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LEARNING, EXPLAINING AND COMMUNICATING SCIENCE WITH STUDENT-CREATED BLENDED MEDIA

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ABSTRACT
The aim of this pilot study was to trial the feasibility of students making "student-created blended media" as a new form of assignment in a science methods course for trainee primary. This form integrates video with animation and static images, all linked by a narration, that students create to explain a science concept for the purpose of teaching someone. There were 129 students in the course spread across four locations and each was allocated a science topic to explain. Two hours of the course were allocated to teaching students the skills of making blended media and they then used their own technology such as mobile phones, digital still cameras and free movie making software on their own computers. Results showed that all 129 successfully make the blended media in their own time using their own technology. A wide variety of blended media were submitted. Three of the preservice teachers who volunteered to be interviewed to explain their experiences stated that the process helped them to learn science and all enjoyed the experience and preferred this to writing an essay. Further studies will need to be conducted to confirm these findings and to validate the quality of science learning involved.

INTRODUCTION
New teaching and learning approaches are needed to help school and university students engage in learning and communicating science concepts (Rice, Thomas & O'Toole, 2009). In particular the rapidly increasing use of digital technologies in the teaching of science is offering students new opportunities to represent content in different ways. For example, students could summarise information about phases of the moon, which could then be re-represented in sketches and then re-represented again in 2-D or 3-D models that can be animated. Creating multiple representations of the same concept enables students to revisit and reflect upon content as well as allowing for different possibilities of representation (Hoban & Nielsen, 2011).

Whist the teaching of science has often used media created by experts, technology is becoming easier to use so that students can now become the designers of digital media. Easy to use and free software programs are available on most computers to support students in representing their science ideas by integrating different modes such as text, sound, still and moving images in digital media such as animations, videos, screencasts and podcasts (Jones & Issoff, 2007). Additional communication and presentation skills can be gained if students are encouraged to share and justify their digital science explanations with peers. The affordances of Web 2.0 technologies are also enabling students to disseminate their ideas widely and seek feedback by uploading their digital media to social media sites such as Facebook and YouTube.

Forms of Student-created Digital Media
The ever expanding accessibility to personal digital technologies over the last 10 years offers a timely opportunity in science teaching and learning to provide new ways to engage students in creating their own digital representations using digital cameras, smart phones, flip cameras, video cameras, web cams and iPads as well as laptops with Web 2.0 connectivity. Inviting students to design and create digital media to explain science concepts to peers is a powerful way to learn as "the people who learn the most from instructional materials are the designers. . . .we have all stated at one time or another that the quickest way to learn about subject matter is to have to teach (design) it" (Jonassen, Myers & McKillop, 1996, p. 95).

There are a number of forms of student-created digital media that can be used in university assignments, each with particular affordances that are features or qualities unique to that form. For the purposes of this paper, an "affordance" is the quality or feature of a technology that allows it to perform a particular action or purpose (Gibson, 1979). One of the simplest digital media forms for

students to create is a *podcast*, which is usually a 1-3 minute audio recording where students explain an allocated science concept. A challenging and imaginative form of podcast is to get students to explain their science knowledge as an analogy. This involves summarizing content and re-representing it in a script for audio production. For example, a chemical reaction could be explained as a "tug of war" between the reactants and products or oxidation and reduction could be explained using the analogy of a boxing match (Bartle, Longnecker & Pegrum, 2011). The New Media for Science website includes other examples of podcasts using analogies for learning science in universities (Rivkin, Longnecker, Leach, Davis & Lutze-Mann, 2012).

Another media form is a *digital story,* which is a narrated slide show usually with static images that each stay on a screen for 10-20 seconds (Lambert, 2003). The key to a good digital story is writing the narration first to present a compelling explanation, which is then accompanied by finding static digital images to fit the narration. In a science context, a digital story is suited to explaining the history of science discoveries such Faraday's work with electricity or Alexander Fleming's discovery of penicillin. A third type of digital media is *animations*, which have proven valuable for learning science concepts, particularly to show changes at macroscopic or microscopic levels (Linn & Eylon, 2011). But learners have been limited in creating their own animations because the professional software available, such as Flash Animation, is usually too time consuming for students to learn and use. There is, however, a simplified way for school and university students to make animations, called *Slowmation* (abbreviated from Slow Animation), which are narrated stop-motion animations that are played slowly at 2 frames/second to facilitate a narration explaining the slow-moving images (Hoban, Loughran & Nielsen, 2011).

