Three New Pillars of Digital Education

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Abstract [French]

Le modèle des *Trois piliers de l'éducation numérique* proposé par Paul Kleiner (2014) offre une représentation de l'éducation numérique selon trois piliers que sont la *science informatique*, l'*usage d'outils numériques* et l'*éducation aux médias*. S'il permet de sortir d'une relative confusion concernant les contenus de ce que l'on appelle *l'éducation numérique*, il reste principalement dans une description de l'état actuel du monde éducatif, notamment en Suisse, et connaît des limitations pour présenter ce qui est souhaité pour l'avenir, en particulier le traitement des aspects sociétaux de l'éducation numérique, dans laquelle les thématiques précédemment appelées *usages d'outils numérique*, alors qu'un nouveau troisième pilier apparaît sous le nom de *société numérique*, offrant une place à part entière à l'étude des aspects sociétaux (problématiques, enjeux) qui émergent du fait de l'omniprésence des technologies et des algorithmes dans le monde qui nous entoure.

Article [English]

Computers have been in schools for around 40 years now, and the way they have been considered has varied across time: as a medium to make first experiences of programming, as a tool to produce documents, as support to learn computer science (Sysło & Kwiatkowska, 2015). However, there have been — and in some ways, there still is — a lot of confusion about the meaning of words that are used to define the domain related to digital, such as *computer science, computing* or *informatics*: are we talking about tools, about a "real" science, or about something that enhances learning? In order to get out of the confusion, there have been several propositions to model the content of the field, a model of what we could call *Digital education*.

Three pillars of digital education: the initial model

Among those, one model was of particular interest to us: the *Three pillars of digital education* initially proposed by Paul Kleiner (2014). In this model, digital education rests on three distincts, though porous, pillars. The first pillar is *Computer science*, a scientific

discipline that describes the principles that are behind digital information processing. Here we find topics like *algorithms*, *programming*, *representation of information*, *networks*, and *machines*. The second pillar is the *Use of digital tools*, seen as the acquisition of know-how in the use of digital devices or software. It is sometimes called *ICT* and has to do with learning to use any kind of software or hardware that helps produce content and supports learning. The third pillar is *Media education*, a field aimed at decoding the role and language of media, making learners critical about any media or documents.



This model has the advantage to provide a better understanding of the field of Digital education. It was particularly well received in the context of Switzerland where it was proposed by Kleiner probably because of the fact that it properly describes the existing state of Digital education in Swiss schools (even though a large proportion of them may be lacking in the first pillar). Switzerland has one curriculum per linguistic region. The curriculum in the German-speaking part of Switzerland called *Lehrplan21*¹ has a discipline called *Media and Informatics,* which assembles the first and the third pillar. *Use of digital tools* — the second pillar — is considered as a transversal topic under the responsibility of every teacher. In the curriculum that exists in the French-speaking part of Switzerland called *Plan d'études romand*², we find a transversal topic that groups the second and the third pillars called *MITIC* (Media, images and ICT) and no computer science. But a recent reform engaged for this curriculum will bring a new

¹ <u>https://www.lehrplan21.ch</u>

² <u>https://www.plandetudes.ch</u>

discipline representing the first pillar, missing right now. This can be seen as a confirmation of the adequacy of Kleiner's model to describe the present situation. It is important to note that Media education has traditionally played an important role in the country for many years, as a record of the links that have existed between the media (especially television) and education.

The movement towards teaching computer science in schools and the importance of social aspects

After a period of time during which digital education was reduced to the simple use of digital tools, there have been for some years a real trend towards the introduction of a teaching of computer science, sometimes starting at the primary level³ (Sysło & Kwiatkowska, 2015). Among the arguments for this movement towards computer science, there is the idea that the knowledge brought by computer science has become crucial to understand the world of technologies that surrounds us. It is said that today's kids — future citizens — will require a basis of understanding in computer science to grasp the challenges that we face as society, in the same way they need knowledge in physics to understand the material world around them. So roughly speaking, there is a strong expectation expressed in the politics and the media to introduce the first pillar of Computer science where it still wasn't present, but with an aim at explaining social aspects and bringing solutions to social challenges.

In the Swiss context, some have taken the shortcut to say that regarding the model of the *Three pillars of digital education*, social aspects were the domain of the third pillar of *Media education*. But there is a problem with such an interpretation, because Media education mainly cares about the role and language of media and not about other aspects of the digital world, such as explaining the challenges we face with processes driven by algorithms in many domains. This view is too restrictive. Moreover, Media education has often been taught in the form of an injunctive speech, telling children how to behave or not when surfing the web, trying to get them to adopt moral behavior and bringing few real content and understanding. Research has shown that such a speech has no effect on young people (Capelle, 2018).

Coming back to our model, if it has served to correctly display the state of the present situation of Digital education in Swiss schools, it is problematic and mostly failing to elaborate what we want for the future. We are thus coming with a proposition of a new model, elaborated from the first one, called the *Three new pillars of digital education*.

Three new pillars of digital education: the revised model

In this new model, the first pillar remains as it was in the previous model: Computer science. As second pillar, we propose to expand the original second pillar of Use of digital tools with some aspects of the original third pillar of Media education to call a new and broader second pillar of Digital literacy. The aspects of Media education that we

³ For a recent mapping of the situation in Europe: <u>http://cece-map.informatics-</u> <u>europe.org/map/informatics first contact</u>

move to this second pillar have to do with evaluating the quality and liability of information, validating sources, being aware of copyright and copyleft. Prevention-related content can be dealt with separately in targeted actions, a bit like road prevention. In this way, the third pillar can be transformed into a new topic called *Digital*



society whose contents can be completely adjusted to answer the social expectations we have mentioned earlier.

The new third pillar of *Digital society* would discuss and evaluate the impacts of digital technologies on societies, cultivating a digital citizenship. Among the topics to be discussed, we can mention the transformation brought about by considering information as first in relation to material aspects and the revolution it generates in fields as vast as industry, medicine and sciences (physics, biology, human sciences... — Berry, 2018). Further on, it is also the transformation of work, the question of the distribution of wealth produced by algorithms, the notion of ownership, changes in institutional and political structures, justice, personal data and privacy, not to mention the vital issue of ecology (Abiteboul & Dowek, 2017). Beyond that, it is interesting to see what thinking the world in an algorithmic way teaches us about the structure of the problems to be solved and the properties of their solutions (Christian & Griffiths, 2016).

Regarding the variety of areas concerned by these issues, the third pillar of *Digital society* is likely to be addressed in a large number of school subjects. The computer science teacher is crucial in providing the scientific knowledge necessary for students to formulate an informed opinion on these issues and to go beyond the

clichés often found in the media. But teachers of other disciplines as law, economics, languages or philosophy are in the best position to discuss issues related to their fields.

Conclusion

We described the model known as the *Three pillars of digital education* and discussed what we consider shortcomings of that model with respect to societal aspects of computer science. We mentioned those aspects as being essential concerns and primary goals of teaching of computer science since primary schools in many current initiatives. We thus proposed here an alternative model to better take those aspects into account, the *Three new pillars of digital education*. It is a first formulation that should be discussed and further developed. Particularly, the content of the new third pillar of *Digital society* must be elaborated in a more detailed manner.

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