Informatics Europe comments on CC-2020

1. General comments

CC-2020 is an impressive work providing a very well justified framework for curricula construction for bachelor programs in a broader sense. Informatics Europe appreciates in particular that it is based on competencies and their description rather than on content and knowledge. However, we feel that the explicitly stated claim or goal of this work “to summarize and synthesize the current state of curricular guidelines …” does not exactly match the main contribution of this report, which is more a well substantiated framework for the development of curricular guidelines.

From a European view, the emphasis on general needs and requirements from industry does not really address mainly bachelor programs, because in most European countries there exists a variety of different programs, ranging from general school education in computing related areas, sub-academic programs for technicians in that field, Bachelor programs in informatics, specialized areas inside informatics, interdisciplinary studies involving informatics up to educational programs on master and PhD level preparing for a scientific professional activity. On each level, potential employers would expect different competencies, which is not sufficiently distinguished in the report.

There is also kind of a terminological mismatch between “computer science” and “computing” on the American side and “informatics” and “computer technology” on the European side. In the majority of European countries, “informatics” aims at a more encompassing view of the field, including mathematical and logical background, theory of computing etc. up to social aspects of information systems. Nonetheless, due to the different languages in Europe, “informatics” translates to Informatik, Informatica and similar, but also confusingly sometimes to “Computer Science”, which is then meant to be a synonym to informatics. Apparently there is a common agreement about the core of the discipline Informatics in Europe. Consequently, study programs in informatics reflect this core, whereas other programs specialize on a subset of these core elements or combine informatics with other disciplines.

Surprisingly, the document does not contain a complete list of relevant topics in computer science but rather restricts on examples. Therefore, we consider it more like a meta-survey and a manual indicating how additional topics should be formulated. Since, as mentioned above, the scope of programs like computer science, computing, information systems or informatics might differ significantly, a definition of the scope of a particular program has a high importance, from the academic view, from the view of employers and in particular for potential students.

2. More specific comments on the importance of general education in informatics and educating the educators

The CC2020 includes a chapter about the “Evolution of Computing Education”. Although this chapter is well structured, we consider that a more in depth review on the importance of general education in computing (informatics) must be included. Digital Literacy, Computational Thinking and other Informatics related competences are important for pre-university students, especially to generate attraction and make them understand what computing really is. The basic discipline has to be addressed and ways of thinking identified, developed and nurtured. One aspect of this is developing strands of Informatics education in a way that suits different stages of school education. The relevance of the CC2020 project will help stimulate

the support of the governments with appropriate legislation and sustained funding schemes to implement them. Being the purpose of the CC2020 project to offer curricular guidelines to situate and contextualize them in the landscape of computing education globally, it is surprising that no attention has been devoted to any of the existing curriculum initiatives for primary and secondary education.

Another point we suggest to cover in the report is how educating the educators. There's a common lack of digital competencies in society and educators are not out of this problem. This leads to a bad approach when some courses on informatics are introduced in primary and secondary levels using a strongly practical approach and overcoming the fundamental scientific ideas of Informatics. Additionally, the use of IT resources are limited by the poor competency level of teachers. This is provoking a loss of time, money and confidence in the system as most of times students get a better level of digital proficiency by themselves or at home.

Which are the basic competencies that an Informatics educator should own? Teaching computing in schools has followed very different paths in the different European countries. But in all countries there seems to have been, since 2012, two opposite ideas for this: for some a broad approach where a very general subject (called Numérique in France; IT in the UK for example) has been taught. For others, a topic called Informatics (or a variation) based on a strong scientific core. In all cases the first approach has been described as a mistake (see reports by the Royal Society https://royalsociety.org/topics-policy/projects/computing-in-schools/report/ and by the Académie des Sciences https://www.academie-sciences.fr/en/Advice-Notes-and-Reports/teaching-computer-science-in-france-tomorrow-can-t-wait.html) and new courses closely organized around Computer Science (also called Informatics) have been introduced.

This second approach is usually found harder to implement: it requires better and specifically trained teachers, whereas, often, the first approach is based on the idea that any teacher who knows about some aspect of computing or even specific technologies can teach. The way the CC2020 report defines computing competency could undermine the attempts made by many, in Europe, to teach the topic in schools in a systematic way, seeing this both as a science and a technology. Experience from UK (the European country where computing education for all students in school started first) show that an appropriate education of a large enough number of teachers is the main obstacle for a successful uptake of computing education in school https://royalsociety.org/topics-policy/projects/computing-education/

We suggest to focus on the importance in school of general education in informatics seen as a fundamental science, as well as to enhance the relevance of having well prepared educators, capable of motivating and engaging students through this field. Also, important documents related to basic digital competencies like DigComp in Europe or the IEA International Computer and Information Literacy Study 2018 (ICILS 2018) should be considered.

3. Further remarks

As written above, the document covers extensively most domains inside computing, and analyzes the skills and competences which are today important. Nevertheless, there are some specific differences between a global view and the European situation. We want to add in this section that, from a European perspective, the following elements would probably have been emphasized in a European report:

1. Artificial intelligence does not appear as a specific field. It is mentioned in the document as a possible field, but not in sufficient detail. On the other hand Data Science is. From a European

perspective, AI is taking today a more central position, growing, with Data Science probably being a part of AI.

2. It is unclear that European industry has exactly the same problems as those described in the report: the *skill gap* may not be the most important concern industry has when dealing with training and education issues. Our feeling is that industry is asking for trained workers which would be more versatile and a lot more emphasis is put on the soft skills. Our analysis would nevertheless require a more complete study to be done in common with the professional organisations.
3. As mentioned before, a key concern in Europe, in all countries and for the European Commission, is to deal with the correct training of teachers in order to get the pupils interested in the different topics inside informatics. This could also require a competences based approach, but the set of competences would plausibly not match those important to industry.
4. There have been a number of studies and documents produced by European organizations concerning competency models; we do believe they could have helped in this work.

4. Acknowledgements

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