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Validating the Slowmation Learning Design: Comparing a Learning Design with Students' Experiences of Learning

Garry Hoban, Wendy Nielsen, David Macdonald and Brian Ferry

Abstract

A slowmation (abbreviated from slow-motion animation) is a narrated animation designed and made by learners that is played in slow motion at 2 frames/second to explain a science concept. The purpose of this study was to compare the proposed learning design of a slowmation with the actual learning experiences of three preservice primary teachers as they created an animation about an obscure topic over a period of two hours. A range of data gathering methods were used to document the students' learning experiences including individual interviews before and after creation to ascertain their pre and post knowledge as well as videoing and audio-recording the creation process. Data suggested that the proposed learning design is a guide for planning the teaching but does not adequately represent the iterative process of learning at each phase. Findings suggest that research should be conducted to compare a learning design with the actual learning experiences of students to make the learning design a more accurate representation of the learning process.

Background

The increasing presence of Web 2.0 technologies and the widespread use of learning objects necessitates documenting how they are planned and designed. This is because devising a system of documentation means that good designs can be more easily shared and possibly replicated or adapted for different purposes. According to Agostinho (2006) a learning design "represents and documents teaching and learning practice using some notational form so that it can serve as a description, model, or template that can be adaptable or reused by a teacher to suit his/her context" (p. 3). A learning design, therefore, is a conceptual framework for structuring a digital environment and identifies the key elements, steps or components to support how learning occurs. Oliver (1999) provided a way of representing learning designs which analysed digital technologies into three parts — tasks, resources and supports. This three-part description was later developed into a visual sequence of triangles (resources), rectangles (task) and ovals (supports/organization) as an output of AUTC grant and given the name "learning design visual sequence" (LDVS) (Agostinho, Oliver, Harper, Hedberg, & Wills, 2002).

The notion of learning design has been applied to many ICT representations such as a web-based environment, learning objects on DVDs and teaching approaches. The question needs to be asked, however, is whether a particular learning design adequately represents the actual process experienced by learners. The purpose of this paper, therefore, was to compare the learning design of a simplified form of animation, called a "slowmation," with the actual learning experienced by three university preservice teachers as they create an animation. This comparison will "test" the quality of the proposed learning design visual sequence and tell us whether the proposed design is a reasonable representation of the learning processes involved in this form of animation. A discussion will be held as to the effectiveness of the learning design visual sequence in communicating a

design for learning about creating animations of this type including identifying limitations of the design.

