Research & Policy

Bringing Together Multimodal Composition and Maker Education in K–8 Classrooms

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This article makes a case for integrating multimodal composition in language arts classrooms, presenting core features and practices of multimodal composition workshops and maker spaces and showcasing promising projects.

It's an early spring night at Otter Elementary School, and the maker space is pulsing with intensity as children excitedly share their multimodal composition projects with parents, teachers, and administrators. There are sounds of curiosity, wonder, and laughter as participants watch animation videos and green-screen news broadcasts; touch and listen to tactile fables composed with craft materials, Braille, and Makey Makey sound; view colorfully designed digital posters on internet safety; and read multimodal shoe poems. Working in collaborative pairs, children are eager to explain how they created their projects with digital tools and materials to achieve their vision. Matt shyly shows some parents how to press a 3D grasshopper button to complete a circuit and make a chirping sound for his tactile fable, "The Ant and the Grasshopper." Estella and Annie pose in front of a green screen, gesturing to show how their news story about saving wildlife was filmed and produced with photographs in the background. Audience members rotate around the room, munching on cupcakes and filling out sticky notes on the Composers' Wall for each child to take home at the end of the evening.

Finally, the energy wanes and the room is filled with hugs as children say goodbye to the graduate students who have been their coaches throughout this after-school digital literacies workshop. Parents and children call out thanks as they exit the door for home and dinner. The maker space is suddenly quiet, yet the felt emotions around it—joy, pride, playfulness—linger on. I am filled with my own feelings of happiness and gratitude (and, yes, relief). As the graduate students and I quickly move to set up the space for another busy school day, I wonder, how can we bring these kinds of engaging compositional experiences into more students' regular school day and language arts curriculum?

The opening vignette describes a celebration of children as multimodal composers. Working with graduate students enrolled in a digital literacies course that I teach, the children created a series of composition projects, creating images, sound, video, words, and tactile materials with digital tools. In partnership with a local elementary school, we intentionally located this nine-week after-school children's workshop in the school's maker space. We wanted to expand notions of what it meant to be a composer, with the hope of shifting from the kinds of writing instruction that dominates many classrooms to a focus on designing communicative messages that may include writing or may be expressed through other modes such as image and sound. We also chose the maker space because it fit with our emphasis on "making" composition products for an authentic audience, using tools, materials, spatial arrangements, and practices that are common to maker education (Halverson & Sheridan, 2014) and that resonate with writing workshop practices. I believe that language arts educators are more likely to realize our goals for developing children as writers and multimodal composers when we fuse composing and making.

I begin this article by laying the foundation for multiliteracies pedagogy, focusing on the New London Group's contributions to our understandings of literacies and multimodal composition. I then discuss the benefit of connecting multimodal composing and making, drawing on core practices of maker education and multimodal composer workshops, followed by a discussion of the importance of tools in mediating composition goals and processes. I feature three promising multimodal projects to show the varied ways in which multimodal composition is enacted with children at different age levels and in different contexts. Finally, I examine three tensions constraining progress related to the U.S. Common Core State Standards (CCSS), high-stakes testing, and the need for professional development support:

1. A strong vision for multimodal composition in the CCSS, but limited guidance regarding what students should know and be able to do;
2. High-stakes assessments that focus on print-based writing, coupled with a lack of informal classroom tools for multimodal composition; and
3. The need to support teachers' professional development in multimodal composition.

Foundations of Multiliteracies Pedagogy: Multimodal Composition

As Dyson notes (1990), literacy is multimodal, and it always has been. Throughout history, children's stories have come alive by being drawn, written, performed, and shared with audiences. But today's multimodal literacy is not yesterday's literacy: we now live in a networked social and material world that offers unparalleled access to digital tools, technologies, media, information, and people. This hyperconnectivity is not neutral—it is used for varied purposes, and these purposes are always politically and socially constructed. The democratizing aspect of digital literacies is thus tempered by the potential for oppression, hate, and fear to spread unchecked across time and space. These challenging times require that we develop students' critical perspectives as they consume and produce content on the internet (Janks, Dixon, Ferreira, Granville & Newfield, 2014).