Students can also plan and create a *video* with images playing at 25-30 frames/second to explain an allocated science concept or demonstrate how to do an experiment. In a science context some examples include cell division, states of matter, forces and projectile motion. Encouraging students to enter their videos in a popular international competition called "60-Second-Science" (www.60secondscience.net/) can also be an engaging and motivating influence where student-generated videos compete for cash prizes to provide the best science explanations.

Whilst each digital media form has its own particular affordances, aspects of these forms can also be integrated or *blended* enabling students to mix and match media for particular purposes (Hoban, Nielsen & Shepherd, 2013). When planning for a blended digital explanation of a science concept, students need to be aware of the affordances of each digital form and then select the most appropriate to suit the purpose of the explanation. For example, the four main features or components of a written explanation can be aligned to different digital media forms to generate a succinct digital explanation: (i) an explanation begins by naming a topic and identifying key elements or parts and this can be represented digitally by narrated static images similar to a digital story; (ii) the next part of an explanation shows how the elements or parts dynamically relate to each other and this can be represented digitally by a simple animation or "slowmation"; (iii) an example of a concept can be demonstrated with a short video if the elements move by themselves or if not, then represented by a slowmation; and (iv) the conclusion of an explanation summarises the main points and can be represented digitally using a static image. What links the media forms is the narration explaining the science.

The key to creating effective explanations using blended media is for students to write the narration first to explain the science and then make decisions about which digital media form best suits the purpose of what is being explained. Table 1 shows the features of a written explanation and how these components can be represented digitally using the affordances of different digital media forms. For example in making a blended media to explain a complex topic such as "phases of the moon", a student could start by researching the science of how the moon phases change. Once the topic is understood then resources could be gathered in terms of how to make the digital media form that best suits a particular part of the explanation. For example, the first part of the digital explanation could be naming each phase of the moon with narrated static images, the next part could demonstrate the dynamic relationship between the sun, moon and earth that results in different moon phases as they appear on earth with a slowmation. This could be followed by a video showing changing phases and then a conclusion with one static image of the all the different moon phases as the narration revisits the progression and a final summary. Table 1 is followed by the method used in the study to ascertain the feasibility of using this form of student-created digital media as an assignment in a science method class for primary preservice teachers.

Table 1. Affordances of Digital Media to Suit Explanations Using Blended Media

Text Type/Purpose	Features of Explanations	Digital Construction Process	Affordances
An explanation articulates how or why something happens. eg What causes phases of the moon?	1. Starts by naming the topic and identifies elements related to the topic in the right order. eg. Names each phase of the moon in turn.	1. Narrated static images with 10-15 seconds per frame similar to a digital story.	1. Static images stay on the screen as long as necessary allowing learners to focus on each image whilst the narration introduces the topic and elements of the topic.
	2. Explains how the elements relate to each other and to the topic. eg. Shows a slowmation of the moon and earth moving around the sun	2. Narrated slow moving animation with images moving at 2 frames/sec similar to "slow animation". This could be interspersed with static images of tables, flowcharts, graphs or diagrams to illustrate particular evidence for the phenomena.	2. Slow moving images allow a learner to see how the elements move slowly in relation to each other.
	3. Provides an example. eg. shows a video of the phases of the moon	3. Use video with fast moving images at 25 frames/second) by itself or static image to show an actual or real life example.	3. Fast moving images like a video allow a learner to see how something moves by itself in real life.
	4. Finishes with a concluding or summary statement. eg. an image with all the phases of the moon showing the progression.	4. Narrated static image presented in a still photo to provide conclusion.	4. A static image allows a learner to focus on the still image as a summary of the conclusion.

METHOD

The assignment that the students were asked to complete was to create a 2-3 minute narrated blended media to explain a science concept that had been allocated to them as a resource for teaching a primary aged child. This is the exact wording from the subject outline:

> Construct a 2-3 minute blended digital media to explain **one small concept** from your allocated outcome from the K-6 Science and Technology syllabus. The media is a digital explanation to be designed as a resource for teaching children in your particular stage and outcome. The digital explanation can be made using Windows Movie Maker (PC) or iMovie (Mac) and should be submitted on a CD or thumb drive and uploaded to YouTube (optional). Provide a one-page rationale (250 words) explaining the design of your resource as well as a storyboard that helps you to plan your resource. See web site www.slowmation.com for examples and resources.

