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When in Doubt, Map it Out: Teachers' Digital Storytelling Researched through Documentation

Cartographier pour comprendre : la mise en récit numérique documentée par des enseignants dans un cours de 2e cycle à l'université

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Abstract

This article considers how documentation enriches literacies learning in higher education, specifically in a graduate course designed for language teachers. Building on a one-year research study with graduate students at a university in the Atlantic region of Canada, the authors demonstrate how participant-generated documentation, including cartography, presents relational understandings impacting literacies. Specifically, the authors look at a case study of two teachers enrolled in a graduate literacy course who crafted and designed digital stories using *Scratch* and used multimodal dimensions from music to animation and movement. Teachers' documentation challenges the idea that making is solely a question of doing, and considers instead long-lasting processes that influence teacher practice and development.

Keywords: making; teacher education; storytelling; cartography; multimodality

Résumé

Cet article démontre comment la documentation enrichit le concept de littératie à l'université, en particulier dans le contexte d'un cours élaboré pour des enseignants de langues. En s'appuyant sur des données issues d'un projet de recherche mené auprès d'étudiants du deuxième cycle dans une université des Maritimes, les autrices expliquent comment la cartographie produite par les participants présente des concepts relationnels qui déteignent sur la capacité à faire des liens, à comprendre, à réfléchir et à réagir. Pour ce faire, les autrices se penchent sur une étude de cas impliquant deux enseignantes inscrites dans un cours de deuxième cycle portant sur la littératie. Ces étudiantes ont composé un récit numérique à l'aide de *Scratch* et ont mobilisé des dimensions multimodales comme la musique, l'animation, et le mouvement. La documentation effectuée par les enseignantes interroge le concept voulant que la

composition rime avec la simple action de « faire » et prend en considération des processus de réflexion importants en littératie, dans un contexte universitaire.

Mots-clé : production ; formation des maîtres ; mise en récit numérique ; cartographie ; multimodalité

Introduction

Attuning to Process in Literacies Research

There are 12 numbered steps in Jenny's[1] map, in colours ranging from a golden yellow to a pastel purple, with directional arrows connecting them suggesting non-linear pathways. The first step, labelled 'Emotions' reads, "I feel excited about our project", while the fifth step reads, "I have to clear my mind and do this logically." These bubbles and arrows form a diagram for a MakerMap, a relational cartography made as part of an assignment for a graduate-level literacy course Amélie Lemieux taught and developed at a Canadian university in the winter 2019 semester. The MakerMap acts as a participant-made documenting strategy to enliven entwined processes of making. This MakerMap in particular captured Jenny's situated entanglements with computer programming (or coding) during a joint project with a classmate, Grace, who was also new to this digital platform. In their processes, the graduate students, who were in-service teachers pursuing a graduate degree in literacy education, identified challenges in using unfamiliar technological resources in classroom settings. The following case study examines Jenny and Grace's literacies to inform how documenting literacy processes is useful for professional development and higher education research. Our research questions ask: What thoughts, feelings, and related reactions do teachers experience when they engage in maker literacies, and how can these be articulated through documentation? What are the implications of documentation for teachers' own classroom practice? This article delves into these questions, with attention to literacy processes of teachers enrolled in higher education courses.

Documenting Maker Literacy Practices and Processes: Challenges and Opportunities

Maker education refers to the active creation of material and technological artifacts based on shared knowledges and expertise (Peppler et al., 2016; Sheridan et al., 2020; Vossoughi & Bevan, 2014). Maker literacy practices are often deeply entangled with craftivism (Rowsell & Shillitoe, 2019) and relational ontologies (Keune & Peppler, 2019; Lemieux et al., 2020; Lemieux & Rowsell, 2020). In its expression of creative and communal drive, making allows students, teachers, and practitioners to take responsibility and be accountable for what they are creating, as the social aspect of maker education conditions and determines design, topics, and decision-making as part of student-led inquiries.

With making, learners engage in cross-disciplinary knowledge and minimize engagement in unidimensional pedagogical transmission models. In so doing, these processes nurture participative and collaborative practices. As collective learning unfolds, knowledges are expressed, bartered, generated,

[1] All participant names are pseudonyms.

and cross-pollinated rather than transmitted from expert to beginner (Tucker-Raymond et al., 2016). In that vein, makerspaces, as cross-disciplinary communities of practice (Halverson & Sheridan, 2014), encourage the implementation of overlapping complex engagement, among them sensory experimentation, digital play, and materially-oriented knowledge production. For instance, tinkering and trial-and-error experiences are effective for student engagement and skill development (Li & Todd, 2016), while discovery, real-time feedback, differentiated learning, and risk-taking are conducive to experiential learning and modelling (Li et al., 2019).

Making has received a lot of attention in the learning sciences, yet several barriers impede the general uptake of making in schools and limit teachers' capacities to document their forays into making as a classroom practice (Peppler & Bender, 2013). Makerspaces in school environments require substantial oversight, complicated by staffing limitations and restrictive web-related school policies (Li & Todd, 2016), often not conducive to documenting literacy practices. Since some curriculum restrictions hinder design models of making (Kafai et al., 2014), teachers are often discouraged to expand on (and thereby document) their making practices.