As we seek to develop powerful and critical multimodal composition pedagogy, it is useful to look back to the influential work of the New London Group (NLG, 1996), which offered a new pedagogy of multiliteracies. The NLG argued for an expanded view of literacy that reflected an increasingly diverse and globalized world and rapidly evolving information and communication media and technologies. They envisioned a multiliteracies pedagogy that developed students as critical and fluent consumers (readers) and producers (composers) of print and digital texts for purposes of personal, academic, work, and civic engagement.

A key understanding of the NLG was that we communicate through multiple modes—image, sound, movement, and words—that are culturally and historically constructed and situated in particular contexts and practices. Further, modes carry affordances, or potentials for expression; for example, video is likely to better represent a timed sequence of actions such as a car chase or heart operation than a written description or image (Jewitt, 2006; Kress, 2003). And while we commonly represent something in one mode (e.g., a written text with no illustration, an audio podcast), today's communications are increasingly multimodal, combining one or more modes to express something that is more than its parts. For instance, although a digital story with images and music may be composed as two layers within a video-editing program, the story is played and viscerally experienced as a single unified piece.

The NLG presented "design" as a core pedagogical concept, positioning students as active designers who are learning to understand the historically and culturally constructed nature of designs and who remix these designs to make new meanings and, in some cases, critique the status quo. For example, in a public service announcement (PSA) video, two children convince their friend not to litter (https://www.youtube.com/watch?v=zeLyF1oObpU). They open with an everyday scene, chatting and eating together. When one child throws his paper plate into the yard, his friends take him into the yard to demonstrate how his actions will negatively affect the environment. They end their

PSA with a dramatic montage of video excerpts drawn from popular culture and nature shows, such as horses galloping on a beach and a koala sleepily waking up in a tree. For their parting shot, they return to a high-energy positive message, remixing the familiar "Go, Team!" chant by putting their hands together and cheering, "Go Nature!"

The children's PSA shows that they understand how PSAs work as a genre of communication that is designed to influence an audience by appealing to logos (information about the littering problem), pathos (emotionally appealing nature video), and ethos (the message to do the right thing and protect the environment). Not too long ago, producing a PSA video would have been beyond the reach of many children and teachers. Today, the ubiquity of less expensive tools and easy access to online content has contributed to remixing the PSA as a new compositional practice whereby youth customize and combine content and media to produce unique creations (Knobel & Lankshear, 2008).

The NLG conceptualization of multiliteracies has been foundational to our field, especially in regards to multimodal composition. Not surprisingly, the group's theorization of a multiliteracies pedagogy has been critiqued, with some scholars pushing to increase the role of critical perspectives (Mirra, Morrell, & Fillipiak, 2018) and others arguing for the need to theorize and teach multimodal composition as an embodied, affective experience that is diminished or unrealized when we over-rely on teaching students the logic of design and strategic use of modes (Ehret, 2018; Leander & Boldt, 2012).

Multimodal Composing Research

Although schools still tend to focus on the teaching of writing, the broader view of composition described above is part of the vision presented in both the CCSS (2010, 2012) and state standards, as well as in position statements and standards from the National Council of Teachers of English (http://www2.ncte.org/), the International Literacy Association (https://www.literacyworldwide.org), and the International Society of Technology Education (https://www.iste.org/). Teachers and the public are also generally in agreement that students need to know how to compose and communicate for a variety of purposes in print and media formats, using a range of tools and media to achieve their goals. However, the standards often lack specificity, and instructional frameworks and practices are still emerging as teachers and researchers work to develop theory and practice to guide teachers in the classroom (Dalton, 2012/2013).

We do have a sufficient base of research and practice to support moving forward more aggressively to integrate multimodal composition in classrooms.

Clearly, there is much to learn; however, we do have a sufficient base of research and practice to support moving forward more aggressively to integrate multimodal composition in classrooms. A growing body of research shows the benefits of multimodal composition (for reviews of theory and research, see Mills, 2015; Smith, 2014). Children and youth tend to enjoy working on multimodal composition projects, and doing so supports their identity development as communicators who have particular interests that are worth pursuing and expertise that is meaningful to themselves and to others (Hull & Nelson, 2005; Vasudevan, Schultz, & Bateman, 2010). Expanding the communication palette beyond writing offers new opportunities for students, and especially for those who do not view themselves as writers in traditional literacy contexts (Dalton & Jocius, 2013).

