Using mobile phone cameras to capture images for slowmations: Student-generated science animations

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CHAPTER 11

Using mobile phone cameras to capture images for slowmations: Student-generated science animations

Garry Hoban

Abstract:
A common phenomenon in many countries is that science is often poorly taught or not taught at all in primary school classrooms. ‘Slowmation’ is a new yet simplified form of stop-motion animation that encourages school or university students to create their own animations of science concepts. Even though this process of creating an animation is relatively simple, there is still a need for teachers and students to have access to basic equipment such as a digital still camera, a tripod and a computer with relevant software. This chapter presents a study of a group of preservice primary teachers who guided their school classes in creating slowmations of science concepts using the camera in mobile phones to capture the images. Using a mobile phone camera improves the accessibility to a camera, but the quality of photos taken by mobile phone cameras needs to be improved to make it a worthwhile use of the technology for creating animations.

Introduction
The teaching of science in Australian elementary schools is a national priority (Committee for the Review of Teaching and Teacher Education, 2003). Yet science is one of the least taught subjects in the primary curriculum in Australia (except for Languages other than English) averaging 41 minutes or 2.7% of teaching time each week (Angus et al., 2004).

One way to address this concern is to encourage preservice teachers to teach science in new and engaging ways whilst undertaking their university courses. Using technology can be a motivation for preservice teachers to implement science especially when using a popular medium such as digital animation.

However, nearly all uses of digital animation involve learners using expert-generated animations. An alternative way for preservice teachers to implement science is to encourage them to make their own animations to represent their understanding of science content. According to Bransford, Brown, and Cocking (2000) technology is a powerful tool for learning especially as ‘learners might develop a deeper understanding of phenomena in the physical and social worlds if they could build and manipulate models of these phenomena’ (p. 215).

Empowering learners to make their own animations of science concepts is consistent with the theoretical framework of ‘constructionism’ promoted by Seymour Papert (1980, 1991). He contended that students engage in deep learning when they have to research, design and construct an artifact or model with technology to represent their knowledge. Constructionism draws on both the Piagetian notion of constructivism, whereby learning occurs when individuals construct models or artifacts to represent their own understandings of concepts, and Vygotskian social influences when the artifacts are shared with a wider audience. However, most attempts by students to create animations involve using complicated
software such as Macromedia’s Flash which is usually beyond the expertise of most learners, especially in primary school.

**Slowmation: A new form of stop-motion animation**

‘Slowmation’ (abbreviated from ‘Slow Motion Animation’) is a new form of stop-motion animation that simplifies the usually complex process of making animations so that they can be created by learners (Hoban, 2005, 2007, 2009). Similar to other forms of stop-motion animation such as clay animation, Slowmation involves the manual manipulation of materials with a digital still photo taken at each change in position of the materials. The digital photos are then uploaded into a computer program which plays the photos in a sequence to create an illusion of movement and is seen by the human eye as moving by itself because of a phenomena called ‘persistence of vision’. The process involves students researching information, scripting, storyboarding, making models, photographing digital still images of small manual movements of the models and using a computer program such as Apple’s QuickTime Pro or Windows Movie Maker to create the animation. Slowmation, however, is different from clay animation in six key ways as shown in Table 1. These differences mean that slowmation is simpler and less time consuming to make than clay animation and so becomes a feasible teaching approach in school classrooms.

**Table 1: Comparative features of Slowmation and Claymation**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Claymation</th>
<th>Slowmation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Purpose</strong></td>
<td>To tell a narrative or story</td>
<td>A resource to explain a science concept</td>
</tr>
<tr>
<td><strong>Content</strong></td>
<td>English</td>
<td>Science</td>
</tr>
<tr>
<td><strong>Orientation</strong></td>
<td>Models are made in 3-D to stand up vertically and are moved incrementally as they are photographed with a digital still camera mounted on a tripod looking across at the models.</td>
<td>Most models are made in 2-D flat on the floor or a table and moved in the horizontal plane as they are photographed with a digital camera mounted on a tripod looking down at the models (this is not always the case, however, as existing 3-D plastic models can be photographed in the usual way).</td>
</tr>
<tr>
<td><strong>Materials</strong></td>
<td>Clay or plasticine</td>
<td>A wide variety such as soft play dough, plasticine, 2-D pictures, drawings, clip art, existing 3D models, leaves, rocks, paper, fruit, felt, cardboard cut outs and many everyday classroom materials.</td>
</tr>
<tr>
<td><strong>Learning Prompts</strong></td>
<td>The art of telling the story explains the experience</td>
<td>Prompts are included to help explain a scientific concept such as narration, music, authentic photos, diagrams, models, labels, questions, static images, repetitions and characters.</td>
</tr>
<tr>
<td><strong>Timing</strong></td>
<td>20-24 frames/second to simulate real movement</td>
<td>2 frames/second to explain a science concept in slow motion hence the name ‘Slow Motion Animation’ which is abbreviated to ‘Slowmation’</td>
</tr>
</tbody>
</table>
Making a slowmation usually results in a short 1-3 minute video explaining science concepts. Because slowmations are usually made flat on the ground and are played 10 times slower (2 frames/second) than traditional animations (played at 25 frames/second), they are much easier to make. Learners can therefore represent their own understandings of science concepts in very comprehensive ways (Hoban & Ferry, 2006).

