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Using Slowmation to Engage Preservice Elementary Teachers in Understanding Science Content Knowledge

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Abstract

Slow motion animation ("slowmation") is a new teaching approach that uses a simple animation process to engage learners in creating their own comprehensive animations of science concepts. In this paper, preservice elementary teachers used slowmation, a form of stop-motion animation, to make models of science concepts and take digital still photos as the models were manually manipulated in the horizontal plane. A range of materials can be used, and the animations are played in slow motion at two frames per second. Importantly, the preservice teachers provided pedagogical prompts, such as narration, diagrams, music, and factual text in their animations to help explain concepts. Preservice elementary teachers learned how to create slowmations in their science method course and then made their own comprehensive examples in an assignment to represent a science concept. Slowmation is a use of technology that generates a "real need" for preservice teachers to understand science content so that they can represent and explain it accurately in their animation.

The teaching of science in elementary/primary schools is problematic in many different countries because preservice teachers often lack a deep understanding of science content knowledge. In Australia, research and national reports indicate that this lack of science content knowledge decreases the preservice teachers' confidence and results in science being one of the most neglected subjects in the primary curriculum (ASTE Committee, 2002; Committee for the Review of Teaching and Teacher Education, 2003; Goodrum, Hackling, & Rennie, 2001). For example, research has shown that science is the least taught subject in Australian primary schools (except for languages other than English) averaging 41 minutes or 2.7% of teaching time each week (Angus et al., 2004).

This lack of science content knowledge by preservice elementary teachers has also been reported in the USA (Davis, Petish, & Smithey, 2006), the United Kingdom (Goldsworthy, 1997), Canada (Opwood & Souque, 1985), Italy, (Borghi, Hendrich, & Vosniadou, 1991), and Israel (Trumper, 2001). Moreover, some science concepts are problematic for beginning teachers and tend to be avoided or are often taught incorrectly. For example, primary teachers often have difficulty understanding concepts such as day and night (Atwood & Atwood, 1997), phases of the moon (Trundle, Atwood, & Christopher, 2002), the water cycle (Stoddart, Connell, Stofflett, & Peck, 1993; Stofflett & Stoddart, 1994) and energy (Trumper, Raviolo, & Shnersch, 2000). In one study in Israel to explore the conceptions of basic aspects of astronomy, only 36% of 645 preservice primary teachers answered the questions correctly (Trumper, 2003).

The consequence of inadequate or an absence of science teaching in primary schools is that some children develop a negative attitude and lack of knowledge about the subject. This is reinforced by the way science is often taught in secondary schools where there is an overreliance on use of textbooks and the teaching of facts (Tobin, 2003). Science method courses need innovative approaches to teaching and learning that engage preservice elementary teachers in understanding science content knowledge and promote new pedagogies for the teaching of science in schools.

The Elementary Science Method Course

Preservice primary teachers at the University of Wollongong in Australia enroll in a 4-year bachelor of education (Primary) degree. In the second semester of the first year there is a core science subject that all students must complete, and several electives are offered throughout the rest of the program. In this core subject, EDKS102 Science and Technology for Teaching in Primary Schools, 180 students are enrolled and attend a 1-hour lecture on the theory of teaching science, followed by a 1-hour workshop with 24 students in each group. In this workshop there are hands-on activities to demonstrate the concept presented in the lecture, as well as several field excursions.

Slow Motion Animation (abbreviated to "slowmation") is one of the activities promoted in the workshops, and this approach simplifies the complex process of making animations to enable preservice teachers to create comprehensive animations about science concepts (Hoban, 2005; Hoban & Ferry, 2006). Slowmation is a new form of stop-motion animation involving the manual manipulation of materials with digital still photos taken of each step. It is similar to clay animation, involving students researching information, scripting, storyboarding, designing models, capturing digital still images of small manual movements of the models, and using computer programs such as QuickTime Pro to play the images in a sequence to simulate movement. Slowmation, however, is different from claymation in five key ways as shown in Table 1.