Studies also demonstrate that students develop academic, technical, and social skills as they create, communicate, and connect around their multimodal compositions (Rowsell, Lemieux, Swartz, Turcotte, & Burkit, 2018; Schmidt & Beucher, 2018; Smith, Shen, & Jiang, 2019). As one example, fifth graders composing multimodal retellings of folktales learned about this genre of storytelling and modal affordances as they worked to express plot, setting, character and theme through images, audio narration, and music (Dalton et al., 2015). Through the process they also learned technical

skills such as animation, image customization, and audio-recording.

Research also highlights the complexities and challenges of multimodal composition. Several studies have shown that although children generally report that they like to collaborate, they can also find it difficult to navigate roles and responsibilities, with some children relegated to the periphery of the activity and others dominating access to the tools or control of ideas (Jocius, 2018; Schmidt, 2016). One promising strategy has been to identify roles needed for a particular project (e.g., scriptwriter, image collector, sound producer) and having students take the lead on a particular role (Jiang, Shen, & Smith, 2019; Rowsell et al., 2018).

Research suggests that children tend to enjoy composing authentic products with different tools and modes and that they develop important identities and skills through composing. However, integrating multimodal composition in the classroom offers challenges as well, including how to support children as collaborators and teach skills embedded in meaningful literacy contexts. In the next section, I make a case for how composing and making can go hand-in-hand to support children in becoming engaged and powerful designers of communication.

Connecting Composing and Making

There is growing interest in maker education in today's schools. Maker education draws on constructionism (Harel & Papert, 1991), which extends Dewey's (1938) constructivist theory that we learn by doing. Key principle and practices associated with effective maker spaces (Halverson & Sheridan, 2014) include features advocated in multimodal composition workshops where communities of learners work together to draft, revise, edit, and publish their work for an audience (Hicks, 2009). Maker spaces are social communities and physical places (with virtual online extensions) that offer tools, materials, and expertise in a community of makers. Makers engage in interest-driven and/or problem-based design and fabrication of products. Creative tinkering is valued, with some products iterated over time to a final version that is shared with a public audience and others abandoned early on in the design process. Participants bring expertise to the community and benefit from the shared knowledge of the other members. They have access to a variety of tools and materials that are used by professionals. Membership is fluid, but many maker spaces provide informal feedback to users and offer workshops to develop skills.

Inspired in part by initiatives to increase student participation in STEM disciplines and in part by the popularity of maker spaces in libraries, museums, and other informal learning settings, increasing numbers of schools are investing in developing maker spaces for teachers and students. They are experimenting with different physical spaces and types of learning experiences, ranging from after-school robotics clubs to projects that are embedded in a particular curriculum unit, such as a circuitry science project on the design and fabrication of e-textiles (Searle, 2019).

An important reason for integrating maker education and multimodal composing is the profusion of technology now available to students. Although there is a continued digital divide in the kinds of resources and experiences available in schools, libraries, community centers, and homes, many schools and families have at least some access to digital tools and media. Importantly, many teachers are moving from relying on computers primarily for editing and publishing student writing to using a range of devices and apps to develop students as communicators who compose with story-making apps, record podcasts, design games, and produce videos. For some youth, out-of-school access to technology makes a huge difference as they follow their interests and passions to produce content and participate in online communities (Ito et al., 2010).

Both the multimodal composing workshop (MCW) model and maker education position learners at the center, following their interests, although in MCWs interests, may be guided by choice of tools and modes rather than choice of topic or problem. Both frameworks focus on production; learners design and "make stuff," over time and with feedback, for an authentic audience. Both approaches also involve the use of tools and practices that are authentic in the outside world, and both take place

within a community of learners and involve collaboration and reflection. Finally, both MCWs and maker spaces engage learners in designing for an audience, although this can be more challenging to realize in classroom settings than in maker spaces. While they share core features, MCWs pay greater attention to alignment with academic standards, the development of literacy and technical skills, and instructional scaffolding. Further, classroom communities tend to be more stable than maker spaces, which feature fluid membership and time limits.