Over the last two years over 500 slowmations have been made by preservice elementary teachers at the University of Wollongong in primary science education classes demonstrating many concepts such as day and night, seasons, lunar cycles, life cycles of various animals, particle motion, magnets, fungi life cycle, plant reproduction, weather, movement of the planets, water cycle, simple machines, mitosis, meiosis and phagocytosis. One example, created by a preservice teacher is called “The Earth and its Surroundings,” has 600 digital photos and goes for 5 minutes. It explains the concepts of day and night and phases of the moon, commences with moving 2-D images of day and night using cut out felt that is moved manually and then progresses to moving 3-D polystyrene models. Features called learning prompts are added such as narration, music, diagrams and to help explain the science content. In all, it took a preservice teacher 20 hours to create at home in a room with a dimmer to simulate effects of changing light on the earth and moon. However, slowmations made by school children are usually much shorter and simpler.

**Using mobile technologies**

A possible problem with student-generated animations, however, is that the required technological tools such as a computer, tripod and digital still camera are often not accessible in terms of the restricted resources in schools or teachers do not have the confidence to use them. With the increasing presence of mobile technologies, it is possible that it may be simpler to create animations using handheld digital tools (Heath, et al., 2005). Researchers (Corlett, Sharples, Bull & Chan, 2005; Gado, Ferguson & van ‘t Hooft, 2006) have argued that various hand held electronic tools in the form of mobile technologies will make learning more accessible and feasible for students to use in classrooms. In this study preservice teachers on practicum were encouraged to use mobile phones for taking photos instead of regular digital still cameras to capture digital images for slowmations. The purpose of the study, therefore, was to ascertain if taking photos with the camera in a mobile phone was feasible and accessible for preservice elementary teachers whilst teaching in schools.

**Methodology**

In 2008, twenty four preservice teachers were enrolled in a 13 week science method course in the third year of a four year Bachelor of Education degree at a university in Australia. The elective course was ‘school-based’ meaning that a key component of the subject was spent in schools such that for five weeks the preservice teachers went into classrooms instead of coming to university. The course was designed in three parts: (i) Planning: in weeks 1-5 the preservice teachers were
placed in pairs and allocated to contact a teacher in one of two schools.

A range of classes were selected so the preservice teachers were allocated to classes from Kindergarten to grade 6 in a primary school. The preservice teachers telephoned their teacher at the beginning of the subject to request a topic to cover 5 science lessons that were suitable to teach the class. The preservice teachers then spent five weeks planning the lessons; (ii) Implementing: in weeks 5-10, the preservice teachers went to the elementary school and taught a lesson each week for 5 weeks; (iii) Reflecting and Evaluating: in the final three weeks of the course the preservice teachers reflected upon the implementation of their teaching and gave presentations to the other students to share their experiences.

One of the key aspects of their implementation was to teach a science lesson using the slowmation approach and to use the camera in the mobile phones to take the photos. In most cases this was the fifth lesson so that the children created a slowmation to represent their understanding of a science concept as an assessment task. In the final three weeks of the subject the preservice teachers gave a presentation to their peers on the strengths and weaknesses of implementing their lessons including the value of using mobile phones for taking photos for their slowmations. After the presentation, several preservice teachers were interviewed about the value of using the mobile phone cameras for taking photos for animation and their slowmations were copied as evidence of the school children’s representations of science concepts.