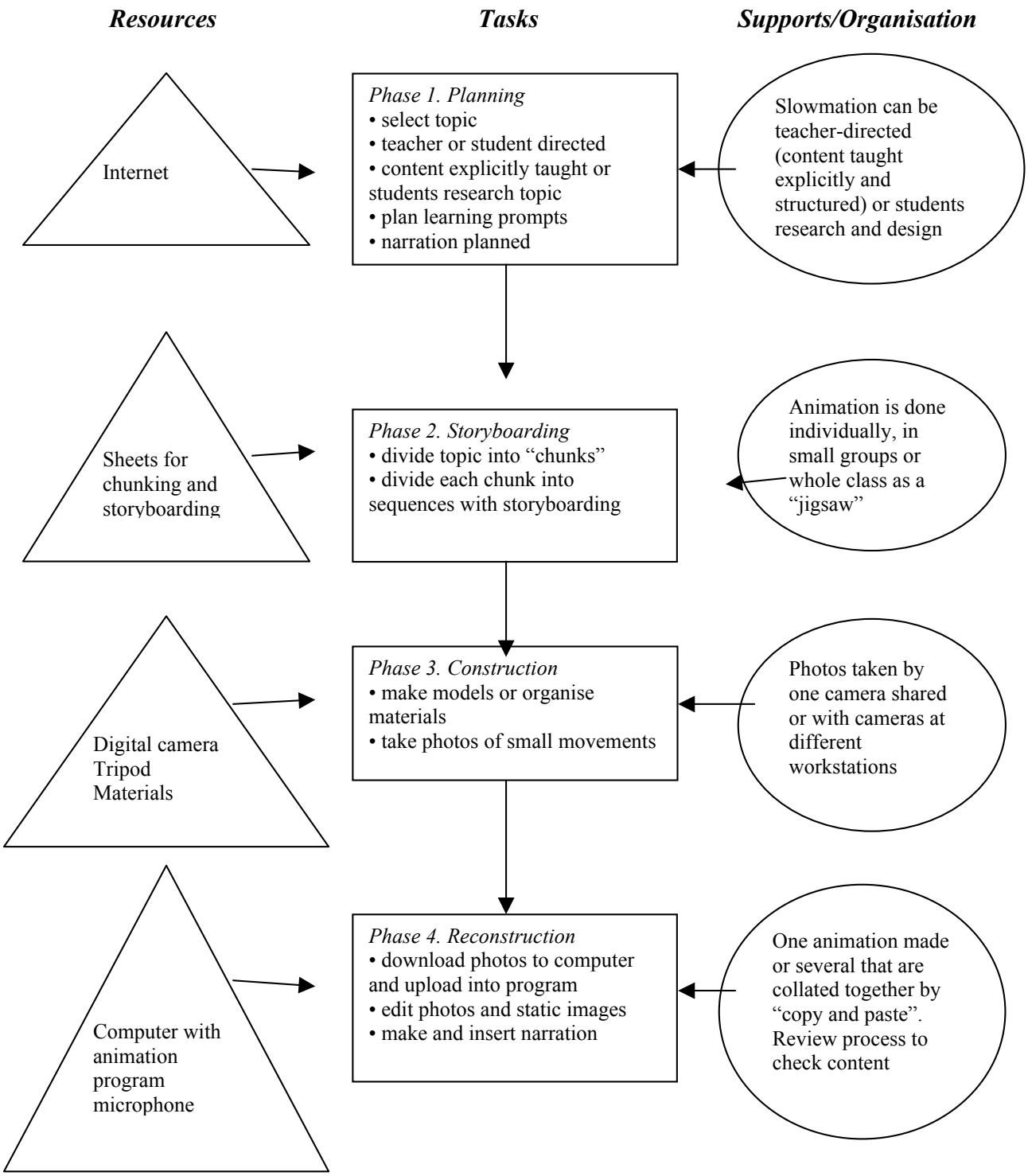
The "Slowmation" Learning Design

Slowmation (abbreviated to Slow-motion Animation) is a new teaching approach that incorporates a simplified form of stop-motion animation to enable students to design and create their own animations of science concept (Hoban, 2005). Research has shown that science education students not only engage with content, but also develop deep understandings because in making an animation, they reflect about the content in multiple ways (Hoban, 2007; Hoban, McDonald, & Ferry, 2009). This occurs through the four phases of the learning design: (i) students *plan* a concept; (ii) they *storyboard* it and hence break it down into components or episodes; (iii) they *construct* models or use existing plastic models and take digital still photos of small manual movements; and (iv) they *reconstruct* the concept by completing the animation using computer software accompanied by a narration. Slowmation integrates features of clay animation (Witherspoon, Foster, Boddy, & Reynolds, 2004), object animation (Laybourne, 1998), and digital storytelling (Lambert, 2002). Slowmations are much easier to make than traditional animations because they are mostly made lying flat on the floor or a table, use everyday materials and are played much slower (2 frames/second) than traditional animations (20 frames/second), hence needing ten times less photos as explained in the following features:

- *timing* — slowmations are played in slow motion at 2 frames/second, not 20-24 frames/second, because the purpose of slowmation is to show and explain a scientific concept slowly, not to represent a narrative or story in real time, hence the name "Slow-motion Animation" or "Slowmation";
- *orientation* — models are made in 3-D and/or 2-D and usually manipulated in the horizontal plane (on the floor or on a table) and photographed by a digital still camera mounted on a tripod looking down at the models, which makes them easier to make, move and photograph;
- *materials* — because models do not have to stand up, many different materials can be used such as soft play dough, plasticine, 2-D pictures, drawings, written text, existing 3D models, felt, cardboard cut outs and natural materials such as leaves, rocks or fruit;
- *content* — the content of a slowmation is a student's representation of a science concept but representations of other content areas are possible as well;
- *purpose* — the purpose of a slowmation is to explain a science concept clearly and so its design can include a range of enhancements supported by technology such as audio narration, music, real-life photos, diagrams, models, labels, questions, static images, repetitions and characters to explain features of a science concept.

