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CHAPTER 13

Expressive STEM Storymaking

Art, Literacy, and Creative Computing

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Abstract

This chapter features intersections of art, literacy, and creative computing. As a component of STEAM, creative computing augments story creation, or storymaking (Buganza et al., 2023; Compton & Thompson, 2018), prompting learners to explore expressive meaning making as collective interactions with texts. To signify a way of teaching that supports such learning activities, we propose expressive STEM as a design principle, illustrated here with examples from an elementary school and a preservice art education program in Texas, USA. Principles of expressive STEM storymaking drawn from these examples and from our teaching and research are offered in the chapter's conclusion.

Keywords

art education – computational literacies – computational thinking – creative computing – storymaking

1 Introduction

This chapter features intersections of art, literacy, and creative computing. Working with new media and computational tools for creative purposes has become increasingly important to contemporary art education practices (Mohanty, 2022; Peppler & Wohlwend, 2018). In fact, "art educators are in the unique position to ask probing and provocative questions about digital media" (Sweeny, 2022, p. 293); but those in the field at large perceive a need for more substantive engagement with creative computing in universities and schools (Knochel & Patton, 2015; Leonard, 2021; Patton et al., 2020). This misalignment represents an opportunity to expand the relevance of creative computing in STEM–STEAM learning across multiple domains, including the

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arts, particularly since computational thinking (CT) has been situated as a core priority in K–12 education (Kafai & Proctor, 2022).

In the field of computer science education, CT has been framed as a way of thinking focused on representing problems as step-by-step procedures, so that those procedures can be programmed and carried out by a computer (Grover, 2022; Wing, 2017). Comprising skills derived from mathematics, engineering, and design that are "deeply symbiotic" (Grover & Pea, 2018, p. 33) with STEM disciplines, CT is a "foundational competency for being an informed citizen" (p. 34). Our focus here is not on isolated computing skills or competencies but on expanding literacy learning activities, particularly story creation, or storymaking (Buganza et al., 2023; Compton & Thompson, 2018), to include creative computing—a goal that aligns broadly with the reorientation of CT in computer science education as a component of socially transformative computational literacies (Kafai & Proctor, 2022).

Teachers of young children from 5 to 7 years of age take their responsibility for teaching literacy seriously, frequently telling us they will work with any tool that increases engagement and student success, yet they view adding computing to their repertoire with reservation. For instance, teachers and preservice students often begin workshops and courses declaring their distrust of computers. "Computers hate me!" is not an uncommon refrain; nevertheless, teachers are generally enthusiastic about the potential for STEAM activities to increase student engagement (Graham, 2021).

To discuss the expressive potential of storymaking + creative computing, we will use the term "expressive" STEM. To illustrate expressive STEM as storymaking, we describe three learning activities drawn from our work as teacher educators and CT researchers. The first is from a kindergarten classroom with 5- to 6-year-olds, where students responded to a read-aloud about camouflage by making an animated hide-and-seek word game in ScratchJr. The other examples come from a preservice digital methods course, where preservice students engaged in storymaking via computer programming and artmaking.

2 STEM–STEAM + Literacies

From preservice art education courses (Justice, 2020) to computer science education research (Justice & Assaf, 2020) to community-centered education (Families Learning Together, n.d.), we have noticed that learners gravitate to activities emphasizing interpersonal relationships, for example peer–peer, parent–child, teacher–student, even if those activities involve unfamiliar tools and materials. Activities aligned with STEAM learning include light-up Mothers

Day cards with LEDs and coin cell batteries, machines that make marks or noise to express the personality of a fictional character, and interactive oral histories programmed on a computer. As explored elsewhere (Justice, 2016, 2020, 2024), learner motivation for such activities appears to be driven not simply by a desire for STEM skills, for example, to improve math or science or computer programming abilities, but also by a desire for strengthening friend and family relationships. This observation is supported by a scoping review of STEM–STEAM and makerspace learning by Johnston et al. (2022), who found a noticeable increase in recent studies arguing for STEM learning centered on literacy, play, and family.

