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Hacking Toys and Remixing Media: Integrating Maker Literacies into Early Childhood Teacher Education

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Abstract

This study examined a literacy playshop curriculum that integrated *maker literacies* (i.e., collaborative play, toyhacking, filmmaking, video-editing, and remixing media) in two US teacher education classes with approximately 60 university students. Students engaged in digital puppetry activities using makerspace tools, iPads, and puppetry apps for young children. The students used craft materials to hack or redesign the children's favorite media characters action figures to make interactive puppets for original films and for teaching a filmmaking lesson with a young child. Nexus analysis of literacy playshop activity analyzed pre-service teachers' knowledge of seemingly "intuitive" digital literacies as a nexus of practice, or the tacit expectations, social practices, and text conventions in viral videos or computer apps that become engrained through engagements with immersive and embodied technologies. The chapter concludes with a summary of maker literacies and implications for early education gleaned from the complex interactions around teaching and learning through collaborative storytelling with iPad touchscreens.

Introduction

We are long overdue for a retooling of early literacy education to accommodate widespread fast-paced technological innovation. Despite growing evidence of a global shift from print to video on social media (Sargent 2016) and digital communication, literacy instruction in early childhood classrooms remains stubbornly print-centric. In schools, young children under 8 years old rarely have a chance to meaningfully engage, produce, or share their own original multimedia. In a 2012 survey (Wartella et al 2013) of 1,457 US early childhood educators, teachers reported that if school literacy involved technology, it primarily involved low-level basic operation of digital media: viewing television, listening to e-books, or clicking through computer tasks practice (Herold 2015). These limited instructional tasks not only underutilize the potential of these tools, they represent a gross underestimation of the significant semiotic and cultural work that young children accomplish through their play and design with emerging technologies in their increasingly digitally-mediated lives.

Digital Technologies and Makerspaces

The networks and practices for participating online are constantly evolving but some throughlines include playful innovation, purposeful exploration, multiplayer collaboration, and digital media production. This is particularly true in makerspaces (Peppler and Bender 2013) where digital computing combines with manufacturing technologies (e.g., sewing, crafting, robotics). Making and makerspaces reflect grassroots approach to technology, tapping into growing trends in independent inventions and entrepreneurial start-ups and Do-It-Yourself (DIY) cultures. The global maker movement has moved into education as schools and libraries provide makerspaces, focusing primarily on science, technology, engineering, and math learning through robotics, 3D printing, and computer programming (Halverson and Sheridan 2014). However, making also supports a range of creative opportunities that develop children's imaginative

storying through filmmaking, animation, and puppetmaking that enable playing and crafting, with innovative technologies.

Maker Literacies

Literacies are expanding rapidly along with new technologies and innovative communication. Important to the early childhood focus of this piece, the small size, icon-based navigation, and intuitive interface of mobile technologies are highly accessible for young children and open new avenues for storytelling that are not dependent on a young child's abilities to read and write print. For example, using wordless digital puppetry apps and iPads, children can create live-action videos with smartphones to record their own play with friends or toys or create their own avatars as e-puppets in cartoons or stop-action films (Burnett and Merchant 2013; Marsh 2010).

What counts as text has changed from static to interactive in this digital revolution (Mills 2016). Writers/makers and readers/viewers of 21st century texts need to be proficient at both producing visual imagery and artifacts and critically analyzing embedded texts in videos and everyday objects like toys. In this chapter, we ask: How might teacher education expand to update early literacy teaching to integrate new technologies and maker literacies? We use the term *maker literacies* to describe sets of practices for making and remaking artifacts and texts through playful tinkering with materials and technologies. Maker literacies include:

1. *Collaborative play* creates "action texts" (Wohlwend 2011, p. 3), stories enacted collaboratively with bodies, toys, props, and puppets rather than written with print on paper. During play, players agree upon pretend scenarios and revise the meanings of realities, bodies, materials, and actions (Vygotsky 1975; Thiel 2015). Through dramatic pretense, children collaborate to craft stories together and must decide who's playing whom (e.g., "You be Elsa; I'll

be Anna"). These embodied live-action videos or animated cartoons are recorded using digital tools, such as tablets and smartphones, and then polished with video-editing that enable trimming and rearranging film clips, dubbing voices, or adding an overlay of color wash, music track, or print (e.g., titles, captions, credits).

