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Creating a narrated stop-motion animation to explain science: The affordances of "Slowmation" for generating discussion

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HIGHLIGHTS

- The discussion enabled the preservice teachers to resolve a resilient misconception.
- Slowmation enables preservice teachers to create a narrated stop-motion animation.
- Slowmation has four affordances for generating discussions about science.

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ABSTRACT

This case study investigated the nature of the discussions generated when three preservice primary teachers made a narrated stop-motion animation called "Slowmation" to explain the science concept of moon phases. A discourse analysis of the discussion during construction demonstrated that the preservice teachers posed many questions, propositions and ideas facilitated by four affordances of the process: (i) a need to understand the science in order to explain it; (ii) making models; (iii) stopping to check information; and (iv) sharing personal experiences. Slowmation is a simplified way of making animations that has four affordances to promote discussion resulting in scientific reasoning.

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1. Introduction

There are increasing opportunities for students in schools and universities to use technology and create different forms of media to promote digital literacies (US National Research Council, 2012). In particular, access to personal technologies such as mobile phones are increasing students' capacity and portability to create media anywhere and anytime (Cochrane, 2011; Jones & Issroff, 2007). According to Traxler (2010), mobile technologies provide users with more ownership of knowledge and responsibility for learning since "mobile devices demolish the need to tie particular activities to particular places or particular times … mobile technologies have converged with the wider user-generated movement associated with Web 2.0 rhetoric and technologies" (p. 151–155). A consequence of students' improved capacity for creating media, particularly when using mobile phones, is that they are increasingly taking still images and videos, but mainly for the purpose of uploading to social media sites such as Facebook and Instagram. Teacher educators could thus draw upon the disposition of their preservice teachers' for making digital media and promote the use of these skills for sharing ideas about teaching and learning.

For example, the process of creating digital media could provide a context for generating discussions, especially if the media is created as a group activity. According to key theorists, discussion is a vehicle for thinking and learning (Scardamalia & Bereiter, 1993; Vygotsky, 1978; Wenger, 1998). Parker and Hess (2001) noted that "discussion widens the scope of any individual's understanding of the interpretations and life experiences of others. Shared inquiry, results, therefore, in shared understanding" (p. 275). For science learning in particular, discussion has been viewed as a key process to promote students' learning of concepts (Lemke, 1990, 1998). Discussions about science concepts are most fruitful when students are encouraged to declare their beliefs, whether correct or incorrect, listen and respond to different perspectives and evaluate and refine their ideas. Discussion amongst peers is key to these processes, especially if learners propose their ideas in ways that are understandable by others.

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Chin and Osborne (2010) analyzed the science discussions of high school students and found that an important influence on the quality of the discussion was the way in which the discussions were framed: "the initial focus on questions prompted students to articulate their puzzlement; make explicit their claims and (mis) conceptions; identify and relate relevant key concepts; construct explanations; and consider alternative propositions when their ideas were challenged" (p. 883). A systematic review of 89 studies evaluated how discussions are used in the teaching of science in schools (Bennett, Lubben, Hogarth, & Campbell, 2005). Bennett et al. showed that discussion was usually part of a broader strategy such as collaborative learning, conducting an experiment or developing an argument. Furthermore, the quality of discussion was related to how the task was framed and the timely introduction of new ideas to scaffold the discussion. Berland and Hammer (2012) confirmed the importance of "framing" a discussion in which students need to be encouraged to ask questions, state their beliefs, argue a point of view, evaluate evidence, reason with ideas and revise their own claims and the claims of others. In short, appropriate framing is key to scaffolding students' discussions and reasoning about science to support learning.

Preservice teachers should also "learn by experience" (Munby & Russell, 1994) in the teacher education program by participating in the type of discussions that they will expect of their future students in schools. For example, when preservice teachers read and discuss case studies, their individual experiences can be elaborated as ideas are shared (Levin, 1995; Richardson, 1991). This is also important for collective knowledge building (Bereiter & Scardamalia, 1993). Mathematics educators have used classroom video episodes to frame professional learning discussions (Borko, Jacobs, Eiteljor, & Pittman, 2008) and technology educators have analyzed discussions in online teacher education forums where the focus was development of ICT skills and knowledge (Prestridge, 2010). In the current study, we investigate whether the disposition of preservice teachers for creating digital media could be used as a context to promote reasoned discussions, especially in regard to making animations to explain science concepts.

