Digital storytelling and the nature of knowledge

1. Introduction

While storytelling pedagogy presents novel perspectives and affordances to educators, a fundamental question that bears attention is the match between storytelling pedagogy and the nature of knowledge. Quite simply, the problem may be posed thus: is storytelling the optimum means for teaching all forms of knowledge? While rather obvious matches occur for knowledge in the social science, humanities, languages and literacy education, would storytelling pedagogy ‘work’ for the natural sciences, technology, engineering and mathematics classrooms? If so, what may be optimum means to integrate storytelling instruction in these latter kinds of classrooms? In this study, we report on the results of an implementation of digital storytelling in a grade five science classroom. Using what we termed the ‘edu-tainment’ approach, we asked students to design a digital story that communicated a scientific concept embedded within the narrative structure—characters within the narrative would experience the effects of the concept, the quality of the story being proxy indicators of students’ understanding of the scientific concept. We propose that this pedagogical strategy presents a strong challenge to discern students’ understanding, and we also discuss the effect of knowledge forms on the success of this pedagogy.

2. On knowledge forms

In a recent paper published in the *Journal of Curriculum Studies,* no less than Michael F. D. Young (2013) wrote about what was perceived as a crisis in curriculum theory. Significant because of his stature as the then de-facto leader of the “New” Sociology of Curriculum in the 1970s, Young was part of the movement that led to the popularisation of the social constructivist movement in education. With the publication of such texts as *Knowledge and Control* (Young, 1971), *Ideology and Curriculum* (Apple, 1979/2004), and *Theory and Resistance in Education* (Giroux, 1983), Young and others set the stage for the problematising of school knowledge. Based upon the core epistemic notion that knowledge is socially constructed, and that therefore, as Marx would have it, the “ruling ideas at any time are the ideas of the ruling class” (Young, 2008), the project was to firstly reveal the hidden biases of school knowledge, and then reconsider different knowledge bases and pedagogical approaches that would discriminate less. This, however, was not to be. Commentators (e.g., Ladwig, 1996; Whitty, 1985) started noticing that many of these classes of projects, while well-intentioned, did not actually result in material changes to the outcomes for the disadvantaged groups, or depended on methodologies which could only charitably be called unscientific. After some time, even the social constructivist epistemology came to be questioned (Moore, 2007; Moore & Muller, 1999), in its place came the candidate epistemology of social realism (Maton & Moore, 2010; Moore, 2009).

The crisis that Young (2013) talks about is the apparent ‘knowledge blindness’ in the field of curriculum studies (and educational studies generally speaking). Young’s concern is that academics may have become so caught up in the politics of promulgating particular perspectives that they have lost sight of what he believed ought to be the object of study—the properties of knowledge itself, and concomitantly, the affordances and limitations imposed upon the sequencing, selection and pacing of curriculum and pedagogy imposed by the structuring of knowledge forms, itself a result of the underlying structuring of reality. Fundamentally, Young
argues, while there may be ‘social construction’ of certain aspects of knowledge, to a large extent, there are structures which pose obligatory limits on how such knowledge may be constructed.

While the intricacies of the argument are not vital to our discussion, it is nonetheless important to provide a theoretical background to our focus on the nature of knowledge in this study; to reiterate, there exists structuring principles underlying the organisation of knowledge forms; these principles are non-arbitrary and pose limitations to the way we may ‘pedagogise’ knowledge. For instance, while certain forms of pedagogy may be highly engaging to students, the possibility exists that such pedagogical approaches are not optimal for students’ acquisition of particular forms of knowledge. For instance, one would probably not consider outdoor adventure learning as a meaningful approach to teach a topic in circuit design or a computer programming language. Similarly, for storytelling pedagogy, one intuitively supposes that good matches exist with it and such knowledge as moral and ethical reasoning (Edwards, Wickford, Adel & Thoren, 2011; Sanchez, Zam & Lambert, 2009; Durgahoe, 1997), language and literacy education (McKeough et al., 2008; Cassell, J, 2004; Ko, Diane & Walters, 2003), and social sciences and the humanities (Benmayor, 2008; Solórzano & Yosso, 2002; Goodwin, 1982). At the same time, one senses that storytelling is unlikely to be especially effective for natural sciences. Why should this be so?