The importance of maker education for composing can be seen in Build a Better Book workshops, where children and teens design and fabricate books and games for children who are visually impaired (https://www.colorado.edu/project/bbb/). In one example, upper elementary students' retold fables in a tactile format; a more common form of retelling might include a written story with an illustration. In this case, students composed their retelling with craft materials, recorded audio sound effects and narration using a mobile phone recorder, created sound circuits with Makey Makey, and programmed the sounds to play on Scratch. They used a Brailler to compose the title and illustration caption. In this context, materials, tools, programming, and visual, sound, and tactile modes played a prominent role in the design and fabrication of the fables.

The Importance of Tools in Multimodal Composition

Educators generally agree that technology should be used in service of rich learning goals and experiences. In other words, cool tools, such as a virtual reality headset or comic book animator, should not drive instruction. However, some push this point to an extreme, arguing that the tools and media resources do not matter and that students should just work with whatever is available. They contend that youth will be strategic in bringing in their own digital devices and resources to accomplish their goals. This perspective has merit; it is true that many, perhaps most, youth engage with technology and media outside of school. However, that engagement might be limited to what is possible on the family cell phone, or may be focused on a particular interest, such as gaming or posting photos. For composing-making purposes, it is important to become digitally fluent and to know how to take advantage of available tools and media resources. Precisely because they offer affordances, tools and modes matter. For example, I chose an animation app instead of a video app for children to use in making short animation videos because it simplified the process, allowing students to focus on shooting their scenes rather than on video production. Students more experienced with animation storytelling and production would benefit from using a video editor app that offered more features to support their multimodal storytelling.

Another factor to consider is that the functionality of the tool interface and available features can either support or constrain students' composing practices and products (Gilje, 2011; Smith, 2017). For example, in one study, a student who viewed herself as a visual artist fluently used an image special effects tool to quickly try out multiple options for her multimodal literary hypertext (Smith, 2017), while in another study, students abandoned their original creative vision because of their frustration with their video tool (Gilje, 2017).

An underexplored aspect of tool use, and one with tremendous implications for classroom practice, is the way in which tools mediate collaboration, a valued practice in composing-making workshops. For instance, Schmidt (2016) provides a rich account of the ways that three grade 5 girls engaged in overt and covert moves to co-create and control their design of a slideshow about award-winning author Jacqueline Woodson. Sitting side by side on the floor, they worked on individual tablets, but within a single, shared Google slideshow. This meant that any member of the group could change the others' work without consultation. This often caused conflict, with the original composer sometimes changing her work back to the original without comment or scolding her partners for "messing" with her work. However, the collaborative design space also supported the girls' composing in positive ways, facilitating co-design as they instantaneously saw and reacted to one another's inputs by offering feedback and applying design features to their own slides.

It is also important to pay attention to the choice and use of tools and apps as a matter of equity. Unsurprisingly, students attending more affluent schools have more opportunities to engage in interest-driven projects with tools that support composing and making than do students attending underserved schools (Herold, 2017). Schools also vary in their policies concerning use of personal devices such as cell phones. When norms are developed to guide appropriate use for academic learning purposes, students may creatively use their cell phones to support multimodal composition at all phases, from audio-recording plans to searching for information and images in heritage languages and English to producing a video and posting it on YouTube. However, some schools and teachers place a greater emphasis on managing and controlling students than others, restricting their opportunities to use mobile technologies as personal tools that support composition and communication work.

Learning from Promising Multimodal Composition Projects

To further explore multimodal composition features and practices, I will now share three different kinds of projects—one in a pre-K classroom, one in a summer writing camp for six- to eight-year-olds, and one in a middle school classroom and afterschool program.

Project 1: Children as Multimodal E-Book Authors of Their Own Lives

The first project offers an easy and powerful entry point to multimodal composition in pre-K and elementary school classrooms: children authoring their own e-books. Over the course of two years, Rowe and Miller (2016) collaborated with a Pre-K teacher to design and enact a writing center that offered emergent bilingual children opportunities to author multimodal, multilingual e-books. Using iPads, disposable cameras, and three apps—Drawing Pad, Book Creator, and iBooks—the children composed multi-page e-books with drawings, photographs, writing, and audio-recordings both in their heritage language and in English (see Figure 1). Children's e-books were shared during class and were available in the class library for children to listen to and read. Second-year findings revealed that all children were able to create a multimodal e-book that included audio-recordings in their heritage languages (with embedded translations from community members). Images served as anchors for their composing, connecting to audio-recorded speech, emergent writing, and other visual design elements (color, spatial arrangement, etc.).

