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A PCT-based approach to teaching and learning how to program

Hugo Cristo Sant'Anna – hugo.santanna@ufes.br

Abstract

Research about learning how to program computers is commonly based on constructivist and social constructivist theories. The former, operating at the psychological level, assumes mental structures or representations about programming concepts built by novices during learning. The latter, characterized at the psychosocial level, deals with properties and dynamics of learning situations, social interactions, and cooperation between novices and experienced programmers to foster learning. This presentation proposes a PCT interpretation of computer programming learning processes, connecting psychological functioning and social interactions under the same framework. Controlled variables at different levels describe diverse local, bottom-up goals of each learning phase: discovering primitive programming language elements, sequencing primitives, translating sequences into loops, and finally building abstractions. In the other direction, top-down reference signals describe global goals of teaching and learning how to program, with decreasing influence of tutoring and direct instruction. The balance between bottom-up and top-down processes is hypothesized as a gradual transfer of control by explicit teaching or peer-interaction to self-built programs which control programming behavior. A case study from a year-long undergraduate teaching experience in Brazil is presented to illustrate the theoretical proposal. Future studies intend to design a PCT model of student behavior during learning processes.