Attending to the documentation of literacy processes can help identify gaps in pedagogical strategies, such as a lack of resources, materials, and digital technology skills. Without this awareness, teachers may struggle to explore ideas and still meet classroom objectives and related program accountabilities (Sanders et al., 2019). Complacency sets making at odds with the traditional classroom structure. In parallel, ethical research conduct and data collection may perpetuate educational systems of thought that devalue underrepresented communities' knowledges (Peterson & Scharber, 2018; Vossoughi et al., 2016), and embed inequitable participation opportunities for digital literacy practices across schools (Dooley et al., 2016). With documentation comes the ability to generate widespread discussion and relational considerations that go beyond representational means (Albin-Clark, 2020). Recent and rapidly expanding technological change and information production demands the reexamination of traditional and static recording methods, and may even reveal new avenues for inquiry through emerging documentation practices.

Making fosters students' interests, supports academic development, and builds communities of practice (Vossoughi & Bevan, 2014); these outcomes depend, in part, on teachers' beliefs related to making and digital technologies. In some cases, teachers' negative attitudes towards maker literacy activities stem from the misconception that making is only possible with expensive technological tools (Cohen et al., 2018), which are misconstrued as being only accessible by the most affluent institutions and communities (Vee, 2017). Other teachers struggle to associate making approaches with their content areas (Cohen et al., 2018) or lack confidence in their own abilities to understand how making can inform their teaching practice (Rodriguez et al., 2018). Helping teachers become aware of these misconceptions and attitudes, by making them aware of their processes through documentation, is a step towards debunking these myths.

In this article we argue that teachers' engagement with their literacy processes through documentation is worthy of investigation as teachers first experience new skills that they may, in turn, teach their students. Without experiencing and documenting their learning through making, teachers

may struggle to offer comprehensive, appropriate support to students undergoing activities such as coding. Into this gap fits documentation of these processes, which mollifies teachers' initial maker-related anxieties, substantiates ongoing professional development, and complements emerging transdisciplinary literacies research.

Why Does Research on Documentation for Professional Development Matter?

Coding generates new attitudes to literacy learning in classroom settings. Through coding, one experiences problem-solving through trial-and-error, decision-making, continuous feedback, troubleshooting, and complex elaboration (Resnick, 2017) based on engagement with online communities. Documenting processes about making and coding can shed light on how these analytical skills, trial-and-error, and decision-making operate relationally in education. Doing so provides evidence-based knowledge that can be used to understand how participant-generated relational processes can influence maker literacy practices and curriculum implementation. Through coding, situated technological understanding is extended towards broad social development (Resnick, 2017), affecting possibilities for transdisciplinary literacies uptake, representation, and digital innovation, among other areas (Furlong et al., 2019; Litts, 2015). In other words, we argue that newly acquired coding skills benefit teachers in understanding new relations to materialities borne out in process documentation. Reinscribing the worth of trial-and-error or tinkering approaches to learning puts teachers in a different role—a vulnerable one—with regards to coding. It is through participant-generated documentation, we argue, that teachers may realize how their literacy processes might alleviate some of the tensions and stresses associated with trying a new coding platform.

Yet reservations still exist in the form of teachers' perceptions and abilities related to coding practice (Wohlwend et al., 2016). Some teachers may not feel confident in their abilities to use technological tools (Cohen et al., 2018), while others may feel unsupported technologically in the schools where they work (Li et al., 2019). It appears the way forward is to recognize teachers' need to familiarize themselves with coding to allay their own fears and to offer meaningful support for students learning these skills. Education outcomes are affected by teachers who model supportive behaviours, resulting in greater communication and collaboration skills (Popat & Starkey, 2019). Long-lasting professional development opportunities can contribute to teachers' personal understanding and application of making principles in the classroom.

What Works in Teachers' Professional Development

For in-service teachers, coaching workshops and activities supporting self-confidence aid in fostering collaborative work, as do pedagogical beliefs in student-centred instruction (Li et al., 2019). Through observation and reflection (Desimone, 2009), modelling and experimentation (Li et al., 2019), and opportunities to experiment with maker-oriented strategies (Darling-Hammond et al., 2017), new approaches to classroom practice allow teachers to meaningfully explore emerging technologies.

Studies show that teachers' adjustments to their practice are more effective when their learning is grounded in the analysis of their learning processes through metacognitive awareness, all the while being supported through a professional learning community (Shulman & Shulman, 2004). However,

little research has looked at how documentation practices, through multiple engagements with different documentation methods including metacognitive ones, might help teachers alleviate their anxieties related to making. Metacognitive practices, such as mapping, may prove useful in this area.