Lately, though, we have become skeptical of identifying with either STEM *or* STEAM because these acronyms appear too simplistic. At root, we question integration as a turnkey principle (e.g., simply inserting art between engineering and math) because it minimizes the way learning matters for learners. This realization reprises something we noticed a long time ago but perhaps did not fully understand at the time. In 2014 during a study of K–12 digital making and learning (Justice, 2016), a director of technology complained that focusing on integration was misguided if it centered on tools rather than on teaching. He said, "If [the teaching] is strong with the FabLab, that's great; but if it's strong without the FabLab, that's great too" (as cited in Justice, 2016, p. 89).

This shift toward *how* learning with tools matters, without fixating on the tools themselves, challenges teaching methods. When we introduce creative coding as a way for students to respond to stories (e.g., Justice, 2019), teachers and preservice students sometimes protest that meaningful engagement cannot occur without deep scaffolding, that is, without teaching the basics of computer programming with step-by-step tutorials. After implementing such activities in classrooms, without becoming experts themselves, however, those same teachers and preservice students are astonished when children become completely absorbed with drawing, coding, and narrating stories on a computer or tablet.

3 Computing as Expressive

Framing computing as expressive follows the positioning of CT in computer science (CS) education as transdisciplinary, a domain without its own content (Grover & Pea, 2018). Grover (2022) argued that CT skills-learning is stronger when embedded in diverse content domains, both in CS and non-CS classrooms, and when teaching is multimodal, that is, taught in a variety of ways with a variety of tools and materials. For Grover, multimodality positions CT "*so that skills developed are conceptual and creative*" (p. 20, emphasis in the original); furthermore, "learning CT in different ways for different purposes, including creative expression, helps diverse learners engage meaningfully" (p. 34). Likewise, Kafai and Proctor (2022) recognized that situating CT across domains frames "computing as a vehicle for personal expression and connecting with others alongside and intersecting a plurality of other literacy practices" (p. 148).

This emphasis on computing as expressive is not unprecedented. Even though educators often associate computers with cold, depersonalized machinery, Denning and Tedre (2019) stated that computation depends on human ways of thinking that have emerged over thousands of years, anchoring CT in the bedrock of human expression. Similarly, Resnick (2006), the MIT Media Lab computer scientist who created the Scratch programming language, has argued "computers will not live up to their potential until we start to think of them less like televisions and more like paintbrushes" (p. 192); and Grover and Pea (2018) have claimed that "from music, math, social studies, history, language arts, and throughout the sciences and engineering, curricular ideas can come alive with CT" (p. 32).

4 Expression as Response

Art and literacy educators understand expressive response as a powerful learning principle relying on coordinated, multimodal partnerships. Art educator Hafeli (2015) proposed that artists begin by noticing the way various tools and materials express mood and concept differently and then learn to work with those differences to elicit ideas and emotions. For example, marks made with hard graphite can feel sketchy or tentative, unsure of themselves, while marks made with soft charcoal might evoke authority, boldness, or anger. Noticing these potentials, or affordances, casts artists as responding *with* tools and materials—in partnership—rather than coldly *using* them. With a similar emphasis on diverse material affordances, Pacini-Ketchabaw et al. (2017) described expressive response as an *encounter* of the world, implying serendipity, or a sense of not entirely preplanned, an experience of being in the world that counters the predictable intentionality implied by conventional notions of artistic control. Instead, Hafeli (2015) and Pacini-Ketchabaw et al. (2017) emphasized artistic meaning making as a coordination of diverse voices, where the artist's task is more about feeling the pulse of experience and calling forth an expressive response *with* those voices rather than telling them what to do or say.

Similarly, literacy teachers Kuby and Rucker (2016) identified writing as a multimodal response comprising diverse practices, not limited to reading and writing. In fact, in the field of literacy education, writing has long been identified as plural, that is, as literacies, or multiliteracies (New London Group, 1996). For Kuby and Rucker, a multiliteracies approach to the teaching of writing positions reading as engaging with the "world through traditional means such as books, but also images, digital encounters, performance, and art" (p. 12). In their view multimodal writing with murals, videos, and puppets sparked "literacy desirings" (p. xv), enhancing student engagement and learning.