1.1. Slowmation: a simplified way of making a narrated stop-motion animation

Animations have been readily available for learning in many content areas, but in nearly all cases these have been expert-generated with students interpreting the information presented (Gilbert, 2007; Phillips, Norris, & Macnab, 2010). If students become producers rather than consumers of information in animations, then they may develop meaning and in the process generate informative discussions. However, there have only been a few studies in which students have created animations as a way of learning science and in each of these studies, specific software was designed that included access to learning objects to support the construction process (Chan & Black, 2005; Chang, Quintana, & Krajcik, 2010; Schank & Kozma, 2002). Even the traditional stop-motion animation process known as "claymation", which was a term coined by Will Vinton in 1975 to describe the stop-motion technique of animating clay models in his movie *Closed Monday*, has been rarely implemented in science teacher education. This is because claymation is a tedious process needing an expensive animation stand to hold a camera perfectly still to photograph small manual movements. Hence, traditional claymation is rarely used as a teaching approach in science teacher education because it is time-consuming and the clay models dry out and easily break apart.

With current digital technology (hand held cameras and mobile phones), however, stop-motion animation in the form of *Slowmation* (Hoban, 2005) has become a simplified way for students to create animations in school classrooms and in teacher education courses. Slowmation evolved in a preservice teacher education course at an Australian university as a way for students to engage with and explain science content (Hoban & Nielsen, 2011). The animation process is simplified by laying the models flat to ease image capture and playing the images at 2 frames/second (normal animation speed is 25–32 frames/second) to create a slow-moving image and hence enable a narration by preservice teachers. In short, a slowmation displays the following features:

- *purpose* — preservice teachers or school students engage with science content to explain a science concept in 2–3 min and through the creation process, learn about the concept. The voiceover can be enhanced with narration, music, static images, diagrams, models, labels, questions, static images, repetitions or characters;
- *orientation* — 2D and/or 3D models are made and manipulated in the horizontal plane (lying flat on the floor or on a table) and photographed with a digital still camera mounted on a tripod, a hand-held mobile phone or iPad (these can be taped to a desk). Laying models flat on a table or the floor makes them easier to make, move and photograph. See Fig. 1 for examples of two possible set-ups by preservice elementary teachers.
- *materials* — many different materials can be animated such as soft playdough, plasticine, 2D pictures, drawings, written text, existing 3D models, felt, cardboard cut-outs and natural materials such as leaves, rocks or fruit;
- *timing* — slowmations are usually played slowly at 2 frames per second, not the usual animation speed of 25 frames per second thus needing ten times fewer photos than in clay or computer animation and resulting in a slow-moving image hence the name "Slow Animation" or "Slowmation";
- *technology* — students use their own technology (digital still cameras with photo quality set on low resolution, iPad or mobile phone camera) and free movie-making software (e.g., iMovie on a Mac or Windows Movie Maker on a PC).

In the last few years, slowmation has been used in a wide variety of school and university classrooms because of its simplicity in terms of the creation process and the use of everyday technologies (free software on Mac and PC computers and the use of students' own cameras and mobile phones). A database linked to the project website www.slowmation.com shows that the site averages 10,000 requests/day resulting in over 15 million requests in the last 3 years from users in 106 different countries. An analysis of the 2000 examples on YouTube show that slowmations have been created in a range of subjects such as in science, math, history, social studies and English and in a variety of international contexts such as in North America (Canada and the USA), South America (Brazil, Chile and Peru), Europe (France, Germany, Italy and England) and Australasia (Australia and New Zealand). The adaptability of slowmation has been demonstrated by research on students creating slowmations about different topics in a range of educational contexts — in early childhood, elementary, secondary and university classrooms. In early childhood centers, there have been studies on 4 year olds in regard to the learning of science concepts (Fleer & Hoban, 2012). In the context of elementary classrooms there have been research studies on grade 4 students' understanding of equivalent fractions in mathematics (Kervin, 2007), the learning of social skills by grade 4 students with mild intellectual disabilities (Shepherd, Hoban, & Dixon, 2014) and storytelling in English (Reid, Reid, & Ostashewski, 2013). In the context of secondary school classrooms there have been studies on students' science learning (Keast, Cooper, & Loughran, 2011). In the context of university teacher education, there have been research studies on how

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