In particular, this research focused on how different modes of representation (Kress, Jewitt, Ogborn, & Tsatsarelis, 2001) influenced learning as "learning, we suggest, needs to be seen a dynamic process of transformative sign-making which actively involves both teacher and students" (p. 10). In particular designing and making an animation involves learners in creating a connected sequence of representations as they engage with text for initial learning, create a storyboard with diagrams, make models whilst taking photos of manual movements and finally putting the still photos in a sequence to create an animation that is explained with narration. Figure 1 shows a diagram of the original learning design for Slowmation using the framework (Oliver, 1999) who analysed digital technologies into tasks, resources and supports that was later developed into a visual sequence (Hoban, 2009). In particular it demonstrates the four phase design of the creation process.

Figure 1. Original Slowmation Learning Design (from Hoban, 2009, p. 318)



Methodology

All previous research studies on slowmation have involved pre and post creation interviews with students recalling their perceptions of the creation process (Hoban, 2005, 2007, 2009). This is not unusual in research studying a design process because the construction process usually takes place over a long period of time. However, in this study, data gathering occurred before, during and after the creation process to ascertain how the learning occurred and if this learning was related to particular aspects of the four phase learning design. In particular, the researchers were interested in finding out if the different modes of representation embedded in the learning design — researching text, designing sketches for storyboards, manipulating models and taking digital photographs — influenced learning in different ways. The research question that guided the study therefore was, "What were the modes of representation at each phase and how does the learning design of a slowmation compare with the actual learning experiences of preservice teachers?" If necessary, the original learning design would be modified in light of the data collected.

At the beginning of the study three preservice teachers as a group were allocated a topic that they had little familiarity with (life cycle of a lady beetle) and were requested to design and create an animation. All three students had previously designed a slowmation and were familiar with the construction process and software. To facilitate the project within the time limitations they were provided with plastic models of each of the four stages of lady beetles at the beginning of the two hours so they did not have to make the models but still had to make the animation to explain the life cycle. The three preservice primary teachers were able to conduct research about the topic and create a slowmation in the two hour period. The data gathering occurred in four parts: (i) before they started any interaction each student was interviewed about their knowledge of the content topic and they were asked to sketch a concept map to ascertain their prior knowledge about the topic; (ii) during the creation process, they were encouraged to "think aloud" during the four phases of the learning design as they were videoed and audio-recorded over the two hour period of creating the animation; (iii) after the creation process a focus group occurred for 30 minutes in which they reflected on how the different phases of the learning design influenced how they thought about the science concepts; and (iv) the final data collection involved an individual post creation interview as well as modifying their original concept map.

Results

An overview of the results of the study can be seen in Table 1. Findings indicated that each of the four phases of the learning design — research, storyboarding, construction and reconstruction — influenced their learning in some way. The students explained how each phase supported them in reflecting upon the content in multiple ways to make links and create understanding. Hence it was not one phase of the learning design that influenced their understanding, but a sequence of connected learning phases. The data in the table also suggests that there were influences from multiple modes of representing the content at each phase (eg text, visual photos, 3-D models, sketches and verbal interactions). Furthermore, that the learning was not linear, but iterative, "We're going through our information, we're double checking it, we're linking what we have learned through the photos, the differences in our narration and coming back and saying the narration" (Jackie).