At least one approach to understand this issue derives from the work of Basil Bernstein (2000, 1977). Conceived as a series of excavations into the interaction between the social effects of the differential distribution of knowledge and the school curriculum, Bernstein’s work has had significant sustained impact upon the field of sociology of curriculum (see, e.g., Apple et al., 2002). While most of his work and applications of his work have been primarily in the context of education provision policy and similar sociological level of analysis, one of his later investigations deals with the nature of knowledge. Specifically, Bernstein (2000, pp. 155–174) discusses the difference between what he termed horizontal and hierarchical knowledge structures. Hierarchical knowledge structures, as paradigmatically exemplified by a discipline such as physics:

> attempts to create very general propositions and theories, which integrate knowledge at lower levels, and in this way shows underlying uniformities across an expanding range of apparently different phenomena. Hierarchical Knowledge Structures appear by their users to be motivated towards greater and greater integrating propositions, operating at more and more abstract levels.  

Thus, for example, we notice that the physics of parabolic motion of objects within the scale of our daily lives also extend to the description of subatomic particles in electromagnetic fields; or that the physics of fluid flow explain not only riverine systems, but also the human circulatory system. In fact, part of the epistemic power of knowledge in the natural sciences arises out of this transcendental property—where abstract knowledge derived from within one particular context of its generation may be found to explain phenomena in contexts distant in time and space.

In contrast, horizontal knowledge structures, exemplified by knowledge such as sociology, consist of segmentally organised knowledge claims, where “a series of specialised languages with specialised modes of interrogation and criteria for the construction and circulation of texts” (p. 161). In the case of sociology, for example, the diverse theories of functionalism, post-structuralism, post-modernism, Marxism, and others all attempt to describe and explain social reality, but for the most part, each of these theories are not commensurate to any of the others; there are no principled means of subsuming one set of explanations within the unified explanatory framework of another. Knowledge development in horizontal knowledge forms consist of the radical break, in establishing “a new language […] offers the possibility of a fresh perspective, a new set of questions, a new set of connections, and an apparently new problematic, and most importantly, a new set of speakers” (p. 162).

If this categorisation scheme is admissible as at least a “first pass” attempt at distinguishing between
knowledge forms, we come closer to understanding our intuitions on the affordances of storytelling pedagogy. For knowledge in the humanities and social sciences, where multiple equivalent knowledge claims may be made with virtually identical epistemic status, multiple ‘stories’ may be told depending on the perspective taken by the interlocutors. For instance, narrative pedagogy, commonly used in legal or business education in recounting a series of events in demonstrative cases, draws upon this concept of perspectivism in that the story that is told is but a recounting from one privileged point of view; other perspectives exist, other stories exist, and while there are often means to tell if a particular perspective is ‘better’ than others, more often than not the power of such an analysis lies in the revelation of a polysemous nature to what was formerly considered a unidimensional narrative. With hierarchical knowledge forms like the school sciences, where the object of the lesson is most commonly for students to acquire canonical knowledge in depth, typical storytelling pedagogies are less likely to be considered good candidates for the task: teachers tend to focus on a reductionistic search for the underlying explanatory mechanism that supports the diverse contexts where the phenomena present themselves. While narratives may be used in the science classroom, they are often only used as introductions, ‘attention grabbing’ activities that cue students on to become aware of particular classes of phenomena. Hence, we arrive at the central problem of our study: how could we design a storytelling pedagogy that could effectively communicate scientific concepts in a way that maintained the centrality of scientific concept within the narrative?

3. ‘Edu-tainment’ storytelling

Our solution to this issue involved what we termed as the edu-tainment stories. This class of narrative structuring is certainly not novel, having been found in, classically, ethical and moral stories where characters are put in situations which recount ethical dilemmas for the audience’s consideration. More recently, children’s text and video productions like Curious George (Rey, 1941; Heming & Malkasian, 2009) or even Mickey Mouse Clubhouse (among the Disney stable of productions) (Ward, 2011) have used this narrative form to present ostensibly educational-entertainment value to their audiences. Typically, characters within such a narrative would be introduced to a problem context (e.g. estimating the number of balls in a large container for a guessing contest), and would spend much of the story searching for a solution as a limiting condition (e.g. a rapidly closing deadline) advances the narrative to its climax where the lead character would discover a concept that resolves the problem just in time (e.g. modelling the large container and contents with equivalent objects and estimating via layers)1. While students were avid consumers of this form of media text, we wanted to see if they were able to generate productions of their own.