Metacognition consists of "knowledge or beliefs about what factors or variables act and interact in what ways to affect the course and outcome of cognitive enterprises" (Flavell, 1979, p. 907), and has been compartmentalized into general thinking and learning strategies, knowledge of tasks and their appropriate strategic applications, and knowledge of self and motivation (Flavell, 1979). It is not surprising, then, how students become more aware of their own thinking, as well as thinking in general, through metacognition (Pintrich, 2002). In literacy studies, students require time when reading not only to apply a particular strategy to increase their comprehension, but also to reflect on their thinking to assess the appropriateness of the strategy (Wilson & Bai, 2010).

For teachers, metacognition affects planning, monitoring, and evaluation by way of "an internal and active process of self-monitoring and self-awareness" (Beach et al., 2020, p. 397). The ongoing consideration of effects of their practices depict teachers' capacities for metacognitive understanding. However, research shows that effective teachers are ones who recognize they can continue to learn about teaching despite their existing abilities, while ineffective teachers tend to believe their teaching practices do not require improvement (Pressley, 2008). The metacognitive orientations of teachers, like others, may be an effect of personality, reflecting imagination, insight, thinking outside the box, and enjoying new experiences; "[o]penness to [e]xperience might be the nourishing source of metacognitive knowledge" (Ozturk, 2020, p. 42). Within the classroom, the applied benefits of metacognition pertain to teaching plans, behaviours, methods, performances, and reflective activities (Jiang et al., 2016). As Ozturk (2018) writes:

> Just like strategic learners, metacognitive teachers plan their instructional practices considering their goals, materials, and students' needs. They also continuously monitor and assess instruction's effectiveness in meeting goals and helping students to learn the content. (p. 32)

Awareness of students' responses and pedagogical flow prompts teachers to "make informed instructional adaptations or changes within the course of classes" (Ozturk, 2018, p. 32). While some schools have added metacognition to their repertoire of teachers' professional development, generally such aspects lack specific understanding and operate instead as additional features of existing programming (Hughes & Partida, 2020). Thus, there is immense pedagogical potential in engaging teachers in documenting their literacy practices and processes in dedicated classes to that end.

For decades, professional development for teachers aimed at documenting variations in satisfaction, attitudes, and innovation (Desimone, 2009), while separately but concurrently, information and communications technologies within classrooms have customarily served to enhance productivity and information presentation. When technologies are introduced in classrooms, there is an expectation that teachers will respond to these positively, and that these will foster teacher efficiency and student engagement. However, in practice, this is not always the case. Much research evidence further points to successful teacher professional development when they engage in open understandings of a subject by

exploring, troubleshooting, implementing concepts, and looking towards improving what they have learned, which, to us, speaks to the ongoing need to document maker literacy practices. An effective way for teachers to consider integrating coding in their classes, for instance, is to try coding themselves through accessible programs because active learning engages teachers in similar learning designs and styles they will expect of students (Darling-Hammond et al., 2017). This is one of the reasons why a few teachers in this class experimented with coding as a novel activity as part of Lemieux's research.

Documenting one's learning can take many forms, crossing the disciplinary boundaries of the arts, visual imagery, graphic capture, and other means of visual recording (Mulcaster, 2017). In this study, we present a MakerMaps methodology. A MakerMap is a participant-generated record of relational engagements in making, deriving from a larger mapping methodology used in the arts and literacy studies (White & Lemieux, 2017). Constructing MakerMaps to document their learning when engaging in literacy processes allows teachers to conceptualize their knowledge to the benefit of their and other teachers' professional development and practice. It is for this reason that we focus our energies in this article on MakerMaps as accessible modes for charting reflection and understanding in meaningful ways, to document teachers' education, and grow the field of maker literacies research. This process can, in turn, reduce barriers to incorporating coding in the classroom. With these goals in mind, the subjects of our case study, Jenny and Grace, document their learning through MakerMaps illuminates the challenges and rewards of making practice for their development as teachers, as maker-teachers, and as maker-teachers of students.

Research Design

This case study explores the experiences Jenny and Grace encountered during a graduate-level literacy class developed by Amélie Lemieux at a Canadian university in the 2019 winter semester. We selected a case study approach because the teachers' encounters with making process were contained in a bounded system (Merriam, 2009) of professional development instruction, where data collection ended with the conclusion of the course. Jenny and Grace were among the 12 in-service teachers in the class introduced to multimodal literacies constructed from reimagined traditional writing, reading, and listening skills (Pahl & Rowsell, 2010). Time in class included six 3-hour workshops to support project creation and design, producing projects involving coding, storyboard and comic design, video editing, and digital art. Students created a lesson plan, artifacts (material and digital), and generated a visual map (or MakerMap) of their responses to making using a mapping software called Inspiration. Students also produced written commentaries to accompany their MakerMaps. Amélie took ethnographic field notes following the sessions, and arranged for a videographer to record three separate sessions of two hours each. Jenny and Grace consented to interviews about their design experiences and were the only students in the class attempting projects that required the use of coding. Grace and Jenny used *Scratch*, an example of an online, free-to-use, accessible computer programming software that both youth and adults can use to generate and gain input into games, animated stories, and interactive artwork. MakerMaps and artifacts consisted of both course materials and research data. Field notes, session recordings, and interviews were for research purposes only. MakerMaps, MakerMap commentaries, interviews (and

interview transcripts), and digital artifacts (Scratch compositions) were primary data sources. Data were analyzed qualitatively, using codes generated by inductive thematic analysis.

