

Chapter 2

Tools to Mediate Learning and Self–Assessment in a STEAM Unit of Work


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ABSTRACT

In some high school learning environments, hundreds of students engage in collaborative, term-long, project-based learning STEM or STEAM units of work. In this chapter, the authors report on an ongoing design-based research project in which researchers and teachers collaborate to design, teach, and assess STEAM units of work. They draw on research on project-based learning and interdisciplinary collaboration to inform the analysis drawing on Jonassen’s typology of problem solving. The purpose of this chapter is to present two tools that functioned as boundary objects mediating learning and self-assessment: (1) a ‘STEAM slider’ used by students in groups to reach consensus on the use of the tools, knowledge, and processes employed in their project and (2) a criteria sheet developed to mediate students’ and teachers’ engagement in self- and teacher-assessment. The authors use these results to make recommendations for the next iteration of the project.

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INTRODUCTION

STEM education is a priority nationally and internationally, as countries identify areas of investment for future workforce planning (Reider, Knestis, & Malyn-Smith, 2016; Timms, Weldon, & Mitchell, 2018). STEAM education includes an “A” to represent the Arts, and much of the literature which advocates for this approach argues that scientific progress will be impoverished without the Arts or creative thinking (e.g. Herro & Quigley, 2017). The use of STEM or STEAM education can indicate units of work that address any single discipline areas (Science, Technology, Engineering, the Arts or Mathematics), or those that require students to make connections between discipline areas (Costin, Thompson & Chapman, 2018). The latter is the focus of this paper. In some high school learning environments, hundreds of students engage in collaborative, project-based learning STEM or STEAM units of work, using their own devices, connecting to school systems, over several weeks. Such learning environments can be described as complex (Goodyear & Carvalho, 2013), and provide challenges both for researchers to understand the interplay of teacher and learner activity, as well as for the design of assessment by teachers (Costin et al., 2018).

In this paper, we present a STEAM unit of work developed over several years, as part of ongoing design-based research project in which researchers and school teachers work closely to collaboratively design, teach and assess STEAM units. The study was conducted with Year 7 and 8 students (aged 12-13 years) as part of a STEM excellence program in an Australian High School. Year 7 is the first year of high school in Australia. A range of scaffolds were provided to students to support the development, implementation and reporting of their collaborative STEAM projects using a portfolio available in a shared, online folder. In this paper, we examine two tools that mediated learning through consensus: (1) a ‘STEAM slider’ that students in groups used to reach consensus on the use of the tools, knowledge and processes employed in their project; and (2) a criteria sheet developed to mediate students’ and teachers’ engagement in self- and teacher-assessment. We initially compare students’ and researchers’ identification of the connection of STEAM disciplines in the projects, and then students’ self-assessment with teachers’ assessment of the final product and report. We provide some examination of the differences in particular elements of the rubric that may help in the provision of feedback in the next iteration of the project. We draw on research about collaborative learning (e.g. Goodyear, Jones, & Thompson, 2014) and particularly in terms of interdisciplinary teams (e.g. Flowers, Mertens, & Mulhall., 2000), as well as project based learning (e.g. Jonassen, 2000) and self-assessment and evaluation (Boud, 1995) to investigate key elements of the design of this collaborative, project-based STEAM unit of work, and provide recommendations for the next iteration of the project.

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