Most importantly, slowmations are played in slow motion at two frames/second, not 24 frames/second, as in clay or computer animation, because the purpose of slowmation is to show and explain a scientific concept slowly, not to represent a narrative or story in real time.

Over the last 2 years, preservice primary teachers have created slowmations averaging 3-4 minutes in length—which are like minimovies of science concepts—including day and night, seasons, tides, life cycles of various animals, particle motion, magnets, mushroom life cycle, plant reproduction, weather, movement of the planets, water cycle, and simple machines. In a secondary science context, slowmations have been made of mitosis, meiosis, and phagocytosis.

Table 1
Comparative Features of Slowmation and Claymation

Feature	Claymation	Slowmation
Content/purpose	Tell a narrative or story	Explain a science concept
Materials	Clay or plasticine	A variety such as soft playdough, plasticine, 2-D pictures, drawings, existing 3D models, felt, cardboard cut outs and natural materials such as leaves, rocks or fruit
Orientation	Models are made to stand up vertically and moved incrementally as they are photographed with a digital still camera mounted on a tripod looking across at the models	Models are mostly laid down horizontally and moved incrementally as they are photographed with a digital camera mounted on a tripod looking down at the models (this is not always the case, as existing models can be photographed in the usual way)
Pedagogical Prompts	The art of telling the story explains the experience	Prompts are included such as factual text, audio narration, music, humor, photos from different perspectives, diagrams, models, labels, questions, static images, repetitions and characters to explain features of a scientific concept
Timing	12-24 frames/second to simulate real movement	Two frames/second to slow down movement

Because slowmations are easier to make than traditional animations and are played 10 times slower, preservice teachers can represent *their own understandings* of science concepts in very comprehensive ways (Hoban & Ferry, 2006). For example, a slowmation explaining the causes of day and night has 600 digital photos, goes for 5 minutes, targets the concept of day and night and phases of the moon and commences with moving 2-D images of day and night using cut out felt that is moved manually. The slowmation then progresses to moving 3-D polystyrene models accompanied by the pedagogical prompts of music, questions, diagrams, and captions explaining the science content. In all, it took a preservice teacher 25 hours to create at home in a room with a dimmer to simulate effects of changing light on the earth and moon.

Phases in Teaching Slowmation

There are four main steps or phases when using slowmation as a teaching approach to a class of university students or school children:

Phase 1. Planning

The instructor or preservice teachers plan a topic or concept to represent that involves change. Students usually conduct research on a particular topic in order to have enough information to identify a sequence with different stages, segments, or episodes. Alternatively, the instructor may explicitly teach about a topic or concept to give students a "big picture" representation of the relevant concept.

In a primary/elementary science context, topics could include the four seasons, seed germination, life cycle of a frog, the water cycle, life cycle of a caterpillar, why boats float, a rocket blast off, chemical reactions, particle motion, phases of the moon, development of a volcano, plate tectonics, mountain building, weather patterns, geological movements, digestion, or movements in the solar system. Pedagogical prompts to explain a concept need to be decided during this phase, but these may change during construction.

Phase 2. Analyzing

There are two layers of analyzing the science concept that involve storyboarding and storywriting for each segment. First, once a group or an individual has a big picture developed in the planning phase, the topic needs to be *sequenced* or broken down into several episodes or scenes that make up the whole concept or topic. Second, each segment has to be further broken down into "chunks" to identify a sequence of steps to be digitally photographed for making the animation. Each segment, therefore, needs to be storyboarded showing the incremental movements and the science involved.

Through this "chunking" of science knowledge, many of the traditional problems preservice teachers face regarding a lack of content knowledge are addressed, because they need to provide appropriate content as a vehicle for explaining the concept in the animation. Sequencing can guide an individual in making the animation or can be the basis of different sections allocated to groups of students for a class project similar to a jigsaw approach. For example, a sequence could include one of the life stages of a frog, one of the four seasons, one of the stages of a rocket take off, one stage of a volcano developing, one part of meiosis or mitosis, or one part of a chemical equation.