Results
There were 12 pairs of preservice teachers involved in the study and all were able to use the camera in a mobile phone to take the images for their slowmation. In most cases the preservice teachers held the phone in their hand to take the photos whilst the children made the small manual movements for the animation. Some of the topics prepared for teaching were Electricity for Year 4, Life Cycles for year 3, Garden Animals for Kindergarten, Back to Nature for year 1, Magnetism for year 3 and Living Things for year 6. Examples of slowmations from kindergarten and Year 4 classes will be presented highlighting their use of the mobile phone cameras followed by a case study showing the use of the phones for taking photos in more detail.

Example 1

Teaching Kindergarten about garden animals (spiders)
Two preservice teachers were asked to teach 5 lessons about garden animals to a kindergarten class. The fifth lesson was about spider webs and the teachers guided the kindergarten children in creating a slowmation of the making of a spider web on a blackboard placed flat on the floor. As a child drew a line on the blackboard with chalk to represent a part of a spider web, the preservice teachers took a photo with the camera in a mobile phone.

One of the interesting aspects of using the mobile phones was the challenge of keeping it still enough to take a photo of something that
was being manually moved. To help keep the phone stable they taped the phone to the back of a chair as shown in Figure 1. In this way the phone was positioned to look down at the blackboard that was laid flat on the floor and so enabled the kindergarten children to draw the spider web on the blackboard laying down flat on the ground.

A sequence of several photos in the slowmation of produced representing the creation of a spider web can be seen in Figure 2.

It should be noted that this animation was created by five and six year old children in kindergarten over a period of 30 minutes. Once the teachers had the phone taped to a chair they were able to take the photos using the phone (this would be beyond the manipulative abilities of kindergarten children) but the children moved the spider and mapped its web creation with chalk. The photos were then uploaded into a software program to create the slowmation after the class.

Teaching Magnetism to Year 4

In this Year 4 class the teacher was asked to teach 5 lessons on magnetism. In the fifth lesson, the teacher used a mobile phone to take photos for an animation that the children made to show how like poles repel when placed together as shown in Figure 3.
In this situation, the mobile phone was held in the hand of the teacher and the children were able to manipulate the magnets in small movements to show the force of repulsion by two like magnets. The following case study gives more detail about how two preservice teachers Jessica and Melissa (pseudonyms used) organised the class to create a slowmation and how they used the camera in the mobile phone to capture the images. In particular they were creative in designing a technique to keep the phone camera still to provide continuity for the slowmation.

**Case study of Jessica and Melissa teaching Seed Germination to Year 4**

The teachers had taught the Year 4 children about the life cycle of plants and in the last of the five lessons they intended their students to create a slowmation that summarised the plant life cycle. Because they only had one lesson to teach the children about how to make and do a slowmation, they introduced several scaffolds to enable the animation to be created and completed within one lesson. One of the challenges for the preservice teachers is that they needed to overcome the need to hold the mobile phone still to enable continuity and focus between the photos (normally a digital still camera is mounted on a tripod looking down at the materials to be photographed). To overcome this problem of a need for steadiness, the students constructed a paper template with a border so that the camera in the phone could focus on this frame for each photo. This meant that as long as the frame was in the same position relative to the viewer in the camera, there would be some control over the relative movement of the camera.

Another innovation was that for the animation to be completed within one lesson, they thought that it would be too difficult for the Year 4 students to create models of different parts of the plant life cycle. For this reason, they gave a template that they had created to each child. Each child had to draw their particular part of the plant life cycle using the template with the seed within a rectangular frame in the same place to give the students a basis for drawing their part of the plant. However, this was still a challenging task as the children in the class of 24 were divided into 6 groups and each group was allocated one particular part of the plant life cycle to represent. Hence the organization for the lesson, which took 90 minutes in total, was like a jigsaw with 6 groups creating a part of the life cycle of a plant, and within each group, a child had to draw one part of their allocated cycle. Hence each group had four pictures each showing a movement in growth of the plant and it was like each child creating a frame of a cartoon which then showed movement within their group and across

**Example 3**

![Figure 3: Sequence of photos from the Slowmation showing repulsion by the similar poles of a magnet](image)
the six groups as well. Melissa explained in an interview how they organised the class:

We divided the class up into six groups so that each group would represent a part of a life cycle of a plant so it became a class animation. I had drawn up a picture that showed the main thing in each phase as a guide because we had to do it in one lesson. But each group of students had to plan their own four movements and work out what to do. We also talked about the sun moving so that it progressed in the animation. I think the whole scaffolding bit before helped them to understand it. So the students drew their pictures first like a storyboard and also had to work out their narration.

