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Investigation of the Physical Computing in Computational Thinking Practices, Computer Programming Concepts and Self-Efficacy for Crosscutting Ideas in STEM Content Environments

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Abstract : Physical Computing, as an instructional model, is applied in the framework of the Engineering Pedagogy to teach “transversal/cross-cutting ideas” in a STEM content approach. Labview and Arduino were used in order to connect the physical world with real data in the framework of the so called Computational Experiment. Tertiary prospective engineering educators were engaged during their course and Computational Thinking (CT) concepts were registered before and after the intervention across didactic activities using validated questionnaires for the relationship between self-efficacy, computer programming, and CT concepts when STEM content epistemology is implemented in alignment with the Computational Pedagogy model. Results show a significant change in students’ responses for self-efficacy for CT before and after the instruction. Results also indicate a significant relation between the responses in the different CT concepts/practices. According to the findings, STEM content epistemology combined with Physical Computing should be a good candidate as a learning and teaching approach in university settings that enhances students’ engagement in CT concepts/practices.

Keywords : arduino, computational thinking, computer programming, Labview, self-efficacy, STEM
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