Working Group

Constructionism in upper secondary and tertiary levels

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In the constructionist paradigm, the fundamental premise is to create student-centered learning situations for students to consciously engage in constructing shareable, tangible objects, through meaningful projects. In Papert's vision, one particularly valuable means of doing that is in programming the computer because, in doing that, the student "establishes an intimate contact with some of the deepest ideas from science, from mathematics, and from the art of intellectual model building" (Papert, 1980, p. 5). Since the 1980s, there have been countless experiences and studies exploring and documenting the use of the constructionist paradigm, many of the first ones using Logo computer programming, but mostly with young students at primary or middle-school levels. However, experiences in upper secondary and university levels are scarcer. The purpose of this working group is to share constructionist experiences in upper secondary and tertiary educational levels, particularly those involving computer programming and/or computational thinking and environments. Laurillard (2002) advocates for constructionist and collaborative technology-based learning environments in higher education, taking into account how students learn. For this, she considers that "the aim of university teaching is to make student learning possible […] not simply impart decontextualised knowledge, but must emulate the success of everyday learning by situating knowledge in real-world activity" (p. 42) helping students reflect on their experience of the world and ways of representing it. However, another issue is that implementing constructionist exploratory learning environments in school cultures (at any level) is problematic and complex, as has been discussed also by Laurillard (2002) and others.

In the case of mathematics, some examples of constructionist studies in higher levels show how computer programming can support students' understanding of mathematical concepts (e.g., Leron & Dubinsky, 1995) and how it contributes to the development of critical thinking skills (e.g., Abrahamson et al., 2004). Marshall, Buteau & Muller (2014) also describe a long-term complete university curricular implementation that integrates computer programming activities in the pure and applied mathematics syllabi. On my part, I have been involved also in several constructionist projects in higher education (see Sacristán, 2017), where university students engage in computer programming and/or expressive activities (involving topics and data related to real-life phenomena, meaningful for their area of study) for mathematical exploration or learning that include sharing, collaboration and discussion.

Aims of the working group: To share higher education constructionist experiences, reflect on the challenges, needs and differences of constructionist technology-based implementations in the various educational levels, and on how to promote such implementations in upper levels.

Guiding and research questions:

- What are the characteristics of constructionist implementations in upper educational levels? In upper secondary school? At university level? How are they different from lower levels? What are the particular challenges?
- How is, or what could be, the role of digital technologies and computer programming in such implementations?
- How can constructionist implementations be integrated and promoted in higher education? What is required for that?
- Can real-life data, phenomena and problems be harnessed for developing such implementations?

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