To explain how multimodality increased their 7- to 8-year-old students' interest in writing, Kuby and Rucker (2016) pointed to the availability or scarcity of tools and materials in the classroom. For example, Rucker worried she might have discouraged literacy desiring because she "had never made [materials] freely available" (p. 62) for students' responses. Encouraging puppet-making in a writing workshop, on the other hand, permitted a serendipitous frog puppet to catalyze students' desire for "bridging literacies at home with literacies at school" (p. 12). Here, Kuby and Rucker explained that crossing thresholds between school and not-school created a transdisciplinary plurality that augmented individual and community literacies, a desire for sharing in-school learning with family and friends outside school, which reciprocally enhanced engagement back in the classroom.

5 Storymaking

Across domains and learning spaces, with early childhood students 5 to 8 years of age and up to adult learners in professional organizations, storymaking is defined as a playful, exploratory mode of story creation that shapes and sustains collective identity, learning, reflection, and belonging (Buganza et al, 2023; Bunda et al., 2019; Compton & Thompson, 2018; Smeed, 2012). From the perspective of adult learning in organizational development, Buganza et al. (2023) defined storymaking as a bidirectional "collective process of sensemaking" (p. 11), a "discursive tool" for creating "new meanings and shaping intrinsic identities" (p. 12, Table 2.1). By contrast, Buganza et al. described story*telling* as a monodirectional, top-down approach, useful for getting information across.

For Bunda et al. (2019), a research and artmaking collective of Australian women from diverse backgrounds, storymaking fosters collaborative responses to absent or incomplete individual and community histories. In their artmaking the collective brought together diverse materials to reclaim a sense of belonging: "Black and White Australian women provoked resonant and entangled understandings of belonging and displacement through performative making" (p. 158), producing multimodal archives comprising photographs, sculptures, baskets, poems, and stories.

For early childhood learning specialists Compton and Thompson (2018), storymaking comprises expressive responses to "multimodal texts (language, art, acting, connecting, drawing, collage)" (p. 13). When they are storymaking, children work as artists, writers, engineers, and performers to express ideas that matter to them. By sharing storymaking, children expand their own and their community's literacies as interactive, intersecting histories connected to friends, peers, classrooms, and families. Thus, Compton and Thompson have argued, "storymaking creates an inclusive community [where] students come to know themselves and one another" (p. 16). With a nod to Reggio Emilia's child-centered inquiry methodology, Compton and Thompson positioned storymaking as interactions between text and materials that "can include any of the Hundred Languages referred to by Loris Malaguzzi, such as drawing, sewing, painting, sculpting, weaving, dramatic play, music, and dance" (p. 15).

From a historical perspective, Compton and Thompson's (2018) emphasis on the interactional multimodality of storymaking reprises Louise Rosenblatt's (1933/1995) reader response theory, positing meaning making as an interaction between reader and text, not as an isolated property of either component. This notion of interactivity—where meaning making is relational and responsive to the interdependency of reader and text—is consistent with John Dewey's (1934/1980) theory of art as experience, published at roughly the same time. In fact, relational theories of meaning making rooted in experience and response from the early 20th century—like Rosenblatt's and Dewey's—continue to inform approaches to art and literacy in schools (e.g., Hafeli, 2015; Kuby & Rucker, 2016).

6 Storymaking as Expressive STEM

In our university courses and professional learning workshops with teachers, expressive STEM storymaking invites participants to explore story creation with computational tools and materials, sometimes including traditional craft tools and art materials. Learners respond to stories of their choice by focusing on one or two major story elements, such as character, setting, or plot, often centering on early elementary storybooks. The goal is to stage a story or part of a story by inventing an original narrative, by transforming an existing narrative, or by responding to domain prompts from language arts, science, math, or social studies. Elementary and preservice teachers without much experience with creative computing work with computer programming platforms designed for novices, such as Scratch[1] or Scratch Jr.[2] In art education settings the emphasis is on how design choices convey mood and concept with new media principles (e.g., visual, aural, and time-based components) combined with conventional elements and principles of art (e.g., color, shape, balance).

The examples below describe expressive STEM in practice. Example 1 is from a kindergarten teacher who participated in a CT research project (Justice & Assaf, 2020); Examples 2 and 3 are from preservice art education students who participated in digital learning courses.