The students received two hours of instruction in which they were taught how to make a simple animation (called slowmation) in one hour and how to collect free video from YouTube and still images from Google Images in another hour to be used in the blended media. In the second session the web site Creative Commons Australia http://search.creativecommons.org/ was used, which conveniently identifies copyright free videos and still images for use on any topic. Once the still images and video are collected, the preservice teachers have to edit (eg clip the video) and integrate them into the best format for an explanation as planned by the student and then a narration applied using either IMovie (Mac) or Windows Movie Maker (PC). To ascertain the feasibility of implementing the assignment, three forms of data were collected: (i) the number of students who were able to complete the assignment and their technical difficulties; (ii) collection of some of the

blended media as examples; and (iii) interviews with three of the students to ascertain their perceptions of making the media.

RESULTS

There were 129 preservice primary teachers in the course in semester 1, 2013 distributed across four locations (Bega 15, Bateman's Bay 7, Nowra 26 and Wollongong 81). All students were able to complete the assignment and there were relatively few technological difficulties such as not saving in the correct format. Three examples are now provided from interviews with students a month after they had completed the assignment to ascertain their perceptions of making one. The three students were volunteers and had scored high marks in their assignment. It should be noted that the students' comments are about their perceptions of learning and no actual testing of learning was involved.

Example 1: Brooke and her Blended Media about "Convection"

Brooke was in a Diploma of Education (Primary Teaching) and her blended media was about the topic of convection to explain it to primary children. It focused on using simple animation (slowmation) to show how particles rise because they become less dense as they are heated and then fall as they cool down and become more dense. The slowmation is followed by a video of a real life example of convection in a "lava lamp". In the interview, she explained that she had not done anything like this before and she stated how she designed it (P means participant, I means interviews):

P My concept was convection and I wanted to display how it worked. It's a difficult concept to display without images because you can't actually in the physical world, see the flow of heat so I wanted to break it down to a molecular level – looking at the hot and cold and how it moved. I thought that doing it with a models and movement was the best way to do it. Doing the blended media, I used a lot of images to make it look more like an animation. I started with the concept of convection overall; how it happens in the atmosphere and then looking at heat – how heat is created from a heater and then watching how that flow goes.

She explained that through the making process she learned a good deal of science which she did not understand initially but it was thinking about how to explain convection in her own words that improved her understanding:

I What about the science – did you learn any science?

P I learned a lot about convection. Within my science unit I didn't cover a lot of convection because I didn't fully understand it myself at first and breaking it down with this and using all the images and showing how it works, it really helped me understand it and be able to visualise how it would work in the physical world.

I Can you think back to how that actually occurred? When you say you broke it down – what did you actually do to understand it better?

P I did quite a bit of research like online, reading articles on websites to find out the science behind it all and try and simplify it as much as I could and then simplified it to how I would understand it…Putting it in words for myself, that helped a lot.

I What sort of resources did you draw upon in terms of the blended media thing?

P The images and stuff I used was from Creative Commons. Most of it was from there; the videos were from there, Google images and YouTube.

Interestingly she was asked if should could explain the term convection even though the assignment was a month earlier and she stated:

P Convection is a form of heat transfer; it occurs in gases such as air and liquids such as water. As the molecules heat up it decreases their density which causes them to rise up and then as the molecules move further away from the heat, the heat starts to decrease which increases their density and causes them to start sinking. So, it's a cycle which is occurring.

I So you can explain it to me now – how come you know it so well?

P Just from working through it all and getting hands-on and being able to see it. I don't know, this process really did help me though to learn about it. I think it's the application, because we had to explain it – we're teaching it to someone else, you had to really understand it yourself. Yes, I think it is the engagement.

Example 2. Alyce and her Blended Media explaining "Phases of the Moon"

Alyce was in another course but had volunteered to make a blended media to explain phases of the moon. She had previous experience in making media such as slowmation but had not made a blended media before that integrated static images with video and slowmation. She stated that it was easy to do and she used Windows Movie Maker and took her about 5 hours of construction time:

P Just as easy because to do a Slowmation you're importing photos so that's essentially what you're doing for a digital story except you're making them longer. It's no difference really; you're still importing photos. The importing videos is the same; wherever you get the video from, that's a different story but you use the same process to import the video as you would a photo for Slowmation. Whatever media you use them, for whatever purpose you use it, you can use Windows Live Moviemaker to import it – it's simple.