Figure 1. A young child composes on her iPad using the photo, drawing, and writing features of the Drawing Pad and Book Creator apps. Permission to print from Rowe, unpublished data, 2019.

This rich language and literacy experience reflects MCW and making principles: students followed their interests as they took photographs at school and at home of objects, people, and places that were important to them. They used tools that were developmentally appropriate (e.g., a child's disposable camera, Drawing Pad and Book Creator apps), as well as the popular mass-market iPad device. Although some of these tools are designed for children, they offer similar functionality to tools used outside of school by older youth and adults. Children composed for an authentic audience of peers, teachers, and family members, sharing in person and through their iBook library collection. The adults (teacher, researcher-teachers, parents, and community members) demonstrated and valued children's cultural and linguistic knowledge, provided just-in-time support during their composing practices, and served as the audience for their stories. This was an embodied literacy experience for children, as they traversed across class, school, and home to write, draw, and talk about their lives with one another and with the help of tools and apps.

Project 2. Children As Sonic Story Composers Through Wearable Technology

The context of the second project is a university-based summer writing camp for children. Wargo, the researcher, collaborated with a teacher to design and enact a sound-based multimodal composition experience for a group of students, ages six to eight, using wearable technology, iPad Minis, digital cameras, and Final Cut Pro (Wargo, 2018). The primacy of tools and apps and flexible indoor and outdoor production spaces positioned children to be sonic story makers. After listening to a read-aloud of Paul Showers' picturebook *The Listening Walk* (1993), children headed outside to re-author his book, working in teams to capture sounds, video, and photographs as they walked through campus to create their own listening path. Each child had a turn to be the lead author, wearing a GoPro camera with headset and boom mic, while others took photos and recorded video on mini-iPads (see Figure 2). Children eagerly entered into this visceral experience of composing with their bodies in a physical, material, and social space that was also imaginative and fantastical: "I'm writing with the ground and with the tree," Iris declared, as she moved with her GoPro mounted on her head. "This is the perspective of an ant. I am the ant. The GoPro's sounds are the ant's sounds. They are our sounds" (Wargo, 2018, p. 514). Later, with the teacher's support, these composers viewed their raw video and other media, drew storyboards for their segments, and used Final Cut Pro to co-edit and produce a final eight-minute soundscape and video version of their listening walk.

Figure 2. Candace examines her wearable with an iPad mini. Permission to print from Wargo, unpublished data, 2019.

Wargo (2018) compellingly argues for viewing this kind of embodied, affective multimodal composing—young children making stories with wearable technologies and focusing on sound—as a new form of production that is more equitable by expanding who is a composer, how they engage in composing processes, and what counts as a composition. When this multimodal composing experience is considered from a composing-making framework, key features are students' choice and freedom to construct their own sonic compositions using tools, space, and people in ways that make sense to them; students' use of digital tools and practices that are also used outside of school; and students composing stories for an authentic audience. Although the entire event took place in one day, children work-played with their products in collaboration with peers and adults, guided by feedback and their own reflections.

Project 3. Youth as Multimodal Sci-Fi Composers and Change Agents

The final composing-making example, Project Imagine the Future (Project IF, http://imaginefuture.org), was first developed as an after-school program before being applied to a grade 6 classroom, where students used STEAM and literacy skills to collaboratively compose multimodal science fiction exploring oceans and proposing solutions to climate change (Jiang, Shen, & Smith, 2019; Smith, Shen & Jiang, 2019).

Working within an MCW framework, students shared the roles of scientist, designer, and writer to learn about climate change. They developed multimodal composing design skills by creating a sci-fi text with embedded images, video, sound,