6.1 *Example 1: Storymaking in Kindergarten*

As part of a computer science research project, looking at classroom teachers' implementation of CT (Justice & Assaf, 2020), we observed a kindergarten teacher invite her 5- to 6-year-old students to code a computational hide-and-seek animation with words that are difficult for young readers to decode, commonly known as sight words, for example, "we," "the," "good" (Figure 13.1). After reading *Ruth Heller's How to Hide a Butterfly & Other Insects* (Heller, 1992), Bridget (a pseudonym) asked the children to respond with ScratchJr., a block-based computer programming platform designed for early readers. The book emphasized the camouflage strategies insects use in their habitats, so Bridget's guided practice focused on the word "camouflage" by asking the children to name things in their lives—that is, in their own habitats—that were difficult to see. The goal was for children to connect "habitat" and "camouflage" with

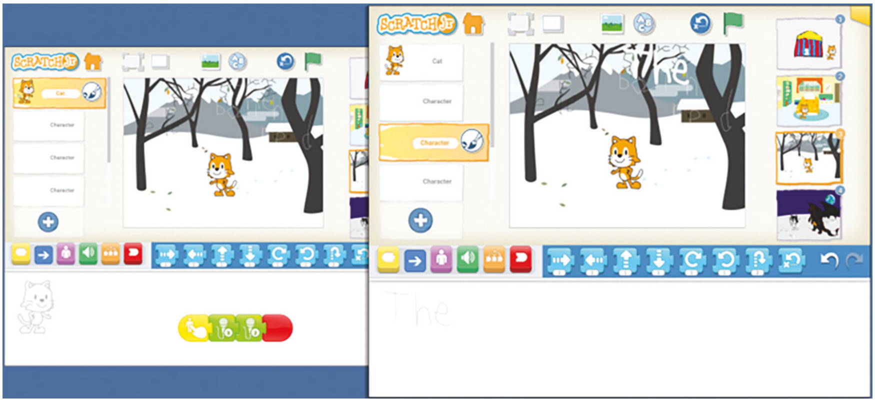

FIGURE 13.1 Camouflaged sight words in ScratchJr. The right screen shows a sight word hiding in the trees. The left screen shows the student's code: when the cat is touched, ScratchJr. will play audio made by the student of herself speaking the sight words she has hidden

things in their world and then to expand their notion of things to include sight words.

To motivate the children, Bridget talked about hiding sight words in ScratchJr. by adjusting color or scale until the words blended into the backgrounds. She also encouraged students to explore other camouflage strategies. Afterward, sitting cross-legged on the carpet, shoulder to shoulder with their partners, the children shared their strategies and identified the sight words they had chosen to camouflage.

On prior visits to her classroom, we had noticed Bridget prompting students to respond to texts with various tools and materials by drawing pictures or making collages with paper, markers, glue, tape, and miscellaneous craft materials. Here, Bridget had innovated her approach by including ScratchJr; that is, despite feeling like a novice with CT—having only recently encountered computer programming as part of our research project—Bridget felt confident enough in what she already knew about teaching and learning to trust the children to find their way with this unfamiliar tool.

And from what we could see, her innovation paid off. Every child appeared engaged and on task, playing with sight words, hiding and then revealing them against multicolored backgrounds. As we listened to their conversations, we noticed children programming animations to represent their thinking about sight words by adapting what they already knew about color, shape, texture, and scale; by comparing their knowledge of sight words with their classmates' knowledge; and by troubleshooting their projects collaboratively with their partners.

A few weeks later Bridget reflected on the lesson during a Zoom interview. When asked what she thought about how the lesson had gone, she said it had been "a home run out of the park, [because] the kindergartners [now] use the word 'camouflage' every day." (all quotations in this paragraph and the next are from Bridget, personal communication, April 7, 2022). When asked how she felt about her teaching overall, she said she had struggled to step back from instructional methods that rely on telling students what to do, that is, rather than inviting them to explore and play. She said, "It's very difficult. I've been taught to be a teacher in a certain way, and that's direct teach. That's what's expected." The challenge, she explained, was that telling students what to do might "ruin their learning moment." And she said, "I've been trying so hard to not just swoop in and be like, 'Look, let me show you how to do it—you click this, you go there, and you do this. Now, show me what you can do.' I don't want to do that. I want them to learn this on their own."