MakerMap Methodology

The MakerMap methodology consisted of teachers:

(1) Writing down, on a sheet of paper, their reactions and thoughts as they were making their composition. These could include boredom, excitement, anxieties, and so on;

(2) Ranking each reaction by level of importance (1 being a barely perceptible moment; 4 being a very impactful moment);

(3) Classifying each reaction by reading the guide of reactions that was provided to them to identify a category. Students could also make their own categories if appropriate ones were not present in the guide;

(4) Colour-coding reactions by themes and categories found in the guide and writing these on sticky notes; and

(5) Digitizing and organizing their map with the Inspiration software.

This methodology, facilitated by Amélie, allowed students to document their process in real time, and also come back to it over the course of the term. The students could then confirm and inform their choices and their gestaltic impressions of experiencing making, all the while accounting for their processes.

Coding a Storytelling Project with Scratch: From Musical Melodies to Multimodal Narratives

Jenny, a Chinese teacher with a BFA in musicology, partnered with Grace, a Jordanian music and literature educator. Amélie's one-on-one interviews and ethnographic field notes indicated that Jenny and Grace wanted to combine literacy studies with music education for their project, in line with the readings they had done on multimodality. They decided to adapt a scene from a short story on international law and human rights into a brief coded animation using Scratch. The narrative presented a bystander that becomes involved in a bullying situation affecting another's life. The activity around the animation consists of the teacher reading the story to the class while intermittently stopping at narrative decision points for students to insert appropriate background or digitally-created music through body movements and related situations. The exercise recognizes the value of collaboration, as students work together to select or create music, and emphasizes students' abilities to troubleshoot, restart, make, and create their own projects and artifacts. In the section that follows, we give background information about Jenny and Grace, how their project came to fruition, their MakerMap documentation processes, and analysis from the MakerMap and reflective discussion findings. Implications for teacher education appear in the discussion section, and we conclude with the significance of this study for professional development and teacher practice.

Documenting Teachers' Affinities Between Storytelling, Coding, and Music

In her interview, Jenny noted how she decided to produce music from do-it-yourself (DIY) instruments to accompany the animation while Grace coded the movements within Scratch. In her MakerMap commentary, Jenny found early in the process that the DIY instrument sounded 'dry' and their imagined project was too 'vague'. Upon learning that Grace had also been creating digital music in Scratch for their animation, Jenny expressed in her interview how she was surprised to find their plans had altered, and noted a lack of communication in their partnership, felt frustrated about her inexperience with DIY instruments as well as Scratch, and considered abandoning the project altogether. However, she found reassurance and motivation in creating a storyboard (Jenny, interview) to help her understand and 'declutter' the creative process (Jenny, commentary). As expressed in her interview, Jenny produced several animation artifacts in succession, and after identifying Scratch's human characters as raising problematic issues of cultural appropriation, she decided to incorporate animal characters instead (Figure 1). Scratch-made narratives include premade characters and avatars that are difficult to 'fit' into predetermined storylines (e.g., Cinderella). As other studies have found, these constraints at times allow for posthuman play, whereby animated characters become the story, and students engage with them as a result, as opposed to the contrary (Lemieux & Rowsell, 2021; Rowsell et al., 2018). Grace noted this limitation in her MakerMap (Figure 2, under Additional moments II).

Figure 1

Storying Non-Humans in Scratch Narratives

Jenny revisited combined self-produced drum sounds with tunes from Scratch's library, noting in her MakerMap commentary how she "felt happy about every choice that [she] made during this process". Grace, in contrast, reflected on the broad significance of the process and its potential application across contexts. Her inspiration for the project was to bring together her interests in music teaching, literacy, and humanitarian international law (Grace, interview). She felt there was a strong connection between felt responses and how music could evoke that "some people need to have their feelings moved in a different way," as she said in her interview. Grace saw an affinity between music and coding in particular:

> The brain needs to understand the symbols. It's transcribing the symbols and thinking of it, and then applying what you comprehend and perform[ing] it by finger movements. And this is very similar to what you do in coding. You need to comprehend and then apply it and then there's a nice outcome that you'll be proud of. (Grace, interview)

Grace estimated in her interview that 60%-70% of teachers are "hesitant to use…technology in teaching," and that teachers ought to be encouraged to find a connection between coding and their subject area. Her assertions motivated us to explore some challenges teachers face, notably the difficulties associated with utilizing novel technologies for pedagogical purposes in classroom settings.