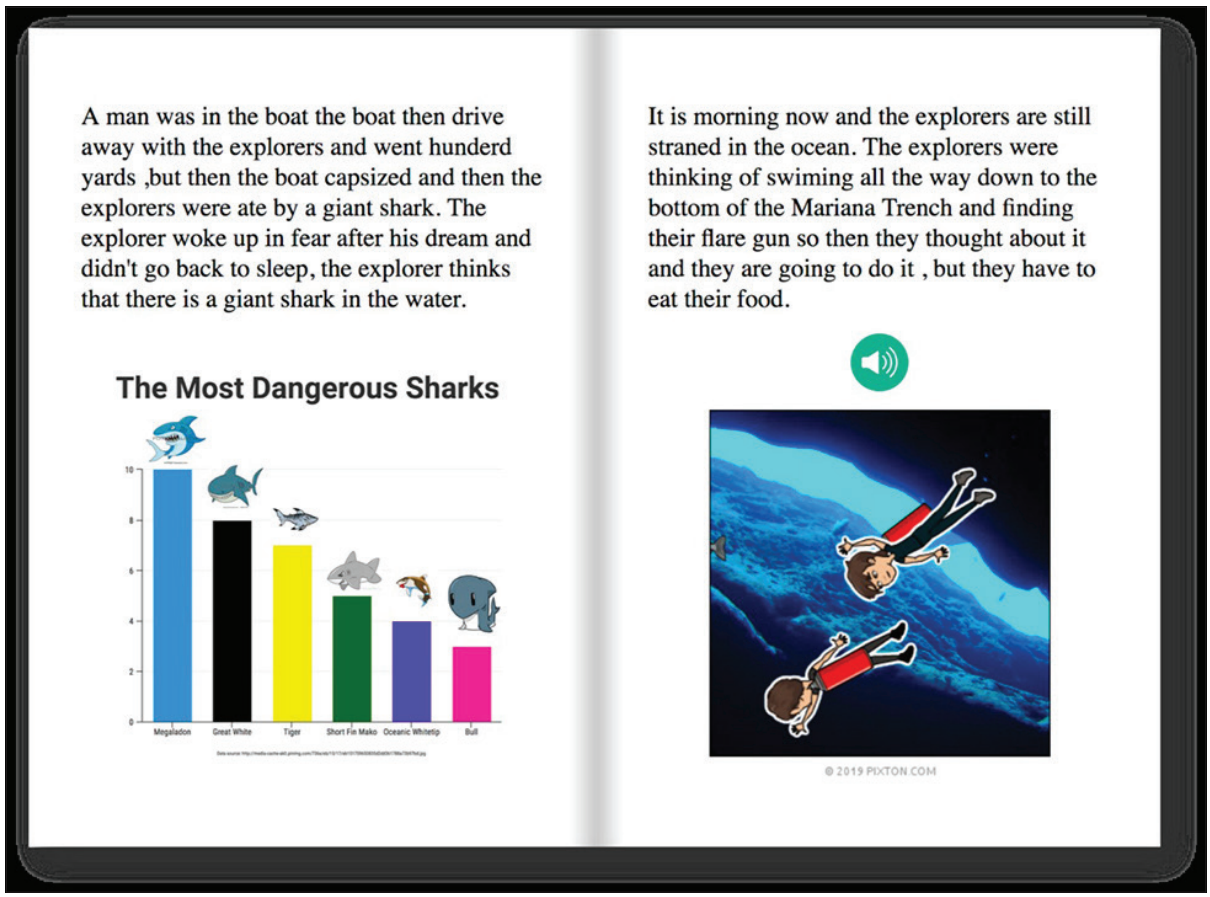
infographics, comics, and text (see Figures 3 and 4). They also developed technical skills, working with such digital tools as Scratch, Pixton, Venngage, and MovieMaker. Students connected with community experts (a sci-fi movie director, a sci-fi author, and different scientists) and went on field trips to the local university's biology lab and sustainability initiative. After rounds of composing and feedback, students shared their multimodal stories online and at a local international sci-fi film festival.

Figure 3. Students collaborate on their sci-fi projects.

Smith and colleagues found that children who participated in Project IF developed identities and skills as multimodal composers and change agents who could contribute to the conversation about global warming that was taking place in their beach community. Evidence showed that the children learned science content, and some expressed interest in future STEAM experiences.

Project IF exemplifies rich multimodal composing-making in both classroom and afterschool contexts. Following common maker education and multimodal composing principles, students pursued their interests, generated solutions to the very real problem of climate change through their

Figure 4. This example comes from "The Aqua Doods," a sci-fi story centered on ocean exploration. Along with written narrative, students incorporated a comic, infographic to display information about "the most dangerous sharks," and dramatic music that sets the tone for the scene. First published in *Voices from the Middle,* 26.4, May 2019, p. 52.



multimodal sci-fi stories, connected with experts in the community, worked with tools and practices that professionals outside of school use, designed and produced their science fiction over time with ongoing feedback and reflection, and shared their work with an authentic audience through social media and by participating in a film festival. Finally, most students were emergent bilinguals, a group that is generally under-represented in STEM academic courses and professions (National Academies of Sciences, Engineering, and Medicine, 2018).