But then she added that she was committed to inquiry learning despite her misgivings because she and her students were learning together. She explained, "We already know that whenever you find something on your own and you learn how to do it, it's intrinsically woven into the fabric of your being."

6.2 *Example 2: Storymaking on the Screen*

In a digital learning course for preservice teachers, Jill Picou, a former art education student who teaches 11- to 13-year-old students in middle school, responded to a storymaking prompt with an adventure story about knights in training (Figure 13.2).

Knights of the Woods (Picou, 2021) presents an original story about a sister and her brother playing in the forest near their home. The story opens with them walking across a forest meadow. As Oliver skips along, he suggests playing knights. Emma takes charge—"Follow me!"—and imagines a training program for knighthood. "Knights are brave," she says, balancing atop a large rock. Later, she and her brother fight a dragon to protect the castle. The story is interrupted when the Queen (Emma and Oliver's mother) calls them home for lunch, at which point the castle turns back into a pile of rocks in the forest and the dragon transforms into Blaze, their golden retriever. The story ends with Emma, Oliver, and Blaze traipsing back across the meadow.

Knights of the Woods combines hand-drawn characters and original dialog with computer code that animates characters and backdrops. To amplify audience participation, Picou also programmed interactive elements into the story—for example, tapping keys on the keyboard propels the narrative. On the project homepage, Picou wrote instructions for manipulating the interactive elements as well as a list of credits. Inside the project, she explained her

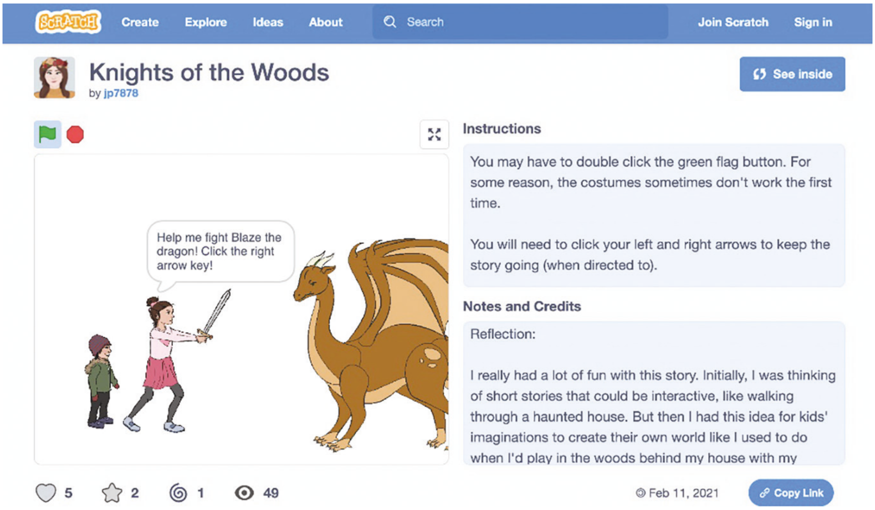

FIGURE 13.2 Interactive, screen-based storymaking. *Knights of the Woods* (Picou, 2021) combined hand-drawn characters with Scratch's stock characters and dialog, music, and creative coding to advance the narrative. To amplify reader interaction, Picou programmed keystrokes that animate the characters when tapped by a reader

computational design decisions, so readers can follow her work or borrow her code.

As evident here, Picou deployed multiple storymaking strategies, including drawing, collaging, coding, sound recording, and written reflection. This robust multimodality deepens reader interaction beyond the narrative itself. For example, on the project homepage Picou explained she had considered creating a story based on a fantasy setting like a haunted house but changed her mind after reflecting on the power of children's "imaginations to create their own world, like I used to do when I'd play in the woods behind my house with my friends" (Picou, 2021, para. 1). Inside the project Picou discussed her learning trajectory: "I learned a lot in the process of creating this story including how to create a loop of movement (changing costumes) until the sprite reached a certain x point or the backdrop changed" (para. 5). She also reflected on art, learning, and computation: "We can draw all we want, but if you can't figure out a way to create movement, then it's not animation. You have to flex both of those brain muscles and not give up on it" (para. 6).