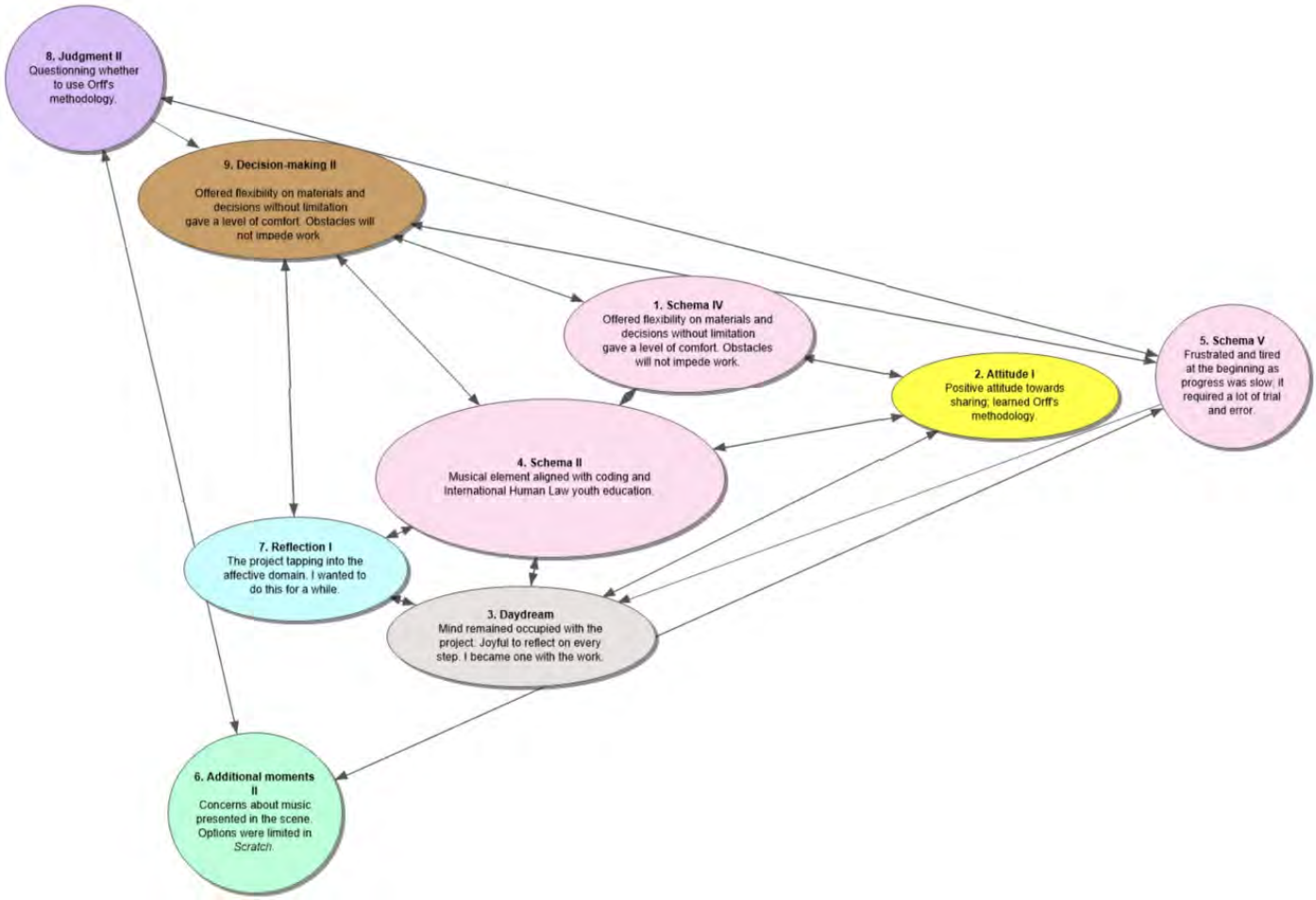
Documenting Maker Processes Through MakerMaps

The MakerMap aided Grace in understanding a process she identified as moving from knowledge to experience, to creativity, and finally to wisdom, leading to "self-improvement" and "self-awareness" as she shared in her interview. Grace's MakerMap (Figure 2) speaks to this awareness through the reactions she had while recording the music and coding the narrative. Numbers in the circles represent the order in which those thoughts were noted on paper. The arrows represent the relational thinking that took place between herself and moments of making. The colour-coded circles point to the different categories of reactions, with a strong emphasis on schematic expression (with different subcategories II, IV, and V). Schematic expression echoes, in the guide of reactions, associative thinking between the learner and previous knowledge or experiences, beliefs, values, and background. Grace's observations on 'becoming one with the [art]work' (Grace, MakerMap) points to our earlier observations around coding, where coding shapes the learner (as opposed to the constructivist narrative where the learner unidirectionally shapes the coding). The argument here further lies in the judgment and decision-making categories, in which Grace hesitates between using Orff's music instruction theory and following her intuitive tastes in music, as she wrote in her commentary. Mapping this hesitancy allowed her to clarify these relationships, bearing meaning-making across reactions, and seeing her coding composition as a sum of its parts over mind, body, and matter.