Creating an edu-tainment narrative was going to be a challenging task—students needed to understand the scientific concept, construct a coherent narrative with plausible problem situations for the setting and characters, and at the same time prepare a climactic situation where the scientific concept could meaningfully resolve the problem without appearing either too obviously as the default solution or as a deus ex machina plot element. Because we coupled the edu-tainment narrative to teach a concept to peers their age, they also had to become mindful of the typical aesthetic that appealed to students their age. In many ways, this was designed as an exercise to provoke students to become metacognitive, engaged learners that would demonstrate their competence in both narrative construction and scientific concepts. We conjectured that the quality of their scientific understanding could be inferred by the degree of integration of the scientific concept into the narrative: if the students did not sufficiently appreciate the concepts, they were more likely to present stories where the scientific content would ‘hang’ incongruously off the narrative, and the lack of integration would be obvious.

With the edu-tainment approach, we believed we had a solution to the knowledge-form problem. Because of the hierarchical nature of scientific knowledge, which necessarily meant that there was to be a diverse range of

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1 this example narrative was drawn from Curious George (TV Series), Season 3, episode 17: The Fun-ball Tally.
possible contexts where the knowledge could provide explanatory value, this activity facilitated students’ search for a diversity of narratives. In other words, while conventional (teacher directed) pedagogy has teachers introducing diverse contexts, planning that some of these narratives may have relevance to the students’ lives, and then abstracting from these asserted contexts into a general scientific principle, we attempted to do a reversal. Students were to start first from the scientific principle, then by themselves, design a narrative context that they felt would be viable means for demonstrating the concept.

4. Research context and lesson design

This research took place in an elementary school in Singapore. Known for its high achievement in international standardised comparisons of Science and Mathematics performance, the education system has witnessed a great deal of change since the country marked its independence in 1965. In its current form, schools in Singapore have been found to be largely driven by:

the single-minded performative orientation of instructional practices generally—and instructional strategies specifically—in Singaporean classrooms that rarely deviated from a logic of curriculum coverage, knowledge transmission and assessment […] The national high stakes assessment system, by virtue of its considerable institutional authority, both shaped the pattern of instructional practice at the classroom level and constrained opportunities for instructional improvement (Hogan et al., 2013).

This background, while not a central problematic of our study, nonetheless played a significant influence on the conduct of our investigation, which we will elaborate later. Framed as an intervention designed to trial an innovative classroom practice, this study was met with some scepticism initially, despite the school being a designated Centre for Excellence in the use of Information and Communication Technologies. We were assigned one portion of a class; while the majority of students in that class had (as part of their grade level) gone for an overseas field trip, these were the ones whom were left behind because their parents had declined permission for their going overseas. While the usual class size was nearly forty students, our class only had twelve students in four groups; and because it was post-examination time, there were no regularly scheduled lessons, so we had the privilege of having their complete attention for four days, at five hours daily. This class was certainly not typical of classrooms in Singapore, or, for that matter, in many other places in the world. Still, framed as a proof-of-concept study, we wanted to see if students at grade five (11 year old) were capable of benefitting from this style of pedagogy. The school desired that the project dealt with the grade five science content of the water cycle, which we later discovered to be a sub-optimal choice as we explain later in this article. We felt, at that time however, that it was important to study the lesson design and satisfy the school’s intentions as they reflected that students in their school appeared to experience challenges with the water cycle.

While the use of technological mediation was considered an important aspect of this study, we nonetheless considered the narrative and scientific content elements as essential pieces of higher importance, and found ways to ensure that the competent use of technology did not become barriers to learning. Specifically, we wanted the students to create storyboards, and we focussed the pedagogical process on improving the narrative structure before the students were allowed to work with the software. The choice of story theme was decided, in large part, by the school; in looking for a means to move away from the traditional ‘sage on the stage’ approach to science instruction, the story-telling approach was considered as an ideal candidate. For this study, the students were to learn about the water cycle, a scientific concept which we initially struggled to create an appropriate activity, in part due to the nature of this item of knowledge. This point will be elaborated in the discussion section.