2. *Toyhacking* redesigns toys' materials but also their embedded texts. Toys come prepackaged with anticipated identities (Wohlwend 2009), that is, companies produce toys and games with particular consumer in mind, selecting tactile materials, color schemes, and designs, all manufactured to appeal to a particular demographic. Toys carry these sedimented identities (Rowsell and Pahl 2006) or histories of prior meanings, identities, and social practices as embedded identity texts (e.g., characters, toy consumers, film narratives, histories of use) deposited in the toy. Toys are played into significance in classroom peer cultures, accruing additional meanings (e.g., whose turn it is to play with which toy; which roles or actions a toy enables) over days and days of shared pretense with friends (Wohlwend 2011). Finally, popular media toys signify powerful emotional attachments (Marsh 2005; Pugh 2009) as well as multiple media platforms, children's experiences, and peer friendships.

3. *Digital filmmaking* saves a played story, making text durable and shareable (Buckingham 2003). When smartphones combine with popular media toys, digital storytelling captures powerful identity texts embedded in toys, providing a way to recognize and build on children's media knowledge as well as their funds of knowledge about digital technologies in use in their homes and communities (Nixon and Comber 2005; Burnett 2010; Marsh 2006.)

4. *Video-editing* remakes filmed texts by altering particular modes (e.g., color, animation, music, sound effect) (Kress 2009). Video editors trim clips to remove unwanted footage, dub or add voiceovers, music, or sound effects, rearrange clips to alter the sequence of time to create

montages, flashbacks, or other filmic devices. Apps make it possible to easily combine modes (Flewitt, Messer, and Kucirkova 2014) or sync and edit multiple film clips to run side-by-side in the same shot. For example, the Acapella app provides a windowpane grid with 4, 6, 8 or more slots for individual clips simultaneously.

5. *Remixing* combines texts to create new meanings, popular in fanfiction, parodies, and mashups, in social media (Ito 2007). Texts for remixing include not only verbal dialogue or film scripts, but also material messages embedded in toys' materials, histories of use, and user identities sedimented over time (Holland, Lachicotte, Skinner, and Cain 1998; Rowsell and Pahl 2006, Wohlwend 2012). For example, a small plastic Barbie doll in hot pink packaging tucked into a fast food meal can be read as: a toy for girls (only), an ideal of teenage fashion, an inducement to buy a hamburger with french fries, a fan identity in peer culture, and a pre-assigned role for doll players. In this way, popular media dolls, action figures, and stuffed animals are artifactual texts full of film narratives and songs, character traits and actions, manufactured materials and commercial uses, and child roles as players, fans, and shoppers, but also as producers.

In this study, maker literacies included making puppets and amateur digital videos as well as remaking and remixing toys and the commercial narratives associated with children's favorite popular media characters from shows, films, and video games. This exploratory project integrated maker literacies through *Literacy Playshop* (Wohlwend, Buchholz, Wessel Powell, Coggin, and Husbye 2013), a curricular approach to early childhood literacy that merges dramatic play, collaboration, storytelling, crafting, and digital media production. This approach draws upon early literacy research (Marsh 2005, 2010, 2014) that shows popular media is tightly interwoven into the fabric of play, peer friendships, and ways of belonging in digital cultures.

Literacy Playshop builds upon children's media interests and play narratives, providing opportunities to invent and collaborate while also developing their literary and technical abilities to produce digital texts.

Introducing Maker Literacies in Literacy Teacher Education

Teacher education classes are an obvious place to respond to the paradigm shift from writing print-and-paper texts to producing digital video. To introduce pre-service teachers to the potential of play and making as literacies, we developed a digital storytelling that incorporated popular media toys, digital video production, and video-editing in a makerspace. Excerpted from a 5-year study on literacy play, the data document a digital puppetry module in PK-3 early literacy methods classes at a US Midwestern university (3 instructors, 140 university students). In this article, we focus on two classes, each with 20 students, one instructor, and one researcher/facilitator. In each class, small groups of students engaged in toyhacking by cutting up, gluing, combining, and decorating inexpensive commercial mass media toys (e.g., Happy Meal toys), followed by filmmaking live-action videos with the toys, video-editing, and sharing. In a second session in their roles as literacy tutors at a local elementary school, the pre-service teachers used the toys to create a film with an assigned kindergarten or early primary grade student, finishing the project with reflective blog posts.

Students first read instructors' assigned readings, including classroom studies of Literacy Playshop (i.e., Wohlwend et al 2013) and articles about the maker movement (i.e., Peppler and Bender 2013; Fleming 2014). During the next 3-hour class meeting, an instructor gave an overview of two maker literacies, toyhacking and digital storytelling, with video, photographs, and examples of hacked toys.