Jenny's MakerMap (Figure 3) is the one described at the beginning of this article, in which maker discourse can be seen in her captions describing the process: 'explore', 'combination', 'create', 'choices', and 'story'. These words invoke a sense of discovery associated with literacy practice, acknowledging how process affects learning. Jenny's surprise in learning that the music she was preparing for in a hands-on manner was also being created digitally by Grace emphasizes the need for an ongoing collaborative approach, as Jenny pointed at in her interview. This collaboration was frustrating at times, as Jenny noted in her MakerMap under the Emotions category. Jenny's nervousness about adapting a written story for movement, and her solution to use a storyboard to proceed through the animation, was met with a remark from Grace to "just do whatever you want, despite Grace's openness regarding new ideas" (Jenny, interview). More attention to ongoing communication, or check-in discussions, might have produced a less fraught atmosphere for project creation.

Figure 2

Grace's MakerMap

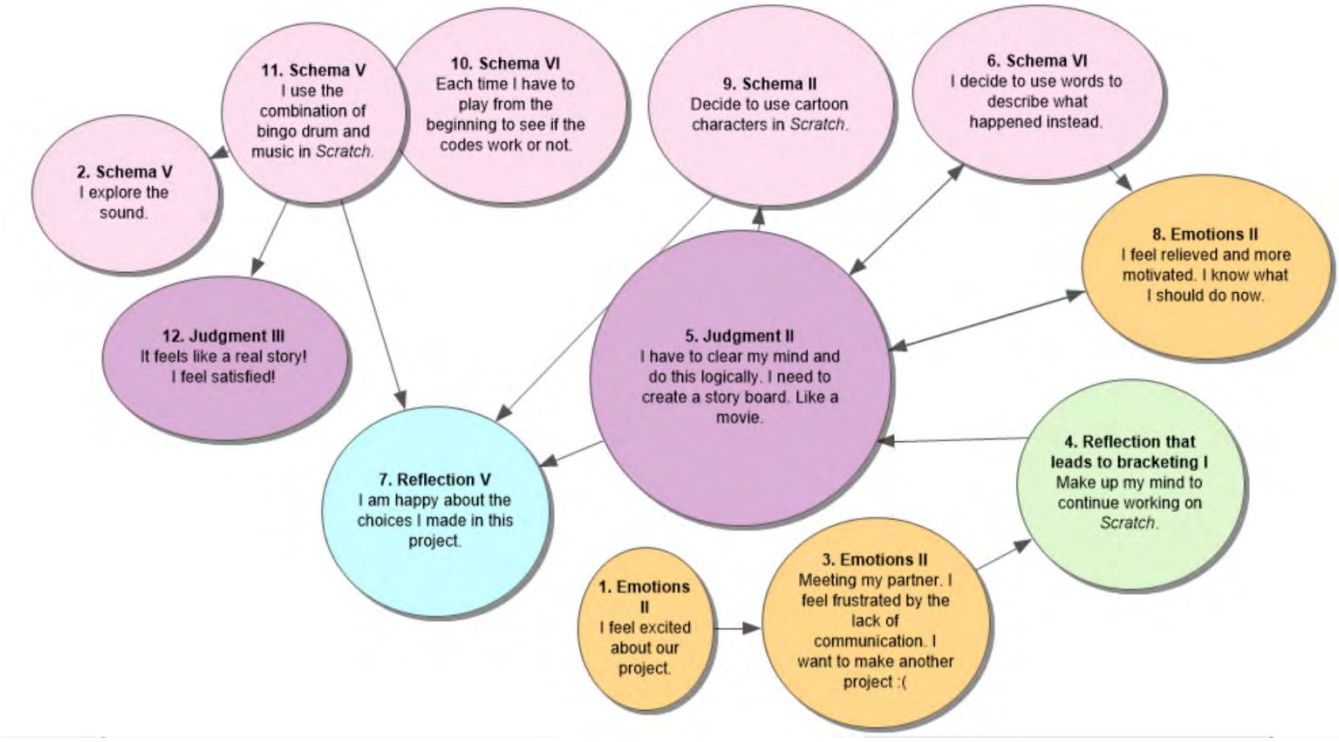


Jenny's MakerMap

Jenny's comment about Scratch's cultural appropriation of human characters relates to her observation that the human movements were not accurate, nor were they sensitive to lower socioeconomic classes, and we agree with her position. As she noted during her interview, there was a lack of diversity in characters. Her critical awareness demonstrates the need to engage with digital technologies critically and consider issues of racialized representation on widely used and accessible platforms, especially in education.

Figure 3

Jenny's MakerMap



Making Stories, Making Music, Making Progress: A Discussion on Documentation

One can speculate on whether this literacies exercise would have been as effective had Jenny and Grace not undergone any difficulties of collaboration, communication, and skills development in their role as learners, rather than as teachers. The various lessons to which Jenny and Grace were exposed during their encounters with coding highlighted the importance of documenting teachers' literacy processes to, in turn, offer more informed support to students who are themselves learning through making their way through coding. With the presented emphases—composition, coding, reactions, process, and teaching practice implications—new areas of literacies in the classroom are enriched, documenting processes is affirmed, and professional development in teacher education is nurtured.