In 2023, while writing this chapter, we asked Picou whether making *Knights of the Woods* still resonated for her now that she was an art teacher. She said it had been one of her first creative computing experiences, and that before the digital learning course, she had never worked with computer code. Perhaps because of that, she said, the storymaking prompt was valuable because "instead of just learning the specific sequence of codes, I had a goal. I was intrinsically invested in learning how to code in Scratch so I could create the story I had in mind" (Picou, personal communication, January 9, 2023).

Regarding her evolving teaching practice, Picou said story creation was woven into her art lesson plans because it enabled students to express their experiences. She added that art and literacy connections were especially important for emergent bilingual students because they strengthened written reflection, language use, and vocabulary. Beyond that, she said, positive responses to challenges like expressive storymaking helped improve students' self-efficacy. This was particularly important because, she said, her "current students seem to give up on their goals very easily when they run into the first roadblock, … [so] the whole process of troubleshooting (in coding or in any other project) is hugely applicable to [them]" (Picou, personal email communication, January 9, 2023).

6.3 *Example 3: Storymaking as Transdigital*

If You Are Given a Cookie … by Lyla Guidry (2022), a preservice art education student, is an interactive digital + physical, or transdigital (Fuglestadt, 2022), response to *If You Give a Mouse a Cookie*, written by Laura Numeroff (2015) and