Groups need to plan carefully the required number of movements for their particular sequence of the concept or topic in a storyboard. Once the sequences are established, specific roles can be allocated within each group. In a school situation roles can be allocated, such as content expert, model maker, script writer, sign maker, photographer, background designer and runner (who is the only one who can ask the teacher questions). It is important at this stage to again reflect upon how the concept can be best explained — should the slowmation be only photographs and text or should it have a narrated storyline or music or both? Decisions also need to be made as to whether the slowmation will be constructed on a blank cardboard sheet or the sheet will be rendered as part of a background. Also, further research may be needed to explain each segment or to clarify or provide extra science information.

Phase 3. Construction

The next part of this construction phase is *making* and *photographing* of the models using a variety of materials such as modelling clay, real materials, or pictures. It is best if the models are laid down on a sheet of project cardboard on the floor. A digital still camera needs to be mounted on a tripod and positioned over a sheet of cardboard so that pictures can be taken vertically looking down at the cardboard. The students make each of the small movements in the model manually and take a photograph of each movement. The photographer needs to take at least 100 photographs of each sequence. It is simpler if the photographs are taken in order of the presentation of the sequences for the whole story. Another way is for each group to have its own camera and produce its own QuickTime movie, which is then collated when editing.

Backgrounds can also be added to enhance the photos. An important aspect of construction is to insert arrows and labels to identify the key features. If more text needs to be included, it can be added as a text box or as a photograph of text. If existing plastic models are used, the models can be moved standing up, with photos taken at a slight angle to the horizontal.

Phase 4. Reconstruction

Once all the digital still photographs are taken, they need to be *downloaded* onto a computer, copied onto the desktop and *imported* into a computer program to put the whole process back together again. An animation program such as QuickTime Pro or iStopMotion is needed to import the photographs. QuickTime Pro is commonly used because it is simple to use, the playback speed is easily selected and varied (usually two frames per second) to produce a QuickTime movie that can be played on any computer, PC or Mac. The command "open image sequence" from the File menu allows you to select which sequence of photographs you want to import.

More technology does not always result in the best slowmation — less sometimes means more. The important question to answer is what technology is needed to best explain the concept? Once the initial animation is made, refinements need to be added to *enhance* and *edit* the animation. These refinements can be made in several ways, such as importing into iMovie, adding music, factual text as static images, transitions, other backgrounds, or a narration.

An important pedagogical consideration is that different QuickTime movies can be made showing the process at different speeds. As the students have worked on different sequences of the process, they need to know what the other sequences were about. The value of a slowmation is that multiple QuickTime movies can be made easily to show the movie at different speeds for different purposes. Initially, teachers can show a slowmation at two frames/second to model the overall change process and then make another movie to be shown at 5 or 10 seconds per frame so each group can explain the details of their sequence to the rest of the class.

Examples of Slowmations

In 2006, 180 preservice primary teachers at the University of Wollongong in Australia completed a science method course, and one assignment involved designing and making a resource for teaching. The instructions the students received to guide them in creating their slowmation can be seen in the appendix. The students had a choice of creating an interactive big book or a slowmation. Forty of the students decided to create a slowmation, and interviews were held with 10 preservice teachers about the process of creating them. In the interviews preservice teachers indicated that making slowmation movies was highly engaging. They enjoyed using digital technologies, and the process helped them to understand science content because they needed to learn the science in order to explain it in their animation.

Also, because the animations were made in sequences, the design process prompted them to deconstruct or analyze the science concept into chunks and reflect upon what content knowledge needed to be introduced as factual text or narration to best explain each section or each movement. Following are two case studies. The first case is about Anne, who created a slowmation to explain the science about an unusual mushroom, and the second case is about Christine, who used slowmation to teach two lessons about the take-off and landing of the space shuttle to a Grade 5 class in an elementary school. Complete slowmations can be seen and downloaded at http://www.slowmation.uow.edu.au.