In the coding projects, Jenny's Scratch-recorded music production was superseded by learning the platform's music resources and combinations; this met her goal to "boost the literacy learning" of students (Jenny, interview). As Grace noted in her interview, "coding is essential in every aspect of life", thanks to cellphones and computers, refuting the beliefs that coding is "complicated", "difficult", or "wastes time". The use of MakerMaps was particularly helpful for Grace, who indicated in her interview how she became "more aware of things that [she] thought about and applied in the project".

Together, Jenny and Grace achieved their goal of making a project incorporating music learning and coding practice to produce a multimodal text. The framework of sonics and collaboration, from the

teacher reading the original short story to the class and the cooperation of students designing musical interludes for the animation, provide still more instances of new and refashioned intertextual instances of multimodality.

Grace holds teaching certifications in English literature, English as a Second Language, and music. Her experiences teaching in these areas make cross-interpretations of learning not only likely but enriching. Jenny has also taught music and English to students in China, and while she first thought to apply musical soundtracks to their project, she came to recognize that moments in their animation required different and corresponding sounds; for example, drumbeats to express running footsteps, and tension expressed with music in a minor key, "a little bit of shadow music, like [the] feeling" (Jenny, interview). This is the redesign and recreation of overlapping, multiple modes of meaning that produce digital and multimodal literacies. Further, and as important, is the need to document how these complexities emerge, as there is a need for data about teachers' metacognitive strategies occurring during their online learning activities to better understand how learning environments operate (Beach et al., 2020).

Why Attuning to Process Matters

Both Jenny and Grace noted affect-laden aspects of music that further strengthen their understanding of literacies. Jenny's comments about the music accompanying their animation were strongly felt. She refers to "slow-paced music," "vibe," "tension," "sadness," and "moving" sounds, as explained in her interview, to match the animation action. In parallel, the reactions that music evokes may enliven and dynamize relationalities:

> Sometimes there's feeling from your emotional feelings about music. But, if you dig really deep into music, there's math, there's everything in music. And, for example, the presentation about the beat in the music, it can help learners to know the punctuations in the readings. (Jenny, interview)

For her part, Grace saw music as activating her responses: "I'm one of the people that if there's no music, I kind of have no feelings. Like, if I want to really cry or be emotional, I'd want to listen to music" (Grace, interview). She felt that people do not generally think about sounds they are hearing, taking both positive and negative sounds for granted, but that doing so is an area open to investigation (Grace, interview). This could lead to insights into affect in relation to learning[2], which has emerged as a separate but related aspect of coding practice that develops socialization (Poth, 2019). Jenny and Grace drew on these skills just as their students would be expected to do, in terms of negotiating communications difficulties and task decision-making; in doing so, they were able to recognize and document their individual learning processes.

From Unfolding Uncertainties to Embracing Literacies Work Through Documentation

Jenny had some reservations about the class, unsure about what would be involved; however, as she read the course materials, which included an explanation of MakerMap design, and became more

[2] See Dernikos (2020) for posthuman considerations of the affects of sounds and silence in early childhood, as well as those of Jon Wargo and Cassie Brownell.

familiar with the class, she grew "clearer and clearer" about the ideas of MakerMaps for education (Jenny, interview). She also came to understand the ways in which making, in this case incorporating music learning into storytelling and animation, might support universal and affect-laden modes of learning: "music is universal. My instrument is a string instrument and some people say it's like people talking … I think the music embeds emotions and information" (Jenny, interview).

Grace felt that few adults were interested in learning coding and referred to herself as someone who was unable to "grasp [coding] that fast" (Grace, interview). She did identify her desire for learning as a strength, as well as her eagerness to apply her learning, as specified in her interview. This disposition is common to adult learners who frequently direct their learning towards implementation in their immediate circumstances (Knowles, 1980).

Jenny and Grace similarly reported increased self-awareness of their learning process through making. The MakerMap and associated commentary Jenny produced reflected her gradual understanding about the project, its stages, her enthusiasms and frustrations, and her pleasure at finding how storyboarding could reinvigorate her passion for the project. Grace entertained the possibility of emerging knowledges by slowing down and not rushing the making process: "One of my traits [is] I jump quickly into [work] … I want to go to the next step and next and next … the MakerMap make me step back and think and comprehend and enjoy every step" (Grace, interview). Attending to these processes allowed both teachers to engage more meaningfully in their compositions.