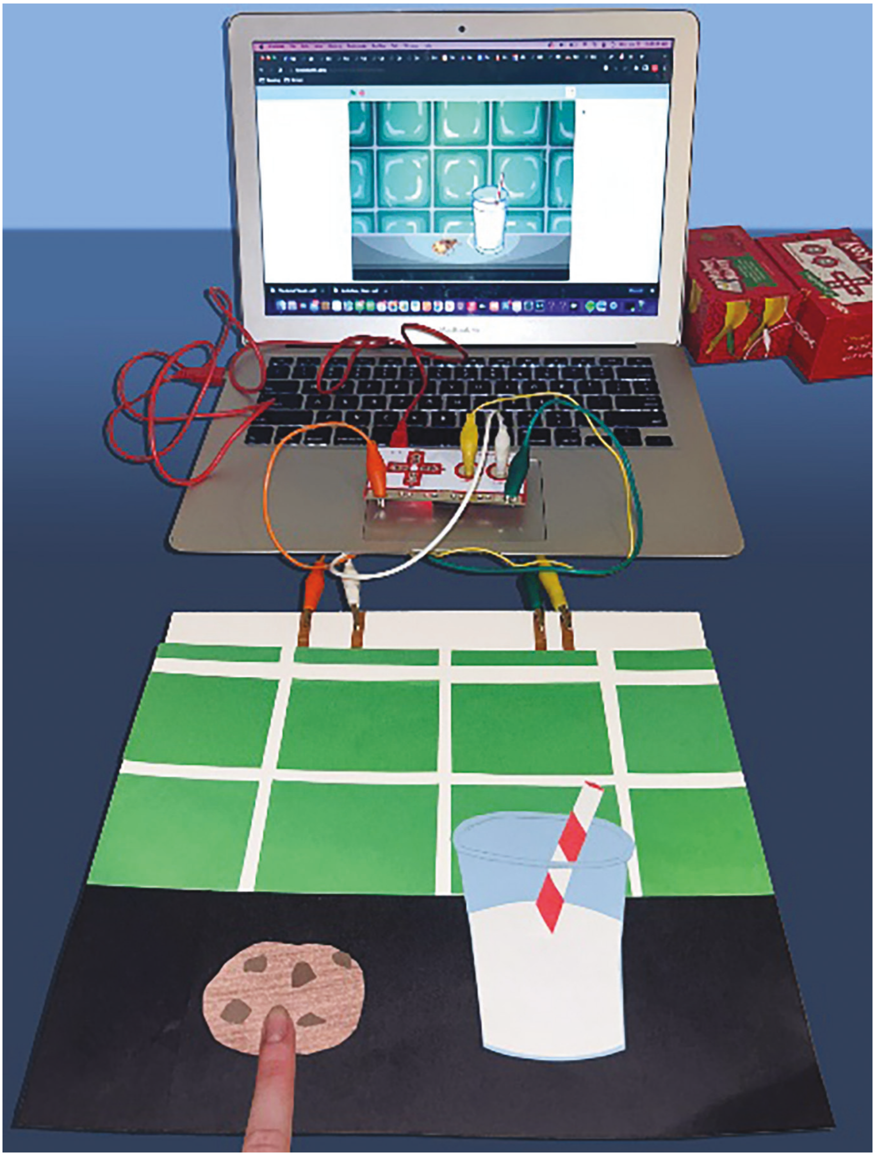

FIGURE 13.3 Transdigital storymaking. *If You Are Given a Cookie …* by Lyla Guidry (2022) is constructed from a paper collage connected to a Scratch animation with a Makey Makey®. Each touch of the paper cookie takes another bite from the screen cookie, producing a munching sound

illustrated by Felicia Bond. Guidry's project included a screen-based animation programmed on Scratch connected to a construction paper collage with embedded electronic switches made with copper tape and a separate circuit board, known as a Makey Makey® (https://makeymakey.com/; Figure 13.3).

The screen-based component can be found on Scratch by searching for its title on the Scratch homepage, but the transdigital components (the collage, the embedded switch, and the Makey Makey®) will not be visible there.

To explore storymaking, Guidry responded to the plot circularity of *If You Give a Mouse a Cookie*: Cookie leads to milk, mirror, broom, nap, story, picture, milk, and back to cookie. With the circuit-collage assembled and attached to the computer, a reader touches the paper cookie (on the collage) to take a bite out of the cookie (on the screen), producing a munching sound. Each touch of the paper cookie takes another bite from the screen cookie, and we hear another munch. After several munches nothing remains of the screen cookie except crumbs, but when the paper cookie is touched once more, the screen cookie reappears, and the touch–munch cycle can begin again. A similar touch–slurp cycle is activated when the glass of milk is touched.

In this transdigital activity storymakers coordinate diverse tools and materials (i.e., screen-based animation, paper collage, electric circuitry) to amplify reader–text interaction. In fact, the story itself invites reader interaction because physical touch advances the narrative. In addition, making the story insists on *writer* interaction because aligning these diverse components requires multiple rounds of designing, building, and troubleshooting.

As with Picou we contacted Guidry while writing this chapter to ask what she remembered about the storymaking project. She said that getting started had made her feel confused and a little disheartened. But then, while watching a classmate fold construction paper to interact with a book about butterflies, transforming paper into butterfly wings, Guidry had a breakthrough. She said that sharing that tiny bit of her classmate's experience produced a spark that lit up her own storymaking desire, and recognizing her classmate's deeper understanding prompted her to dig deeper for herself. Nearly a year after Guidry had taken the digital learning course, the power of that moment still resonated for her.

Specifically, regarding her own storymaking experience, Guidry remembered deciding to respond to a single element from the book and let the rest flow from there. That element turned out to be narrative circularity as expressed by the plot of *If You Give a Mouse a Cookie*. Guidry then created her story response centered on loops, a powerful idea from computer programming (Bers, 2021) that the class had explored in prior computing activities. Subsequently, she said, creating loops in Scratch and connecting the code to the collage via copper tape and the Makey Makey® felt childlike—like a playful exploration of eating and drinking again and again.

We also asked Guidry whether expressive STEM storymaking felt relevant to becoming an art teacher. She said storymaking connected domains that appeared independent by aligning diverse toolsets. For Guidry the activity helped her understand how a teacher might introduce unfamiliar materials to students while focusing on expressive learning and meaning making. With a reference to traditional art making tools, Guidry said, "Most materials I work with are normal to me, [so the storymaking project] humbled me a little bit since I hadn't been in that position in years" (L. Guidry, personal communication, January 9, 2023).

