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Supporting Robotics Education in STEM with Learning Analytics

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There is concern amongst policy makers and employers that students are not graduating with the required skills in STEM subjects (Science, Technology, Engineering, and Mathematics), especially when we look at the exposure to robotics. It is argued that learners must go beyond the acquisition of discipline-specific facts and skills, to develop an integrated understanding of STEM disciplines within an authentic context of collaborative problem solving. Robotics provides this authentic context for developing the skills, processes, and theories. This integrated approach to STEM teaching is at the heart of instructional practices that center on collaborative, hands-on, engineering design problems. The use of hands-on engineering design problems for robotics in classroom teaching are facilitated by physical computing kits, such as programmable microcontrollers like Arduino, and other platforms. These kits provide building blocks that make technology development more accessible to novices, thus allowing them to work on more complex problems. A fine-grained analysis of the collaborative problem-solving process, using learning analytics tools, can provide insight into learning to support both teachers and learners. However, it is hard to track and interpret learner activity in engineering design problems, due to the hands-on and open-ended nature of such tasks. This abstract presents work that begins to address these challenges. We discuss the development of an intelligent learning environment for exploring hands-on STEM activities, using physical computing kits, which use multi-modal learning analytics. The system provides specially designed furniture and the integration of computer vision, log files from the hardware and software, and learner and teacher rich-media input to help understand the complexities of collaborative problem solving that can support robotics education.

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