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SUMMIT~2024**

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The use of digital storytelling in science: meaning-making with students aged 11-12 years old

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Meaning-making and digital storytelling

Meaning: a unit of verbal thinking, containing thought and speech in a functional relationship (Vygotsky, 1987)

Meaning-making: a process of interpreting and negotiating information while sharing it with others through speech/talk (ibid)

Importance of talk to meaning-making and learning: different ideas brought together and worked upon (Mortimer and Scott, 2003) → **learning** built upon the exchange of ideas.



Science learning: an introduction to the language of the scientific community, including concepts, conventions, laws, theories and principles (Mortimer and Scott, 2003).

Meaning-making in science learning: an ongoing process of comparing and checking one's understandings of scientific phenomena with peers (Mortimer and Scott, 2003; Duit and Treagust, 1998).

Digital storytelling (DS): shorter than a typical oral presentation; includes computer-based graphics, audio, video clips, animation, music, images and a narration in the author's own voice (Weis *et al.*, 2002).

Theoretical Background

Socio-constructivism

- Knowledge is inseparable from the social environment in which it is formed (Vygotsky, 1978).
- Learning is considered a process of active construction of knowledge (Woolfolk, 1993) through social forms and processes.

Tricky Topics:

- Contain difficult concepts (troublesome knowledge) that both students and teachers have difficulty in learning and teaching them
- Divided into Stumbling Blocks (SBs): identifiable and assessable components including common student problems

Research methodology

Research Approach: Qualitative Research

- interpretive approach - takes place in participants' natural environments (Denzin and Lincoln, 2000).
- explores the experience of individuals and their subjective meanings

Purpose: to explore how digital storytelling may support engagement in meaning-making as students work collaboratively and share their understanding on the science topic of matter.

Research Questions

RQ1: a) How did students engage in science meaning-making through two different digital storytelling activities?

RQ2: b) How did students perceive the collaborative digital storytelling activities?









Sample: 22 English students, aged 11-12 years (Year 7) from a public secondary school in England-UK.



Data collection procedure

- The students were divided into 2 groups (ActiviyA and ActivityB) and then into small teams of 3 or 4 to work together on an iPad
- **ActivtiyA:** students decided on the order and the plot of the story
- **ActivityB:** students agreed on the plot of the existing predefined story
- Both groups added a written narration
- After the process was completed, group interviews followed
- The whole process was videotaped and recorded

Results

 Scene 10	 Scene 1	 Scene 3	 Scene 5	 Scene 6
When warmth is applied to a liquid, condensation happens, which evaporates and turns into gas.	When Marginen sculpts solid ice, she only just realised that soon enough it will liquify.	When Bob tries to tip some honey into his mouth, nothing came out. He tipped it a bit then and all the honey spills out and gets him all messy. After that he pulls out some water and splashes it on his face. You can see that honey is still a liquid but has a consistency of a solid.	When Jeff puts the kettle on near the end of this, condensation comes out and makes a cloud of fog. After that he drinks a fizzy drink. All this gas builds up and it comes up making a burp.	When you apply water to a balloon it gets heavier and all of gas bubbles are crammed together and haven't got much room. But compared to air it is lighter and the particles have more room to move.
 Scene 7	 Scene 9	 Scene 11	 Scene 12	 Scene 13
When you have smoke it fits into small places but hasn't got too much room to move compared to if it has a bigger place there is more room for the particles to move.	When you apply heat to something frozen it will melt but if you apply something cold to a liquid it will freeze.	When you turn the heat up condensation starts which is a fog and the condensation melts water which will start to drip from the fog.	If something is cold, the temperature goes down but when it's not the temperature goes up.
 Scene 14	 Scene 15	 Scene 2	 Scene 4	 Scene 8
When ice settles on a mountain, it becomes a solid but when the sun comes out it melts the ice and turns into water.	On grass, the sun picks up any water. That's called evaporation but on a desert there is no water. But if there was water on a desert, the sun would dry it out as it is so hot.	Solids are hard objects where all the gas particles are all crammed together and have no space to move.	Liquid can fit into any space as it is flexible. Even the tightest holes it can fit through.	If you go in a freezer you can freeze as everyone has water their body and in the cold freezer it will freeze everybody.

Properties (attributes)	Examples from Activity A and Activity B group interviews	
Ownership of Creation	You 've got to find out the answers like work out yourself (Team F, Activity A)	It makes it quicker as well and no one gets left out (Team A, Activity B)
Fun/ Enjoyability	I think it's a good idea that these videos ... you 've got learning, you learn about them (Team D, Activity A)	We never do anything like this at school... I think we should have like an extra lesson, in which we are doing this kind of stuff (Team C, Activity B)
Conceptual complexity	We had to think harder about how to order the scenes and we didn't know where to start (Team E, Activity A)	It makes it easier for us to think about the content (Team B, Activity B)

Table 1: Extracts from students' views about Activity A and Activity B

Figure 1: The completed story of Team F, (ActivityA)

Research Question 1:

- The students of both groups showed that they understood the processes of melting (solid to liquid) and freezing (liquid to solid).
- There were some difficulties in explaining the motion of particles in the three forms of matter (solid, liquid, gas).
- There were difficulties in understanding the concept of *heat* - which was presented as a separate entity from cold - and *condensation*.

Research Question 2:

- Students in both groups said they enjoyed their activities more than a typical science lesson
- The students in ActivityA found it difficult and laborious as they spent a lot of time thinking about the scenes' ordering and the plot.
- The students in ActivityB found it easy because the scenes of the story were already sequenced so they only focused on the plot/narrative.



Conclusions

- The two digital storytelling activities can help students reflect and externalize their prior knowledge about the matter of bodies playfully and creatively.
- The different activities need to match the learning level of each class.
- Many students continue to have difficulty with certain scientific concepts such as condensation, heat and the movement of particles (gases and/or liquids) especially when the temperature of substances changes.
- The nature of the two activities as well as the collaborative interaction can help students engage in meaning-making while making arguments using scientific explanations.

Limitations

- ❑ The study focused on a specific group of students with learning abilities, socio-cultural backgrounds, and achievement levels.
- ❑ A single study of two different groups within the same school: larger sample needs to support both age groups
- ❑ Issues of applicability: the composition of the story events was based on the researcher's understanding of the specific students' needs. Further research and replication of the materials in different content and context is suggested

➔ *Findings cannot be considered universal truths but rather an interpretation of how these specific cases contributed to understanding how students make meaning of science through collaborative digital activities.*

Thank you for your attention!

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