She was able to explain the affordances or value of the different forms of media in her blend:

P The digital story is good because you can use a real photograph, a real representation of something and you can take time to provide a detailed description of that. It's essentially an extended static image of a Slowmation but the difference is you are telling a story about it and it can be an actual, real photograph. That was really good. I found that that was probably better than doing a Slowmation animation for certain descriptions because the purpose is merely to describe and if you were to do a Slowmation you would get caught up in the animation side of things and there wouldn't be any real learning taking place that would not be better suited to the digital story-telling. So, the digital story is the description side of things with the real photograph representations, the Slowmation is breaking down one concept and really breaking it down into its smallest parts. That's where the animation came in.
The video was good in that it provided a real representation of what it actually looks like. When you're making a Slowmation, you're doing your own representation. The video actually showed the real moon and the real sun – what the real movement looked like – that you couldn't actually make a Slowmation that as effectively represented that process as you could get from a video….the other thing of the video, the purpose it served was it pulled together the description from the digital story and the explanation from the Slowmation and actually provided a real representation. I guess the digital story describes and introduces the topic; the Slowmation really explores it and that's when you're learning – your learning is still taking place as you're creating the Slowmation.

Example 3. Brett and his Blended Media explaining "Features of Living Things"

Brett had some prior experience making media as a soccer coach in which he would make videos of soccer games and edit them for his team. His topic was "Features of Living Things" and he used a combination of video that he created from his back yard, still images of features of living things he collected from Google Images as well as videos from YouTube that he downloaded, clipped and integrated using IMovie. He thought that the process was very simple and had spent about 8 hours in total on the construction:

P Dead-set simple. Not a drama but I'd done it all previously. I'd edited videos, I'd edited music, I'd done all this stuff prior so I knew how to do it so it was simple.

I What took your time then?

P Just getting the lettering, sorting out the earth turning, those little bloody pictures that were put in individually and then I had to rotate them all

He stated that he learned science from the construction process as well as sorting through the different media for the most appropriate to use:

I Yes. Once you've put your feelers out and got into other areas, you've then got to make decisions what to use and what not to use…I think the more media outlets you have, the broader you've got to look and hence the more you find and the more you learn. For example, I had the videos of the water dragons and all that sort of stuff – I had those because that's all around home and the birds and that; we've got a very bushy place and they were all our extended family. If I hadn't done that and I'd seen it, you would have done a little bit of revision to go from there but I already knew bits and pieces…

I Would you rather do this or an essay?

P Oh mate, you're asking the wrong person – honestly. Essays? I hate them, I'm sick of them and mate, as I said if I'd had a bit more time it would have been a fantastic thing to play a bit more with. To be quite honest, you learn a lot more from doing that than I do from reading and writing an essay because you're involved in the process here, whereas an essay is "Oh write that, yes, jot that down", onto the next thing you know. This is your work, once you even get towards the end you've then got to come back and go through and that sort of thing. It's more of a hands-on process because that's the way I learn as well. I'm a doer, a watcher sort of stuff rather than a writer although I've learned lots of things from writing…To me, education is about the kids have got to enjoy their work and you just can't enjoy doing essays; I don't

give a shit how much you like English. This is fun to do and it encourages knowledge, it encourages education and learning to be quite honest.

DISCUSSION

Data collected showed that requesting preservice primary teachers to create a blended media to explain a science concept was feasible as an assignment for a combination of reasons. First, the technology of combining different media forms is relatively simple. Of the 129 who completed the assignment, there were only a few technical difficulties, which were minor. These included students saving in the wrong format or having to download the free software on newer PCs. Furthermore the BYOD process (Bring Your Own Technology) worked well as students can take all the images (still and video) using their own mobile phone/iPad and download copyright free videos and still images from the internet (YouTube and Google Images) to integrate using free movie making software on either an Apple (using iMovie) or a PC computer (using Windows Movie Maker). Also each media form can also be created separately and then integrated or blended as a whole in the movie making software. Students can complete their own blended digital explanations at home using their own technologies, with perhaps some class time devoted to demonstrating techniques.

Second, it appears that creating a blended media provided opportunities for student learning. Whilst the data presented is from the students' perceptions of learning and would need to be confirmed with further research, there were several ways in which learning might have occurred: (i) reading about the concept to gain understanding by looking at various resources on the internet; (ii) viewing YouTube videos and deciding which ones to download and use; (iii) making a slowmation that breaks down the concept into smaller sections; (iv) checking information during the media making process; and (v) devising a narration to explain the concept in the students' own words as a teaching resource.

It is clear that the opportunities for students to use their own technologies to improve their media making skills will only keep increasing during the 21st Century. Science educators should seize this opportunity to encourage their students to take ownership for creating digital media that will also engage them with the learning of science content. Understanding the features of a quality explanation and the affordances of different media forms will assist students in making decisions about what and how to blend different media forms to explain and communicate their ideas to lecturers and peers.

Note

Free instructions and resources for making blended media are available at the project web site www.slowmation.com. Additional resources, support materials and inservice support will be developed as part of Hoban's OLT National Senior Teaching Fellowship.

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