actual (but optional) field. Currently, the committee editing the FHSC is considering recommending adding CS as a mandatory field for every student in MS. This is clearly a disciplinarization process, which the authors adhere to.

The issues we are discussing in the poster are ones the authors have needed to deal with while writing a proposal for a CS curriculum for MS. They include:

- **What is CS?** We detail the three-pillar breakdown proposed by the Hasler Foundation (unaffiliated with the authors) [2]:
  1. *Fundamental CS* (FCS) as both an applied and formal science;
  2. *Digital literacy*, or the ability to adequately use CS-based software and hardware tools;
  3. *Media education* as a social science.

  We argue that FCS should be the main focus of a CS-for-all curriculum.
- **What are the main subtopics of FCS?** We present a high-level cartography of CS as an applied and formal science and a concept map derived therefrom.
- **Where should FCS be classified in curricula?** The current Swiss curricula tend to classify sciences as either experimental sciences or human sciences. We argue that it is vain to try to make FCS as an applied science fit in either category and that applied sciences deserve a place of their own.
- **How should FCS for all be taught?** Rather than delve into mainly theoretical or abstract concepts for their own sake, we argue that FCS for all should start from very applied problem-solving tasks.
- **Who should teach FCS?** Current laws mandate teachers to have the equivalent of a Master's degree in the field they teach. We foresee that this condition may not be fulfilled for the first years where FCS for all would be taught, as current CS teachers are mostly non-specialists who teach concepts closer to digital literacy than to FCS.
- **When should we start teaching FCS concepts at school?** We consider it possible and desirable to get acquainted by FCS concepts much earlier than at the MS level (16–19 years old). There, these concepts could be seen as belonging to *computational thinking* and be understood in a wider context than strictly CS.

Finally, we show how each of these questions has had a direct or indirect impact on the format of our modification proposal of the FHSC document and mention potential further issues.

References

1. R. W. Bybee. Advancing STEM education: A 2020 vision. *Technology & Engineering Teacher*, 70(1):30–35, 2010.
2. P. Kleiner. *Was ist Informatik?* Schriftenreihe der Hasler Stiftung, 2014.
3. Swiss Federal Statistical Office. *Indicateurs de la formation suisse*, 2014.
4. US Congress Joint Economic Committee. *STEM Education: Preparing for the Jobs of the Future*, 2012.