Case Study 1: Anne and Her Unusual Mushroom

Phase 1. Planning

Anne was a first-year preservice primary teacher in 2006 who took 2 days to make a 3 ½-minute animation about the life cycle of a parasitic mushroom called *Cordycepts gunnii*. The fungus is unusual because it is 5-6 cm long and grows from within the mummified remains of a caterpillar that has accidentally absorbed the spores of that mushroom. In all, it took her 2 days to make (about 20 hours) and includes 420 digital still photos that are played at 2 frames/second. She decided to do an animation on this mushroom because she had heard of it before but did not know much about it:

> It was exciting thinking about what I was actually going to do. So the first part of the process was deciding on the topic. So I had a few ideas on the topic but I can't remember what they were now. And then I was talking to my boyfriend about it and he was telling me about the mushroom a while ago, and we both thought it would be really interesting. So I started researching it on the Internet and went onto different forums and there's actually a lot of people who are into fungus and mushrooms, and they talk to each other and send each other mushroom samples and fungus samples and grow them.

She explained that once she got the idea (she had tried to grow mushrooms unsuccessfully at home before), it took her several days to think about the concept and materials she would need:

> So once I decided on the idea, I did some research then thought about the materials I was going to use. I brainstormed ideas for maybe 3 or 4 days before I started doing anything then wrote out a list of materials that I'd probably want to use and started gathering them all together.

Phase 2. Analyzing

After researching and planning, Anne decided that there were six major sequences in the animation, (see Figure 1):

> At that stage I wrote a storyboard on the computer. So I just made a table in Microsoft Word and planned it out in, like, about six or seven different boxes. The final product is slightly like it but it changed as my ideas evolved.

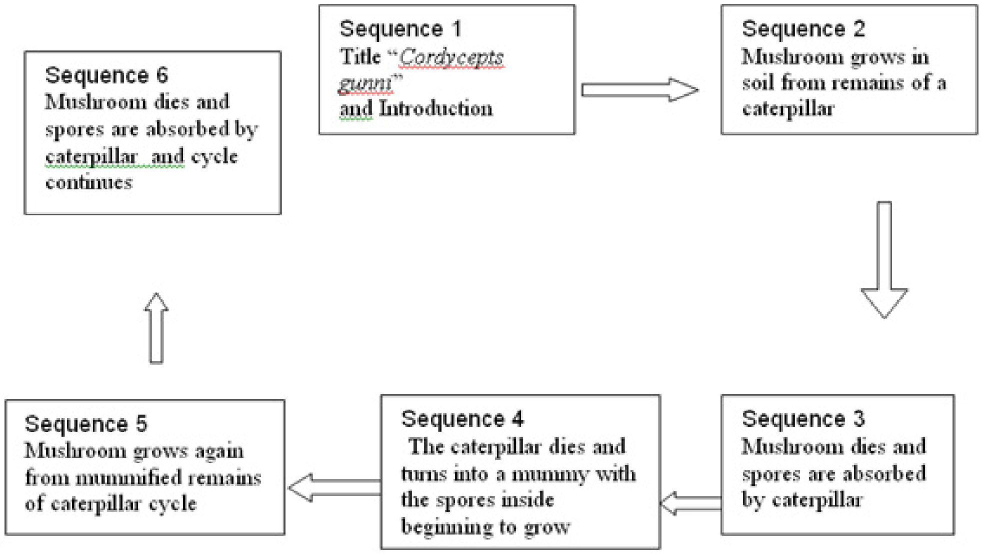

Figure 1. *Six sequences of Anne's slowmation.*

Phase 3. Construction

Figure 2 shows photos from four sequences with a brief description. Anne said that she first visualized and reflected upon the process in her mind and then began constructing the animation, but it involved a good deal of trial and error:

> I just played with it in my head. How I could show it on the piece of cardboard and take photos of it? How would it best represent it visually? How can I practically make it? So the photo I thought would be a good idea because you can gradually just build up on top of each other and then take each shot and you can see how it grows quite easily with the mummification. I could cover it in playdough but that wouldn't be fine enough, so I dusted it with flour instead. So at times I played with ideas, took shots and thought, "No, that doesn't look right," and then I'd try something else.