Table 1. Analysis Matrix of Learning Experiences Through Slowmation

Resources	Task and Purpose	Modes of Learning	Themes from Student Interviews about Learning during the Creation Process
Internet Models of parts of life cycle	*Phase 1. Research* •Find out information about the life cycle of a lady beetle • clarify understanding and misunderstandings	• Print (internet) • Visual (still photos, diagrams) • 3-D models • Video (YouTube) •Verbal/ Social interaction	• *Gathering information from web sites, confirming existing knowledge, developing new knowledge and clarifying mis-understandings:* "My previous ideas have been challenged because I thought this was the lava, but in fact these are the eggs." "Imaging in your own head" [watching the video] "That is where we're actually learn the content. . . . there is both confirmation of our prior ideas and we find out conflicting ideas. . . . My previous ideas have been challenged because I didn't know what an aphid was." "the pictures assisted us. . . .I think when we're reading the text there is a high degree of inferring what is trying to be said. Whereas when we watched the YouTube video its actually showing us what is actually happening."
Storyboard sheet	*Phase2. Storyboarding* • Planning the stages of the animation and the narration	• Diagrams • Written •Verbal/social • 3-D Models • text from box	• *Storyboarding makes decisions about the sequence of content:* "The storyboard helped us to think about it, we had to synthesise all that and put it into a sequence" "Helps us to put down the information and check that it is right. . . .we are constantly reaffirming with each other." "We went from all this complex information and now we are trying to simplify it for the students."
• 3-D plastic model • props (leaves)	*Phase 3. Construction* Making the manual movements of the Life Cycle using existing plastic models and plasticine to share new ones.	• 3- D models •Manipulating plasticine • Verbal • Visual • Text (making labels)	• *Making the models clarifies understanding, checks knowledge with internet* "If you are making it yourself, you're constructing it yourself and you need to go into more information and look for actual visual images." "eggs hatch into larvae, how long is it a lavae? Should we find out, [checks internet], two to five days. . . it's double confirming what we think" "the making is helping us to clarify it and it helps you imagine the life cycle in your head "the YouTube is helping me to clarify the concepts and the storyboard is helping us to make" "we are shifting between the modes, the visual we were translating the written information into a written mode.
• software program • still images	*Phase 4. Reconstruction* Using software to make the animation	•manipulating software • verbal/social • visual	• *Making the animation and adding the narration* "We're going through our information, we're double checking it, we're linking what we've learnt through the photos and the differences of our narration, what we've written down, compared to what we took. Going back and checking the narration and coming back and then saying the narration. . . it hadn't really sunk in until the narration facilitated that." "As we write the narration we're recasting each others' ideas to formulate what we are trying to say" "It acts like a final summation of our learning because we had to articulate everything that we had learnt, verbally.

At the end of making the animation, a focus group for 30 minutes was held with the students where they reflected upon their learning through the four phases. They summarised that the process of creating a slowmation brings together their ideas about a concept starting with what they called "foreign knowledge," meaning bits and pieces of information, to something that has much more meaning so that the learning becomes "personal":

Jackie: Throughout the phases we are moving from informal to formal because. . . we did our brainstorming and our storyboarding. None of these are full sentences, they're just like key words, key ideas, that we want to explore. And by the end of the narration we had full sentences, structured more academic style, because it started off foreign and then it started to sink in.

Alicia: It started off foreign information and then as you started to see pictures we could link the information with the pictures. And then as you saw the video we could think and string it together and say, 'Oh so that and that works together to make this.' And then lets try and put that together ourselves and then it started to sink in, in the actual doing. Even though the information is there you can read something but not take it in. These steps have helped us, you know, take it in. . . gain the knowledge.