Implications for Teaching: Instances of Practice

Jenny commented on her future plans to introduce younger students to a well-known piece of music and allow them to compose their own lyrics to it, but she was aware that in her current institution the teaching of English was an academic endeavour with a very "specific curriculum" (Jenny, interview). She was cognizant that not every teaching situation is as receptive to incorporating composition activities. In her interview, Grace described "want[ing] to experiment with" applying humanitarian models from Red Cross training to her teaching, noting that the facilitators of that course emphasized its usefulness in "any subject matter" for junior high students, such as "social studies, with history, with music…". In the graduate course, Grace wanted to see the outcome of merging music, literacy, coding, and humanitarian international law; she was "really happy with that experience" (Grace, interview). Grace reacted positively and strongly to the class and its structure of experimentation, play, and knowledge production, calling the processes it examined "fun," "easy," and "simple" to navigate: "I think more of this kind of education needs to be there in the education system, whether in schools [or] universities" (Grace, interview). Teacher colleagues who are themselves metacognitive in their approach model a clarity of vision, rely on their judgment rather than prescribed routines, and implement professional development in classroom instruction (Duffy, 2008). Jenny and Grace independently recognized that integrating making principles into the curriculum or their adoption by institutional administrators is an ongoing challenge. After the course, while both felt capable themselves of making use of digital coding technologies in their classroom activities and resources, they identified how teacher colleagues might find it challenging to connect their subject areas with technology integration. While Jenny asserted in her interview that she would not necessarily incorporate

the principles she used, Grace felt encouraging teachers to use "technology in their teaching in any subject matter" would rectify this gap (Grace, interview).

Significance of the Study

This work on literacies lays the ground for more research in teachers' professional development specializing in digital storytelling using coding. In this case study, Jenny and Grace produced a digital story for classroom use within a graduate literacy course and documented their processes through MakerMaps. Their insights generated considerations for teacher practice regarding not only coding integration for professional development, but also accounting for the eye-opening advantages of teachers' documentation processes.

Jenny and Grace's introduction to multimodal texts and digital programming were helpful in navigating situations that were new to them; at-times rocky collaborations, critical thinking tied to social issues, and interdisciplinarity contextualized these ventures. Their reactions to music in part from their musical knowledge enriched their project and awareness, laying the groundwork for them to negotiate different musical approaches common to making practice. Jenny's learning was shaped by a sensitivity to process work, while Grace's understanding proceeded from her committed technological interest and desire for implementation. Their MakerMaps were complex and, in Grace's case, opened the way for a discussion about personal improvement through lifelong learning. Both Jenny and Grace recognized in their interviews specific barriers to incorporating making practice into their teaching: for Jenny, the limitations of institutional support and, for Grace, the absence of support for teachers to acquire digital literacy skills. In terms of collaboration, both Jenny and Grace recognized the challenges of making together, all the while finding ways to listen to, and work with each other.

Conclusion

Research on literacies in this context recognizes two professional benefits relevant to Jenny and Grace's experiences. First, there are benefits for co-construction of knowledge in teachers' professional development. As such, contextual application of technologies "considers the application of technology in combination with pedagogy and content" (Cohen et al., 2018, p. 39), as both Jenny and Grace came to understand when combining their musical knowledges with other content and forms, so that teachers are invested in the process of finding meaningful and aligned processes and multimodal texts. Jenny and Grace, acting both as learners and teachers, carried out "digital participatory pedagogy" (Dooley et al., 2016, p. 53) in the connective work of preparing for students' additions to their animation. Their collaboration "stands in contrast to the ways that individual achievement is rewarded in schools" (Tucker-Raymond et al., 2016, p. 210) and offers growth in shared knowledge production.

Second, making practice regards documentation as integral, whether captures of processes are created through map-making, as was the case for Jenny and Grace, or through other means ranging from blog posts (Rodriguez et al., 2018) to videos (Peppler & Bender, 2013) and 3D-printed materials (Keune

& Peppler, 2019). The emphasis on tinkering encourages recording of attempted solutions or improvements through lists and diagrams, aligning with formal education imperatives to show one's work and embodying good professional development practice in sharing one's understandings with teacher colleagues.

This study showed that there is considerable potential for literacies to enrich teachers' professional development through such practices as documentation. Jenny and Grace used the MakerMap to account for their learning of literacy processes, inscribing their reactions in relatable ways to those they would ask of their students. Their learning is meaningfully reflected through their experiences of coding and documenting, both activities emphasizing attention to process. Offering teachers the opportunity to acquire coding skills, engage in tinkering, and reflect on processes makes for valuable contributions to teachers' professional development practice. Furthermore, it enhances the metacognitive capacities that result in more effective teaching through a strengthened awareness of one's own capacities and potential in literacies research. Through their own encounters with documenting multimodal texts that refashion representational forms, teachers like Jenny and Grace can drive instruction that raises awareness of classroom technologies, promotes teachers' technological confidence, and contributes to pedagogical discourse. Of importance, we argue, is deconstructing the notion that collaboration always goes smoothly, despite resulting in digital compositions. Deromanticizing collaboration speaks to the realities of relational work, and relational work can be both challenging and instructive. Documenting those relationalities can help teachers, and their students, realize that àliteracies present human realities that are central to learning in an era of collaborative and participative practices.

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