We were guided by the following five principles for our design: (i) devolving epistemic authority in the classroom: we experimented with unsettling teachers’ traditional authoritarian role as sole source of ‘correct’ knowledge. Instead of covering content explicitly, teacher produced and prepared learning experiences and
demonstrated key phenomena as a means to motivate learning and self-discovery and research skills. (ii) Storytelling as a means to contextualise conceptual information: To encourage students to take ownership of their learning, students were tasked to tell a story that involved the water cycle as a key learning goal. Essentially, students were to create pedagogical narratives to instruct peers on the knowledge of the water cycle. (iii) By asking students to create stories to teach or motivate the learning of specific principles, the underlying assumption of this pedagogical approach is that students need to possess sufficient fluency with the knowledge and concepts before directing the learning of others in similar stages of learning. (iv) A focus on dialogism, group participation, and whole class discussion where appropriate: Because of the shared nature of story generation, a goal for this research was to encourage respectful student discursive practices in the science classroom, a practice that is counter to the more common individualistic practices in conventional classrooms. (v) A field trip element: By going outside the classroom, a field trip was planned as a means for students to acquire inspirational elements and (in the main project) recursively check their theoretical stances with reality. For the purposes of this study, only one visit to a field site was planned, to a local waterway for students to acquire video footage and images for their project.

We took a recursive approach toward student generation of work, starting with individual efforts before increasing the collective size so as to minimise the effect of ‘free-loaders’. In sequence, we had students, in groups of three, work on: (i) an individual storyboard: conceptualized as (at least) four picture panels with accompanying write up, representing the introduction, problem, climax, and resolution of the story narrative, students were initially tasked to design these storyboards individually. These individual storyboards were then merged with others in a later phase. (ii) a group storyboard: as a means to encourage risk taking, critical dialogism, teamwork, and collaboration, individual storyboards were merged through deliberative discussions to form a group storyboard. (iii) a group digital story: as we did not want differences in technological competence to influence the pedagogical outcome, we offered students the choice to prepare their final products either as a digital video, with live action segments, or with static images accompanied with text overlay and voice over, or as a text document with images acquired themselves or sourced from the internet.

Over the four days, science teacher Mary (all names pseudonyms) conducted almost 20 hours of the storytelling workshop. Briefly, the emphases for the various days were: (i) in day 1, to introduce students to the elements of a narrative, introduce the concept of the edu-tainment story, allow students to begin drafting their individual storyboards, and for student groups to arrive at jointly created storyboards. (ii) in day 2, attend a field trip to acquire footage for planned group storyboards, and for teachers to orient students to the use of Microsoft Windows Movie Maker. (iii) in day 3, student groups were to work on digital stories, present drafts work-in-progress, and then continue work informed by peer feedback. (iv) in day 4, present final student group work to the class.

5. Methods

Because of the lack of precedent from which to draw from, the experimental nature of this study, and the unusual conditions of this class as compared to normal classroom conditions, we decided to study this implementation as a pilot case to demonstrate the pedagogical principles underpinning this use of digital storytelling in the science classroom. As we have noticed from the brief theoretical discussion into the nature of knowledge, context dependency is a core construct that distinguishes between hierarchical and horizontal knowledges—for hierarchical knowledges like the natural sciences, powerful explanatory concepts pose general applicability to a wide range of empirical phenomena. Therefore, a wide range of possible contexts may be suitable candidates for the generation of narratives for the illustration of the scientific concept. In contrast, horizontal knowledges are more likely to offer multiple candidate narratives that illustrate the polyvalent nature of singular contexts.
In this study, we advance the conjecture that the degree to which the narrative was essential to the communication of the scientific content was an indication of its quality and a proxy indicator of the students' familiarity and confidence with the scientific content: if students only had shallow understanding of the scientific concept, it was unlikely that they would develop imaginatively rich stories which illustrate the workings of the concept in contexts not normally associated with the usual forms employed to introduce the concept. This conception is by no means radical—this ability of students to use a learnt concept in contexts distinct from its acquisition is the very essence of the problem of transfer (see, e.g., Anderson, Reder, & Simon, 1996; Bereiter, 1997; Greene, 1997). Conversely, but not studied in this investigation, we similarly conjecture that for horizontal knowledges, an expression of the confidence and fluency with this form of knowledge is in the storyteller's ability to apply sophisticated layers of analysis to seemingly uncontroversial contexts, as perhaps exemplified by Foucault's processes of problematisation and genealogy (see, e.g., Foucault, 1978; Olssen, 2008; Scheurich & McKenzie, 2005).