As Anne made each sequence, she said that she learned some new knowledge. Although she knew some science about mushrooms, she did not know the exact process of how the spores get inside the caterpillar and what the actual mushroom looked like:

Anne: So the caterpillar comes along and gets the spore, I didn't know exactly know how the spore got into the caterpillar for example. I thought the caterpillar would just eat the spore, but on further research I found out that the spore actually gets absorbed into the skin of the caterpillar, cause you know we've got pores on our skin. So, say it was walking near the spore, if the spore got into the pore of the caterpillar that's how it starts to grow from within it. Whereas I thought maybe the caterpillar would just eat the spore but it turned out it actually goes through its skin. So that was something new that I learnt.

Interviewer: Anything else?

Anne: Well, the physical appearance of the actual fungus because I'd never seen one in real life. So when I saw the photos and read about it, I know the information says that the head of the fungus is only 5-6cm long and all that kind of thing. It actually encases the full caterpillar as well, like it mummifies the entire caterpillar. I didn't realize it would be that dramatic. The actual appearance of it, when you think mushroom, you think, "Mushroom, it's got a big like head on the top of it," but it's a fungus which is, it's part of the mushroom family I guess but it's like a spear, it's got a spear shaped head and it's not really that big. It's kind of, it's fairly small. Yeah, and just how dramatic it was, how the fungus takes over this caterpillar and it uses it as its source for growing, it gives it its nutrients to grow.

Sequence 2. The mushroom, *Cordycepts gunnii*, grows from the mummified body of a caterpillar

Sequence 3. Mushroom dies and a caterpillar that comes along absorbs the spores through the skin

Sequence 4. The caterpillar dies and turns into a mummy with the spores inside beginning to grow

Sequence 5. Mushroom grows again from mummified remains of caterpillar

Figure 2. *Photo from each sequence.*

She explained that the process of learning the science content was iterative and incidental because she only realized what science content was needed only after she thought about the different scientific processes she was trying to demonstrate as she made each segment:

> I could have started out finding all the information but you don't really know what you need to know until you start breaking it down and putting it all together, and then you realize the facts you need to include that are important when you actually consider the processes itself. It makes you realise how complicated it all is because of all the little processes that I had to know to mimic it. You go back and forth to the Internet finding out information because you want to represent it right.

Phase 4. Reconstruction

Anne explained that after she took all the photos and created the animation, she recorded a sound track and a narration and edited the slides. She decided not to use any text but rather wrote a script and narrated the change in development of the mushroom. She mentioned that the process of making the animation was very engaging because she enjoyed being creative with technology and it was "the best assignment of the year." She commented on the value of using slowmation for assignments:

> It's different because it was interesting and I enjoyed doing it. A lot of assignments I don't enjoy doing because they're just written and you feel as though you're just reproducing information for the sake of an assessment and that you don't actually learn anything from the process itself. Whereas, creating this taught me a lot from the technology perspective that I had to work out how I was going to do everything from the taking photo stage through to the editing and putting it together, so that was something that I have had experience in but I still needed to extend all my skills.

Case Study 2: Christine and the Space Shuttle

Christine was a first-year preservice primary teacher who had experienced a 1-hour workshop on how to make a slowmation and then decided to use this teaching approach on her practicum in a grade 5 class in an elementary school. What was particularly interesting about the class of 26 children was that it contained four children with learning difficulties such as ADHD (attention deficit hyperactivity disorder) and conduct disorder. When the children were organized into groups, the children with the learning difficulties put themselves in one group and worked well together as they were engaged in the process during the two lessons.

Phase 1. Planning

Christine described how she wanted the children to learn how to make a slowmation, so she planned the making of the animation to take two lessons on different days.

