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Facilitating Meta-learning in Pre-service Teachers: Using Integration and Slowmation Animation

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Abstract

Meta-learning relates to one's ability to have an awareness of one's self as a learner, and being able to use this ability to become a more effective learner. It is important for pre-service teachers to develop this self-awareness about their own cognitive processes so that they can become more skilled in their approach to learning and therefor teaching. They become better equipped to make conscious changes in their approaches to learning and become more productive, independent learners (Winters, 2011). The purpose of this study was to use an inquiry-based learning experience so that primary pre-service teachers could explore their understandings of inquiry and begin to develop a meta-learning approach by integrating an innovative technology into a science methods workshop. Effectively, the aim was to create a learning experience for pre-service teachers that would enable them to participate in modelled inquiry experiences during their university classes, using curriculum and materials that were aligned with the requirements of the *Australian Curriculum: Science*, and had a focus on teacher content knowledge (knowledge of science subject matter (e.g. biology, physics), and knowledge of classroom inquiry). Inquiry-based learning and teaching is central to Australia's national science curriculum – the *Australian Curriculum: Science.* Australian teachers are mandated to apply inquiry-based learning in their classrooms, but unfortunately very few classroom teachers have experienced a scientific inquiry, and even the most experienced teachers appear to have little knowledge of inquiry (Capps & Crawford, 2013). It is quite possible that most of Australia's teachers learnt science through the traditional approaches. Loucks-Horsley et.al. (2003), argue that it is very difficult for a teacher to teach in ways in which they have not learned themselves. Thus, this paper explores the impact of an inquiry-based learning experience, as part of a teacher training program, in terms of self-awareness and meta-learning.

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1. Introduction

The purpose of the study was to explore the understandings of primary school pre-service science teachers as they undertook an inquiry-based learning experience. Inquiry-based learning and teaching is central to Australia's national science curriculum – the Australian Curriculum: Science (ACARA, 2013). One of the unique aspects of the Australian Curriculum: Science is the emphasis on practical work and inquiry-based

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learning. The three strands that comprise the Australian Curriculum: Science (Science Understanding (SU), Science Inquiry Skills (SIS), and Science as a Human Endeavour (SHE)) are interrelated. No individual strand can be pursued as a discrete learning outcome. Both the SIS and SHE strands must be inextricably linked to the development of understanding. The aim of this paper is therefore to describe how an inquiry-based learning experience, integrated with an innovative technology, as part of a teacher training program, lead to transformative learning via excitement and inspiration, self-awareness and meta-learning. Just as it has been well documented that teachers need to identify and build on their students' prior knowledge and ideas when teaching science, it is equally important for the pre-service teacher to identify and build upon their own ideas of not only science subject matter, but on their science pedagogical practices. Science subject matter knowledge alone is insufficient for teachers to teach well, they need the integration of pedagogical knowledge. The paper begins with an explanation of transformative learning, and then moves to a brief description of Slowmation Animation, the innovative technology used in the study.

1.1. Transformative learning

Sterling (2010-11) writes of the assumption that learning is self-evidently a 'good thing' and that much learning discourse is directed towards "making learning effective, to learning to learn, learning methods and so on" (p. 18). There is scant discourse given to the notion of the purpose of learning. Through considering the process of learning, a qualitative shift in perception and meaning making, as performed by the learner, can result in a reframing of assumptions and thinking customs – transformative learning. Stirling builds upon the earlier works of Bateson (1972), Mezirow (2000), and Morrell and O'Connor (2002) in defining and exploring this concept of transformative learning. This work describes orders of learning and change:

- First-order learning is the most common form of learning. It relates very much to the world external to the learner. The material is content led, and often delivered through traditional transmissive pedagogies. This information transfer often leads to surface or shallow learning. Ideas already available to the masses are presented to the learner and regurgitated when required.
- Second-order learning occurs when there is a change in thinking or personal awareness. The learning has taken on an internal dimension whereby a critical examination of the self, in relation to the content matter occurs – a form of meta-learning. This learning is said to be deeper than the surface/shallow learning evident in first-order learning. Prior learnings are challenged and questioned and the purpose of an activity or the content is explored. Kelly and Cranton (2009) state that when a learner questions their assumptions and this then leads to a shift in how the learner sees themselves in relation to the world and content, then they have engaged in transformative learning. Through successive iterations, the deep learner undergoes a process of meta-learning and becomes aware of them-self in the learning process. A deeper conceptual and pedagogical learning is taking place. This may be viewed as an engagement in quality learning approach to learning – the focus is upon the learning process and not on the product.

Sterling (2012-11) describes any shift from first-order to second-order, as sometimes painful to the learner. Resistance may occur as existing understandings, beliefs and values are challenged. The learner is required to reconstruct meanings which may cause discomfort. However, a learner may also experience excitement and inspiration.

1.2. Slowmation Animation

Slowmation Animation is a simplified version of Claymation (the animation process used to make movies like Happy Feet) that uses many of the same learning processes – "researching information, planning and writing a story, storyboarding, designing models, taking digital photographs, using visual literacies, using technology, evaluating and, most importantly, working collaboratively as a team" (Hoban, 2005, p. 27). Hoban's study outlines a seven step procedure for making a Slowmation Animation movie: 1) Plan, research, teach, 2) Jigsaw, 3) Storyboarding and story writing, 4) Making and photographing, 5) Download and import, 6) Enhance and Edit, and 7) Show. Keast, Cooper, Berry and Loughran (2008) describe a three step process they use in conjunction with Slowmation Animation: (A) representation: recognising how the scientific concept can best be represented; (B) deconstruction: identification of the major elements of the process [chunking] through a story-board; and (C) reconstruction: the re-chunking and synthesizing or model making and movie creation. Keast et al. go on to describe Slowmation Animation as a translation task "in which learners translate information from one form into another. In this case, Slowmation requires students to translate abstract scientific information into models to produce animated movies that demonstrate their understanding of the given concept, topic, or idea under consideration" (p. 3).

There is a dearth of research pertaining to the meta-learning resulting from the creation of a Slowmation

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