During this study, we collected audio and video data of in-class interaction and teacher talk, student generated artefacts, as well as recordings of student focus group discussions. We present here an analysis of the student generated narratives, initially independently analysed by the contributors of this paper, and then collectively assembled to resolve conflicting interpretations and to generate the unified result presented here. As the concern here is with the knowledge and narrative dimensions of student generated work, we have left out data from the in-class interaction, and focus group discussions as these data sources inform about other aspects of student learning. Specifically in our analysis of narratives, we wanted to provide descriptive indicators of students’ stories in terms of the degree of connection between the context developed in the narrative and the scientific content. Because the ostensive purpose of the stories students were supposed to generate was pedagogical, we wanted to indicate the degree of fit these stories possessed. In the following, we abstract the qualities of Coherence, Scientific Accuracy, and Centrality of Context from the student generated stories. Briefly, we wanted to describe the dimensions of: (i) Coherence: in terms of how well the narrative was carried from introduction to resolution, how well did the narrative elements fit seamlessly into one another? Did any part of the story appear arbitrarily attached? (ii) Scientific Accuracy: was any part of the story misleading in its communication of scientific principles? and (iii) Centrality of Context: how essential was the narrative context to communicating the scientific principles?

### 6. Results

Four stories were created by the student groups, with various degrees of technical competence. We did not require students to create stories with any particular degree of finish quality, but instead focus on their narrative quality. We present these results in what we perceived to be decreasing order of quality.

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<thead>
<tr>
<th>Story</th>
<th>Narrative synopsis</th>
<th>Coherence</th>
<th>Scientific Accuracy</th>
<th>Centrality of Context</th>
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<tbody>
<tr>
<td>A</td>
<td>Two animal apprentices of a sorcerer inherit magical powers. Evil Mouse uses powers to create a pool of water to sell to thirsty animals in the desert, which promptly evaporates. Good Rabbit uses powers to fly to the Cloud to encourage the rain to fall. Rabbit discovers</td>
<td>High degree of coherence; within boundaries of the story world, events are logical, and narrative flow is well maintained, with no unreasonable</td>
<td>Moderately high degree of accuracy, with the major ‘error’ being that the lead character could encourage rain to fall; however, this</td>
<td>Compelling story with water cycle tightly integrated into the narrative. Water cycle is purposeful to the narrative, and is essential</td>
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<td>Cloud was formerly Mouse’s pool of water. Rain falls, the water cycle is complete, and animals are saved.</td>
<td>Plot progressions or plot holes.</td>
<td>Not completely unreasonable given the narrative world.</td>
<td>To the successful resolution of the story.</td>
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<tr>
<td>Little water droplet is warned by father not to bask in the sun for untold reasons. Water droplet does it anyway and experiences the water cycle personally. In the process, he meets his grandfather who explains the water cycle to him.</td>
<td>Moderate degree of coherence, but audience is left wondering why father did not explain the water cycle in the first place even though it is supposed to be a ‘natural’ and ‘healthy’ process as claimed by grandfather.</td>
<td>Fairly accurate; within story world however, evaporation could have occurred without exposure to the sun. Story implied that grandfather had the conscious ability to participate in the water cycle.</td>
<td>Grandfather’s lecture on the water cycle seems out of place in the narrative, with information provided to little water droplet without his asking, and not pertinent to his concerns.</td>
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<td>William, on his way home from school one day, intends to play soccer, but is prevented from doing so by an unexpected rainstorm. He goes home and asks his parent about the origin of rain, who proceeds to lecture him about the water cycle.</td>
<td>Low degree of coherence, with what essentially is a lecture on the water cycle hanging off an unfinished story of William wanting to go play soccer. No resolution to the soccer narrative is attempted.</td>
<td>Content on the water cycle is accurate, but appears to be a recitation from a textbook.</td>
<td>Context is subsidiary to the scientific content, or at best marginal as a means to introduce the scientific content as an explanation to why it rains.</td>
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<td>Alice is distracted during a school excursion, wonders about the water droplets on the outside of her water bottle, and falls asleep thinking about it. In her dream, she imagines a story of a little water droplet as it</td>
<td>Clumsy narrative attempting to weave in a story within a story, but not succeeding very well. This was lowest</td>
<td>Content on the water cycle is accurate, but appears to be a recitation from a textbook.</td>
<td>Context is subsidiary to the scientific content, or at best marginal as a means to introduce the</td>
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experiences the water cycle. Alice wakes up being the centre of the teacher’s attention to respond to a question, and is magically able to respond to the question by reference to events in the dream world.