Addressing Tensions Impeding the Integration of Multimodal Composition

Clearly, multimodal composition is becoming a dominant medium of communication outside of school. At the same time, print-based writing remains important both in school and in the world at large. Students deserve to develop as communicators who are able to express themselves both through writing and through multimodal composing (which may include writing as one mode in combination with other modes). One is not pre-requisite to the other; both writing and multimodal composition should be part of literacy instruction from the start and should be integrated across the disciplines.

Students' decisions to write or design a multimodal composition depend on their purpose and audience, the tools and modes available to them, and the availability of mentors to guide them during various phases of the process. These mentors are likely to be a combination of teachers, peers, community members, and experts found online. Fusing composition and making contributes to a more complex learning environment, one that will require some shifts in teacher roles and school resources. In the next section, I describe three tensions that need to be addressed to help teachers make this transition toward composing as making.

The Standards Tension

In many U.S. classrooms, it is a commonplace practice to write the state standard that is being addressed in the day's literacy lesson on the board for all to see. Sometimes, the teacher and students read the standard aloud. Teachers typically don't have a choice in this practice; it is required. The problem is the mismatch between the Common Core vision and the specific ELA standards. The Common Core advocates teaching children to be critical and creative multimodal composers. However, the specific Common Core and various state ELA standards, are far more restrictive, focusing on using digital tools to support publishing of texts, enhancing presentations with media, etc. Thus, it can be challenging when faced with the requirement to 'write the state standard on the board' for the day's multimodal composition workshop.

The standards must not be allowed to restrict what we know we should be teaching. My own approach is to write the standards for a particular session based on the vision presented in the standards and ILA/NCTE position papers. I find a connection to at least one of the item level standards, and then use my own language to represent the focus of the session's learning experience. I also add International Society for Technology Education (ISTE) standards, although it is not required. For example, Table I shows how to reference literacy

Table 1. *Connecting Multimodal Composing with Literacy and Technology Standards*

Standard	Standard statement and class focus for an eBook making class project
CCSS.ELA-LITERACY.W.3.3	"Write narratives to develop real or imagined experiences or events using effective technique, descriptive details, and clear event sequences." Class Focus: We are writers who are composing with our words, sound, and image, using digital tools and media.
CCSS.ELA-LITERACY.W.3.6	"With guidance and support from adults, use technology to produce and publish writing (using keyboarding skills) as well as to interact and collaborate with others." Class Focus: We are using the Book Creator app to design, produce, and publish our stories.
ISTE Standard: Creative Communicator	"Students communicate clearly and express themselves creatively for a variety of purposes using the platforms, tools, styles, formats and digital media appropriate to their goals." Class Focus: We are expressing our stories with images, sound, and writing to entertain our audience and will share eBook versions of our stories with our classmates and families on our class blog.

and ISTE standards for a multimodal composing experience where third graders are composing an e-book story with image, sound, and writing.

The Multimodal Assessment Tension

A major stumbling block to fully integrating multimodal composition into the classroom is the current high stakes testing focus on print-based literacies (note that although this is changing, it is more likely the case in the area of reading and online inquiry than writing and communication). Many teachers feel the pressure to prepare children to succeed on specific kinds of writing tasks, such as writing an argumentative essay, leaving little time for multimodal composing. One response to those who question the need to support students in becoming both writers and multimodal composers is to point to the profound disservice to children that we commit when we restrict teaching only to what can be measured on a standardized test. Another response is to reference the growing evidence that composing across modes and tools benefits children's learning and engagement. For example, composing a video PSA can be connected to writing a PSA message and to designing a PSA visual (Compose Our World Curriculum Team, 2019). Across these formats and genres, students are learning how to persuade and to construct an argument. Composing in different modes and with digital tools can also be a powerful motivator to engage in the underlying learning processes. The field abounds with accounts of children and teens who discovered their voice and identity as composers through multimodal work (e.g., Hull & Nelson, 2005; Ito et al., 2010; Rowsell et al., 2018).