Chris:	The reason I planned it that way was that my intention for the lesson was to get them to do a slowmation activity in two lessons. The original idea wasn't to teach them about rockets, it was to teach them about slowmation, because I was aware that you have to break it up into little bits. I think, though, if it was to teach them about rockets I would have planned a whole unit of work on that, I think I would have taught them the whole process as one process, not as five individual bits.
Interviewer:	Did you find it difficult?
Chris:	It was surprisingly easy. I think the amount of planning I did before, prior to it, I thought it would be a difficult thing to implement but I planned it into two lessons. The first lesson was getting them to understand the concept, and the second lesson was getting them to actually do it. I actually found it quite easy, especially when the children were so engaged with the whole idea of it, so there were no real classroom management issues.

Christine also found out some interesting science facts whilst doing some background research herself on the Web site http://science.howstuffworks.com/space-shuttle.htm. She learned that the space shuttle mostly orbits the earth nose first and upside down, which then changes to tail first, upside down when it begins to re-enter the earth's atmosphere. It then flips to fly in a normal aeroplane position to land once it is inside the earth's atmosphere. This interesting orientation of the space shuttle is evident in her sequences (see Figure 3).

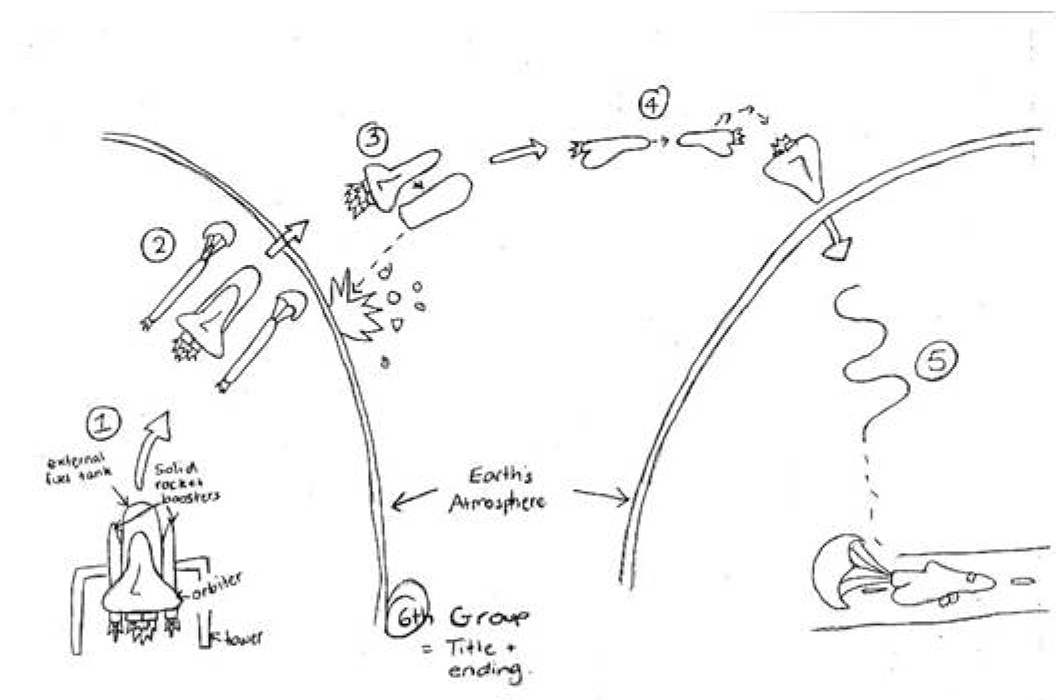

Figure 3. *Six sequences of the slowmation process*

Phase 2. Analyzing

After researching and planning the two lessons, Christine decided that there were six sequences in the animation:

> In the first lesson we discussed what animation was and what claymation was and I demonstrated the difference between claymation and slowmation to clarify what they'd be doing and my expectations of them. And then I showed them examples of what they'd be doing. Then I drew the diagram, I drew the process on the blackboard and explained it as I went bit by bit into six segments for the parts of the lift off, moving through space and returning. And each time I explained one part, showed that's the first part, and that's the second part and that's the third part. And then we went through it again with the kids and I gave them different roles within each group. We first separated them into groups and then they all had their own group roles and then when each group knew their roles, we then went through the whole process again so they knew where they were going, like what part they were. And then we talked about what happens in each stage and what we need to make for what they'd be doing in the next stage. And from then we got onto storyboarding and each group storyboarded together what their segment should be doing for the next lesson.