performing group, and appeared to have appropriated parts of Story B’s narrative after class discussion and revisions to group narratives. Many logical inconsistencies and plot holes make the story difficult to understand.

Scientific content. The water cycle content appears ‘bolted on’, and perceptibly disconnected from the main narrative.

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Table 1: Analysis of student narratives

The data here shows, fairly loosely, some of the typical storytelling approaches taken by grade five students from the Singaporean context, and constitutes three very broad categories of stories that students may generate. In the Category I, exemplified by Story A, we have a well-crafted narrative that imaginatively provides a captivating context which is fully capable of serving as a pedagogical tool. In stories of this category, the integration between the narrative context and the knowledge content is strong and purposeful; with narrative elements in the context being essential to the learning of the content, either directly or by means of a metaphorical reasoning or equivalent. In Story A, for example, the character of the Good Rabbit takes viewers through to the clouds to explain the origin and identity of the clouds.

In Category II, Story B shows us an attempt at a creative story, but falls short of the tight integration of context and content that can be seen in the Category I. In Category II, the narrative arc can be complete, consistent and logical, but the fit between context and content is not thorough. For example, in Story B, the lecture by the grandfather character presented much more information than what the child character needed to resolve the conflict situation of the narrative, and instead appeared to be the team’s effort to demonstrate their competence of the knowledge, including its canonical representations.

In Category III, students in this category struggle either with the construction of a complete narrative, and/or appropriate understanding of the scientific content in that they appear to have difficulties establishing alternative contexts with which the content may be able to provide explanatory value. In this category, students can be observed to re-use contexts and phenomena originally suggested by the teacher or other sources (e.g. textbooks, internet sources) directly in their stories. For instance, in Story D, the character Alice is said to have wondered about drops of condensation appearing on the outside of her cold glass of beverage. This phenomenon was discussed in the students’ textbook, and spoken about by the teacher as an initial “source of wonderment” type question designed to arouse students’ curiosity. For stories C and D, the narrative appears incomplete, and mostly incidental to the knowledge to be communicated.
7. Discussion

In this paper, we have chosen to study one particular aspect of digital storytelling, specifically dealing with the nature of knowledge, and the affordances of the chosen knowledge domain. In our project, the choice of the water cycle as the content to be communicated posed a challenge because while we perceived the water cycle as an example of a hierarchical knowledge claim, it was a comparatively weaker example, but unfortunately chosen by the school.

In other words, an important principle is derived from this study—that it is important to closely consider the type of knowledge that we desire students to acquire through the instructional design—not all knowledge forms are equal, and this concept of hierarchicality and horizontality presents itself as a useful means to categorize knowledge forms. We propose that, as a general principle, optimal topics for (digital) storytelling should belong to knowledge domains which are strongly horizontal in nature. Alternatively, for hierarchical domains, these concepts should be ‘higher up’ in the hierarchical organisation. For instance, telling stories about ethico-moral concepts and issues with multiple perspectives in the humanities and social sciences should be preferred over stories in the natural sciences. In the natural sciences, knowledge of the water cycle (for example) could be used to explain the empirical phenomena observed in many contexts, but not to the same extent as other concepts such as the conservation of energy, the principle of acid-base interactions, or the theory of evolution.