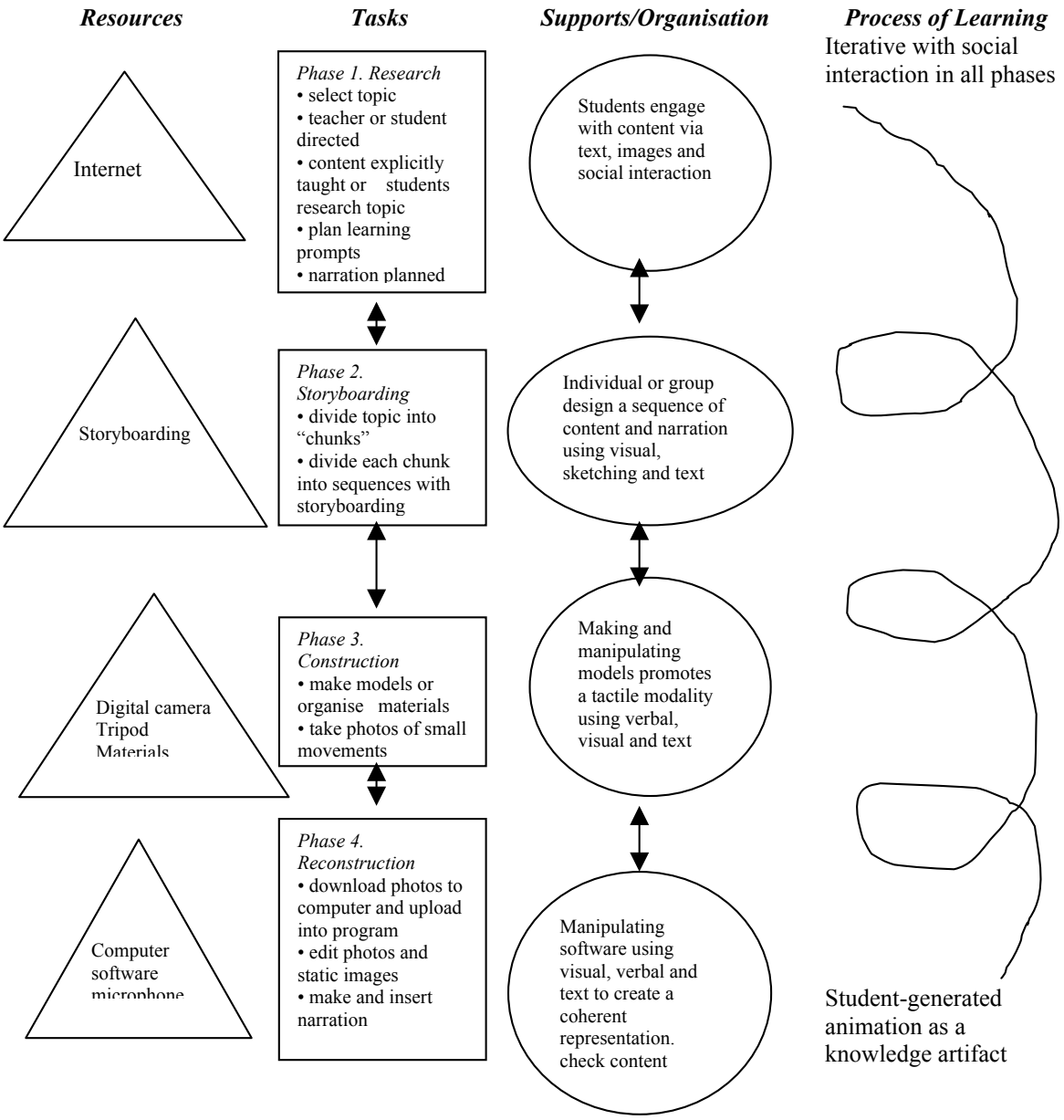
Jackie: I think that's because we had to represent it in multiple ways.

In comparing the proposed learning design in Figure 1 with the actual learning experiences of the students shown in Table 1, the following comments were deduced:

- The actual process of making a slowmation is much more dynamic and iterative than the linear, step by step, progression suggested in the original learning design.
- There are multiple "modes" of learning in the actual slowmation process which also occur in different phases and can be better described in the "supports/organization".
- It is more appropriate to call the first phase "research" rather than "planning."
- There is a strong social aspect involving the students sharing and comparing ideas to clarify and confirm understanding which needs to be more strongly represented in the learning design.
- The learning design provides considerations for planning the linear steps for teaching but does not actually adequately represent the process of learning which is non linear i.e. the iterative way students are constantly checking their understandings via the internet, studying the models and comparing ideas which occurs at each phase.

In light of the data collected and analysed, the original learning design in Figure 1 was modified to be more representative of the dynamics of teaching and learning that occurred which is shown in Figure 2.

Figure 2. Modified Slowmation Learning Design



Conclusion

The main insight from this study is that the actual experiences of creating a slowmation are more dynamic than represented by the proposed learning design in Figure 1. In particular the learning design presented suggests a linear, one way process whereas in reality the learning occurs in a sequence but it is much more dynamic across the four phases with a strong social emphasis. The notion of a learning design visual sequence is a useful framework for representing designs for learning. However, as this study shows, the visual sequence is simplistic and does not properly represent the iterative and dynamic nature of the learning across the four phases. As shown in the revised learning design in Figure 2, the visual sequence involves labelling the diagram with more interactive arrows and representing the process of learning with a cyclic visual diagram.

We believe that future learning designs would be enhanced if they included a section about the process of learning. This would provide extra guidance for instructors who wish to reuse learning designs and not promote linear ways of learning, but rather encourage iterative ways of learning and social interaction. We believe that there should be more studies that actually document the learning experienced in comparison to the learning design visual sequence to ascertain if the learning is linear or not and represent this in the learning design. If this occurs, then the visual sequence will not only be more representative of the resources/organisation that support learning, but will better represent the processes of learning involved. This will in turn inform the planning and implementation of learning designs and hence their reusability.

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