Phase 3. Construction

Figure 4 shows photographs from four of the sequences followed by an explanation from Christine. Christine explained how she organized the sequencing:

Chris:	Well, they got into their own groups and had different roles. Everyone had to do a storyboard, and then two people were in charge of the background and two were in charge of making it.
Interviewer:	Now what about when you were taking the pictures of each group? What were the other groups doing while you were taking the pictures of one group?
Chris:	While I took photos, everyone was still practicing their movements, but by the time the first group was finished, all I had for them to do was an animation flip book, make their own one of that. They were wanting to see what everyone else was doing anyway, so they were kind of around helping each other.
Interviewer:	So were there any classroom management problems?
Chris:	There wasn't, surprisingly, because I had four children with learning difficulties who were all in one group. They put themselves in one group. Yes, they did it themselves, I thought, "Okay, let them do it," and they surprisingly were probably the best group in terms of how they worked. They were just so engaged with it and, of course, they had stuff going everywhere and everything like that with the people, but they loved it and there was no management problems. They were the last group as well. I don't know, had they been the first group, then they would have had more time.

Sequence 2. Lift off for the space shuttle

Sequence 3. Space shuttle loses it fuel boosters

Sequence 4. Space shuttle re-enters earth's atmosphere

Sequence 5. Space shuttle coming down to land on earth

Figure 4. *Photo from each sequence.*

Phase 4. Reconstruction

After the Grade 5 students prepared for making the slowmation in the first lesson and made the models and took the photographs in the second lesson, Christine took the camera home, downloaded the photos onto her computer and then uploaded them into QuickTime Pro to make the animation. She stated that the children were so excited to see the animation the next day and wanted to show it to their parents:

Interviewer:	Are you sure it engaged them?
Chris:	Definitely. Especially considering the fact that the next day when I had the parent/teacher meeting they were dying to show them, and they were proud to show them, and they knew about rockets and science and shuttles and stuff.
Interviewer:	Okay, so any other indicators of engagement?
Chris:	I think definitely those four children with learning difficulties, like the two severe behavioural problems, the fact that they were engaged and enjoying it and doing it all, taking the photos and everything, that's definitely a sign of engagement for me, especially considering I couldn't engage them in other lessons I taught. Like it was instantly, they had the space shuttle, I don't know if it was the space shuttle or the plasticine, I don't know, but they were definitely engaged.

Conclusion

A widespread problem in many different countries is that preservice elementary/primary teachers lack science content knowledge, which makes them reluctant to teach the subject in schools. Slowmation is a simplified form of stop-motion animation that can engage preservice teachers in understanding science content knowledge because the process generates a "need to know" so that the concept can be explained accurately in an animation.

In particular, the process of creating a slowmation facilitates the learning of science content in three ways. First, during the *planning* and *analyzing phases*, the science concept has to be split into several segments, and each segment is then chunked to devise out the individual movements of the models. This systematic breaking down generates a need for the designer to research the concept in order to understand how it can be accurately broken up into these segments and chunks.

Second, during the construction phase the models are moved incrementally, as a digital photo is taken of each small movement, which enables the creator to reflect upon the science in small steps as the animation is made. Third, there are multiple avenues for reflection during the creation process, as the designers must think about the topic, break it down, make it, reconstruct it, and edit it. Hence, the iterative process of creating a slowmation encourages the designer to reflect deeply upon the science content, both wholistically and minutely, throughout the four phases of planning, analyzing, construction, and reconstruction.

This development of science content knowledge is evident in both case studies described in this article. In the first case study, Anne learned about the unusual mushroom *Cordycepts gunnii*, which grows from the mummified remains of a caterpillar that has accidentally absorbed some of the spores of the fungi. In the second case study, Christine learned about stages of the space shuttle in order to plan how she was going to teach it.