7 Principles of Expressive STEM Storymaking

After reflecting on expressive STEM storymaking with young children in schools, families at public libraries, preservice art education students at the university, and teachers in professional learning workshops, we have noticed that balancing the contrasting and sometimes conflicting affordances of new and traditional tools and materials can be challenging. For example, in a transdigital activity, preservice art students might be comfortable expressing themselves with picture-making materials but frustrated by copper tape, circuit switches, Makey Makey®s, and Scratch. We see the same thing but in reverse with computer science students who hesitate to engage with drawing or collaging. The situation is similar with most other learners, too, the first time they encounter Scratch or ScratchJr. or any number of other expressive STEM materials. Nevertheless, as illustrated in the examples above, learners dig in, become deeply engaged, play, and explore purposefully, iterate and troubleshoot, adapt themselves to failure, and above all, share the storymaking process with their community of learners.

The following principles of expressive STEM storymaking have been gleaned from more than 10 years designing and implementing creative computing learning activities. Some are evident in the examples described above, but others have not been explicitly discussed; for example, we did not describe the classroom setup and only briefly mentioned the importance of *noticing* rather than *assessing* as a way to spark storymaking desires. Thus, the list is not a catalog of best practices; instead, along with resources listed in the Appendix, the list might help as a framework for starting with expressive STEM storymaking even for teachers with little experience with creative computing.

8 Ten Guiding Principles for Expressive STEM

1. Invite responses to multimodal text(s) as an experience of meaning making rather than as an exercise of tool use.

2. Encourage exploration of the way tools and materials express differently, for example, hard graphite vs. soft charcoal; fast, skittery motion vs. slow, smooth motion; looped percussion vs. continuous melody; interactive touch via the keyboard vs. a transdigital collage, also known as an *interface* (Justice 2019, 2020).
3. Facilitate collaborative interactions between learners and story elements or domain prompts by focusing on interpersonal relationships; for example, rather than focusing on simple appearances, ask, "How would it feel to be in this setting or with this character?"
4. Minimize instructional talk to allow time for exploration, iteration, and purposeful play with examples, tools, and materials.
5. Maximize multimodality of learning resources, for example, demonstrations plus videos plus handouts plus websites plus instructional manuals plus safety data sheets and more.
6. Design participant-led show-and-shares that emphasize noticing instead of assessment; for example, after sharing their work, learners ask each other, "What do you notice about my project?"—not, "What do you like?"
7. Arrange the classroom or studio with large tables instead of individual workstations to enhance learners' interactions with one another.
8. Share models and examples instead of step-by-step instructions.
9. Make sure tools and materials are visible, plentiful, and multimodal, for example, digital, computational, and traditional craft or fine art.
10. Intersperse reflective turn-and-share moments with uninterrupted making and building.

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Notes

1 https://scratch.mit.edu
2 https://www.scratchjr.org/

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Appendix

Resources for getting started with expressive STEM storymaking activities.

Creative Computing

- Scratch. https://scratch.mit.edu/
  Create stories, games, and animations. Share with others around the world.
- ScratchJr. https://www.scratchjr.org/
  Coding for young children.
- Creative Computing Curriculum. http://scratched.gse.harvard.edu/guide/
  Ideas, strategies, and activities for an introductory creative computing experience using Scratch.
- Scratch Foundation. https://www.scratchfoundation.org/
  Supporting creative coding for everyone.

Transdigital Making

- Makey Makey®. https://makeymakey.com/
  Invention kit for the 21st century. Connect the world to your computer!
- micro:bit. https://microbit.org/
  Get creative, get connected, get coding! The pocket-sized computer transforming the world.
- the Interface. http://seanjustice.com/interface/
  This website contains instructions for a transdigital computational making activity.

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Jonah B. Firestone
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Don McMahon
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has conducted research on a variety of technology-based interventions for individuals with disabilities, including mobile devices, video modeling, communication tools, podcast-based read-aloud testing accommodations, augmented reality applications, and virtual reality. In summer 2011 he was selected to attend the Harvard Graduate School of Education summer institute on universal design for learning. Dr. McMahon has 12 years of experience involving inclusive postsecondary education. A cofounder of the WSU ROAR program, he has served as its director.

Isao Ohashi
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Vedat Özsoy
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