Assessment further restricts the role of multimodal composition in literacy learning because it is unclear how best to evaluate progress with modes, media formats, and genres. What constitutes a high-quality podcast with an intent to persuade? To inform? To make us laugh and remember? How is a digital story different from an animated video scene? Rubrics are available online for some of the more common forms of composition, such as PowerPoint presentations or certain kinds of digital story (e.g., the personal narrative photo story). These rubrics often address the traits of the particular genres and formats, multimodal design, and technical quality. However, because a multimodal composition is an aesthetic experience that sometimes feels more like an art than a science, these rubrics can fall short when applied to a particular piece. Further, multimodal composition rubrics generally do not reflect criteria that are highly valued in maker education spaces, such as problem solving during the design and fabrication phases, strategic use of tools, and sharing expertise with the learning community.

An approach that serves both a learning and assessment function in composing-making spaces is to have students explain their work, voicing their goals, describing their design choices and processes, and highlighting moments of triumph and problem solving. This can be shared in writing, in annotations on the piece itself, and in an oral presentation or conference. Some teachers ask students to document their process by taking photos or video clips and preparing a brief video self-assessment report. When these are shared, peers can post comments so that everyone learns from everyone else. Finally, students can generate their own criteria after reviewing several examples that vary dramatically in terms of potential audience impact to figure out what they think contributes to a more or less successful product.

The Teacher Identity and Professional Development Tension

Recent surveys show that many educators generally value technology and believe it is important for students to become fluent digital readers, writers, and learners (McNeil, 2016). They also value developing digital citizens who care about their world (Baker-Doyle, 2017). At the same time, teachers express the need for more help integrating technology and literacy in their classrooms. Many focus on students' consumption of digital resources and online media, relying on computer-based supplemental reading programs, skill-building programs, and access to subject area text and media resources. They may feel less prepared to tackle multimodal composition, except to use the default slide-show

and video tools that are frequently found on their classroom tablets. Although teachers may be very skilled at composing for their own purposes outside of school (e.g., by writing a blog or posting to Instagram), teacher preparation and professional development programs are lagging when it comes to integrating technology into instruction. Too often, professional development fails to meaningfully connect the use of instructional tools to the curriculum.

Teacher study groups and professional learning communities have demonstrated their effectiveness in other areas (DuFour, DuFour & Eaker, 2008), so it makes sense to use them for instructional technology, too. For example, one team might decide that a priority is to develop their students' critical reading and reporting of the news. They decide that they want students to take on the role of news reporters, using green-screen technology and video. In preparation, the teachers come together in a digital literacies workshop to research and video their own news reports. They critique their process and evaluate the tools, making choices about what might best support their students. They generate a plan and develop some mini-lessons about the art and craft of news reporting, including oral performance with a green screen and use of transitions, online text, and voice-overs. The teachers try things out with their students, continuing to meet weekly to share successes, troubleshoot problems, and review student work with the goal of better understanding what is possible. When they are ready, they end this phase of their digital literacies workshop and identify their next PD project.

It is this kind of teacher-led and -supported PD that is likely to be sustained and to make a difference, since it focuses on teachers' interests and needs in a collaborative context. In addition to the teachers' investment in this process, it is also important to have administrator buy-in and support, access to onsite tech support, and sufficient access to the technology itself. Heavy investment in a particular tool is unlikely to pay off in the long run; instead, a more productive approach is to focus on students' multimodal experience and what can be composed with particular tools, including basic production apps that come with most tablets and laptops (International Literacy Association, 2018).

I believe that fusing composing and making offers a powerful leverage point for integrating multimodal composition into literacy and STEM instruction.

Conclusion

Multimodal composition is multifaceted, requiring knowledge and experience designing with varied modes and a wide range of constantly evolving digital tools in service of specific learning goals. In this article, I have focused on students as composer-makers because I believe that fusing composing and making offers a powerful leverage point for integrating multimodal composition into literacy and STEM instruction. Multimodal composition expands the communication palette and thereby contributes to more inclusive and equitable learning experiences. As the opening vignette illustrates, multimodal composition can engage students in rich learning experiences composing and making products. Along the way, there should be moments of joy and play.

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