An important aspect of learning science that Anne highlighted was that understanding the content actually occurs incidentally as, "You don't really know what you need to know until you start breaking it down and putting it all together and then you realize the facts you need to include that are important when you actually consider the processes itself." Hence, the process of designing and making a slowmation generates an authentic "need to know" and engages preservice teachers with a real purpose to understand the science content.

This process is not always linear, as the content needs to be revisited during the four phases and such learning becomes an ongoing and generative process for the preservice teachers. This motivation to understand the science content is reinforced if the preservice teachers know that they will share their slowmations with other preservice teachers or school children.

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Appendix

Making a "Slowmation" (Slow Motion Animation) Using QuickTime Pro (modified 3-4-07)

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A. Purchase QuickTime Pro at the online Apple Store

1. http://store.apple.com/133622/WebObjects/australiastore.woa/wo/StoreReentry.wo?productLearnMore=D3380Z%2FA (a code to put into your existing QuickTime) by paying A$44.95 (PC and Mac versions). QuickTime has a very good "Help" section and step by step tutorials are available at http://www.apple.com/quicktime/pro/tutorials.html

B. Taking the photographs

1. Make sure the students are aware that many small movements are best (make a simple animation on some post it notes and flip them)
2. Build the models in the horizontal plane with the camera mounted on a tripod looking down and the camera set on **"LOW RESOLUTION**" or the **"SMALLEST SIZE POSSIBLE".**
3. Make sure the models/play dough are movable and not stuck to cardboard.
4. Take the photos moving the materials one small bit at a time. Try to get 50-60 photographs of each sequence.
5. Include text if needed taking one photo which can be copied for a static image later.

C. Making the animation

1. Click on QuickTime Pro
2. Select "File" and select "Open Image Sequence"
3. Locate Folder with digital images and click on first image
4. Click on "Open"
5. A new dialogue box appears, select the desired frame rate (usually 2 frames/second) and Click "OK" and the movie will appear on the desktop.
6. Open the File menu and select "Save". Write the title in the dialogue box and select where you want to save it, click "OK". Make sure you "save as a self-contained movie" as this will make it independent with the photos compressed within the movie.

D. Making static images and text

1. Open the movie and play the movie until you get to the desired photo to copy. Use the stop button to stop the movie and the left and right arrows to get the exact movie frame to copy. Take a previous picture of your desired text and Go to Edit and select "Copy" and then "Paste" the photo about 10 times or as long as you want it to stop. Make sure you bring together the small edit tabs until they disappear otherwise you will copy unwanted images.
2. An alternative way is to open a photo in a graphic program and type in the text.

E. Adding a sound file— narration or music

1. If making a narration open "File" and select "New Audio Recording". Make sure that the microphone in the computer is turned on or use an external microphone. Click on the sound file and then the animation to record the narration. Delete the first second or two of the audio file (using the tabs) so that it matches the animation.
2. If adding a music file, Open "File" and select "Open File". Locate the music needed and click on it. Make sure the length of the music matches the length of the animation
3. Click on the narration or music file, choose "Edit" and select "Select All" and then "Copy."
4. Select animation and choose "Add to Movie".
5. It is important that you click "save as" and save it as a "self-contained movie" to embed the sound track.

F. Saving the animation

1. When you click "save" there are two choices. You can save the animation as a "Self-contained movie" which means that the photos and sound file are embedded as a self-contained unit in the animation (and can be copied and shared) or as a "Reference movie" meaning that the animation is linked to the photos or sound on your computer but will not copy for sharing. Hence, you must "save as" a self-contained movie which is bigger than a reference movie.

G. Modifying the animation

1. Edit the QuickTime Movie itself with delete, copy and pasting in new photos directly.

H. Emailing an animation

1. Open animation and Choose "File: and select "Share"
2. Select size "small or medium", click "share"
3. Movie is automatically attached to an email. Write email address in box and press send. (try around 500kb-1MB)