They explained why they made the template with the frame to try to keep the photo steady:

And we made up a frame with a bean seed drawn in the middle so that all the students would make their drawings with the same perspective so that we could get some continuity across the groups and the diagrams would fit together. And I had drawn one picture that represented their stage as a model and the children had to draw their own pictures ... the students drew their pictures first and then worked on their narration. Most of the groups picked one person to do the narration. So after we took the pictures then we got the children to do the narration. It did not exactly match the photo sequence so then we changed some of the photos.

When asked about the classroom organization of different groups doing different parts like a jigsaw this was their response:

We thought it was easier than trying to get the whole class engaged and doing the one thing. So each of the six groups had four different frames so that each student had a frame and were responsible for drawing their part of the animation. Once each group organised their drawings they came out and we took a photo of each of the four movements in a group and then we moved onto the next group. So for example each of the four students in a group changed the position of the sun and had one picture to draw of the movement of their plant.

Figure 4 shows a sequence of photos showing different parts of the plant life cycle.

When asked if the student enjoyed making the animation the preservice teacher’s response was:
They loved it. The hardest thing was getting the six different groups to do a different part of the plant life cycle and then putting it together like a jigsaw. So when the groups were all finished I called them out one at a time into the art area and took the photos. Meanwhile the students who were waiting while the photos were being taken worked on their narration.

When asked if they would use the mobile phones again for taking photos, they replied:

It depends on the quality of the camera in the phone. Some of them are not very clear and when you download them to the computer they are pixillated. We held the phone with our hands but we had the frames on the paper so that we just had to line up the camera with the frame. So the students just turned the pages over and we could take the photos. It was important that they were taken in order to get the sequence right. If we had plenty of time it the groups would be able to make their own from start to finish.

Discussion

This study shows that it was feasible for preservice primary teachers to create slowmotions about a science concept with their classes of primary school children using the cameras in their mobile phone to capture the images. Hence there is potential for mobile phones to be the handheld tools to support the creation of animations (Heath, Herman, Lugo, Reeves, & al, 2005; Corlett, Sharples, Bull, & Chan, 2005; Gado, Ferguson, & van't Hooft, 2006). However, only three of the 12 pairs of preservice teachers were able to complete their slowmation in one lesson including adding a narration. Clearly more time is needed such as several lessons. Most of the other pairs were able to take photos with the mobile phone and upload to a software program to create the slowmation, but did not get time to get the students to complete the narration. Hence the use of mobile phone cameras provides an accessible technology for creating photos, however, the quality of the photos could be improved in many cases.

The case study example of Melissa and Jessica was the best slowmation produced by the different primary classes, but they were very well organised and introduced some innovations to make the creation of a slowmation in one lesson achievable. This included using a pre-drawn template for each child with a fixed seed and line to provide a base framing for the camera as well as have each child draw one frame rather than making models. The class was also well organised into six groups with each group of four being responsible for one part of the plant life cycle and one child responsible for one drawing within a group. So the way it was organised was like creating a class comic. Nonetheless, the preservice teachers were able to get a Year 4 class to make a 2 minute slowmation from start to finish never having made one before.

Conclusion

The main insight from this study is that the Slowmation approach greatly simplifies the normally complex process of creating student-
generated animations and using mobile phone cameras provides an accessible technology. However, the clarity of the photos is not satisfactory at this stage. A limitation of this study was that there was no research conducted as to whether the creation of slowmation to represent a science concept was beneficial for the children’s learning. In this study the slowmation was created in the last of five science lessons and was intended to be an assessment task for the children. However the focus of the study was exploring the feasibility of using mobile phone cameras for creating slowmations rather than ascertaining the influence on student learning.

In the not too distant future, every child in a school may possess a mobile phone camera, and the quality of the cameras will improve meaning that slowmation could become a commonplace teaching approach in classrooms. One of the preservice teachers in this study predicted that a mobile phone will not only have improved cameras but will also have a recording facility for a narration as well as the software for uploading and creating the animation. This leaves the door open for every school child to possess a tool for hand-held animation creation. The implication is that it may be possible for children to create slowmations of different educational concepts at their own school desks. This use of mobile technology means that each child may become a more active knowledge creator as opposed to a knowledge receiver as is the case in many science lessons in school classrooms.

Note
In 2006, Slowmation won two ‘Technology Leadership Awards’ presented by the international Society for Information Technology and Teacher Education (SITE). Free examples, software and information about Slowmation can be accessed at www.slowmation.com.au which is has been funded from an ARC Discovery Grant.