How can students be encouraged to progress toward a higher quality of storytelling? How can students graduate from telling basic stories to crafting deep, richly textured scenarios with artful characters? While our research presented here does not directly address this challenge, we nonetheless feel that this remains a goal worth pursuing. In part, one obvious means to achieve this goal would be to alter the lesson design such that imaginative stories are privileged: if students were given story A as exemplar, perhaps more groups would have taken the invitation to creative visualisation. Besides this, we believe that a commitment to occasional contextual changes in students’ learning plays a significant role in their learning and creative journeys—in ‘trying out’ abstract ideas in new contexts, students are encouraged to make active sense of their possibly latent understandings of abstract knowledge. For instance, if students were to learn about the water cycle through the stereotypical image of rain falling down mountains, draining through rivers to the oceans, they may struggle to reconcile their understanding of the drainage when confronted with a manmade feature such as a canalised river. However, this form of struggle can actually be productive as students learn to transfer their knowledge to contexts beyond the sites of their acquisition. To facilitate the frequent change of context, we therefore support the use of outdoor learning, and in school situations where outdoor learning is not considered feasible, ingenious use of telecommunication technologies. Specifically, we believe that students communicating their local perspectives through a form of video sharing to their counterparts in foreign locales promises to be a productive means for students to vicariously experience contexts different from their own.

As planned, we had intended the digital storytelling approach to pose as a disruptive innovation to the regularities of schooling, especially in the Singaporean context where, as Hogan et al. (2013) surmises, the strong emphasis on curriculum coverage under a tight time constraint meant that, from our perspective, there was an especial emphasis on the teacher planning every possible aspect of the classroom interaction in order to deterministically establish the learning sequence. We wanted to use digital storytelling as a means to devolve epistemic agency away from the teacher, and to enhance students’ epistemic agency, in this case, by getting students to decide for themselves the contexts by which certain scientific principles could apply. Certainly, one would argue that there were many other areas for students to acquire epistemic agency, perhaps most meaningfully in the acquisition of the content knowledge itself. This remains an area which we intend further development in subsequent iterations of this study. With this study group of students, because of the unusual circumstances of their involvement, they had previously acquired knowledge of the water cycle through conventional classroom means, we had decided not to examine their knowledge acquisition processes in this
phase of the study. In agreement with our teacher participant in this study, we found that the digital storytelling pedagogy took a long time to implement, with time taken by both teacher and students in acquiring revised epistemological stances as most significant. While this may be the case, we believe ultimately that the longer term benefits of this different epistemic stance to outweigh the time taken to acquire it; in fact, much of the discussion here mirrors the difference between belief mode and design mode orientations to knowledge as elaborated by Bereiter & Scardamalia (2003).

This paper reports on work done in preparation for a subsequent study which will integrate a mobile video application (Multisilta, Suominen, & Östman, 2012; Tuomi & Multisilta, 2010) into students’ learning experiences. While we attempted to emulate the discursive and interactional aspects afforded by such mobile video applications, much data was not collected that could not be reported on here. For instance, student teams planned, collected video footage, and edited the final video; these activities occurred with much discussion and deliberation, but without a recorded trace for analysis, much of the evidence for student learning processes can only be inferred upon here, and only loosely.

Storytelling in science using the edu-tainment approach remains a feasible pedagogy and deeper explorations should be mounted; while we have demonstrated a line of analysis of student narratives, the larger problem of assessing student understanding remains and is likely to draw from such evidentiary sources as their comments and messages that they exchange as the group negotiates a joint project. While we have demonstrated a rudimentary classification scheme for student work, we have hardly analysed the process factors that contribute to the students’ relative degree of success. With regard to knowledge we are left here to simply reiterate the importance of considering the nature of knowledge forms that researchers intend to work with in designing interventions; some kinds of knowledge can be a better fit for particular tasks, and the hierarchical/horizontal distinction is a useful heuristic to explain this fit.

References