Toyhacking: Following this short PowerPoint presentation, students began the toyhacking portion of the project; one of the two focal classes worked in in the university's newly dedicated makerspace or Multimedia Interactive Learning Laboratory (MILL) , the other class worked with a makercart (Peppler and Whiting 2016) in the literacy methods classroom. Both the MILL and the makercart provided craft materials and tools: craft foam, beads, fabrics, and fake fur as well as hand saws, hot glue guns, and exacto knives. Preservice teachers were given about 40 minutes with the supplies to change/enhance inexpensive fast food promotional toys (e.g., McDonald's Happy Meal toys) and their associated popular media narratives.

Digital Filmmaking: Students worked in small collaborative groups for about 40 minutes to create a single story with their hacked toys. Students used the toys as puppets as the stories were acted out and filmed using the cameras on class iPads, sometimes augmented by mobile apps or sound effects played on smartphones.

Video-Editing: After reviewing the raw film footage, students worked cooperatively to edit the clips into short films using the iMovie app on the iPads. Frequently, students spontaneously began browsing and downloading elements to add layers of music, sound effects, photos or video clips, voice dubbing, or other elements. After completing the editing process, students shared their films with the entire class.

The Literacy Playshop module concluded with university students conducting a one-on-one filmmaking session with a 6-, 7- or 8-year-old student in a local school, using the hacked toy to inspire children to create an original script. Following these sessions, the university students posted blog posts of reflective writing on the entire playshop experience.

Documenting Playshop Learning through Video Data Nexus Analysis

Data sources include video of university students' toyhacking and filmmaking/editing, the collaborative videos they made with hacked toys, and their reflective writing. The research team worked together to catalog and summarize the events in each video clip, using Excel field to tag the video data with identifier codes such as student ids, materials, tools, toy names, commercial franchises. In a next pass through the data, the team interpreted patterns of maker/player actions among participants in the video data, identifying a set of emergent codes. Through discussion, the team discussed differences and resolved these through consensus to agree on common codes for this content analysis stage.. Coded data within each maker literacy stage (i.e., toyhacking, digital filmmaking, video-editing) were examined for further questioning and discussion within the team. For example, initial codes identified makers/players, their actions, toys, added materials, and attached meanings such as character names. We then followed the objects to track any changes in a toys' meaning or maker's/player's participation.

Nexus analysis (Scollon and Scollon 2004; Wohlwend 2014) provides a way of tracking seemingly intuitive digital literacies that are actually a learned nexus of practice (Scollon 2001) of tacit expectations, social practices, screen conventions, and computer navigation. In this study, we analyzed crafting and film production as assemblages of players, actions, materials, and texts to track collaborative meaning production and shifts in participation. Content analysis tracked maker literacies and their patterns of meanings and participation as assemblages developed, from toyhacking to video-editing. Nexus analysis of student films showed traces of prior texts (e.g., commercial music videos or amateur viral videos that inspired imitation) or tools (filmmaking template apps such as Acapella). We identified moments of collaborative transformation (e.g., agreements to change characters' texts, storylines, students' roles). Patterns in the video data were cross-checked with students' reflective blog posts for resonances and tensions.

Maker Literacies in Two Films by Pre-Service Teachers

For preservice teachers, the Literacy Playshop provided an opportunity for creativity and collaboration. This began with toyhacking in the makerspace, where students physically hacked toys to alter their commercial characters and narratives, embedded in the colors and materials of these artifacts. Students chose familiar toys from popular culture franchises such as My Little Pony, Barbie, Hot Wheels, and Peanuts, and then manipulated these with tools and other artifacts to create new puppets, toys that reflected the maker's own voices in addition to their sedimented meanings. For example, one student chose to alter the identity of a Smurf figurine by adding flowing hair made from a My Little Pony mane and a red carpet made from red felt. This participant altered the identity of his puppet by combining multiple narratives that included a Smurf and a diva. He called his hacked toy, Smiva, the Smurfalicious Diva. Smiva was primarily hacked by adding decorations and costuming. Another example of a hacked toy included a more physically mobile pony, which included a unique hybridization of several popular culture toys. The participant joined two halves of a My Little Pony toy with a Slinky as the body using tools such as a hacksaw and a hot glue gun.

After this initial session in the makerspace, students began filmmaking in small groups to plan and film a story that featured the hacked toys. The stories created by the preservice teachers reflected an amalgam of identities and genres that demonstrated collaboration, imagination, and current student agendas and influences. The storymaking process of the playshop included time for students to gather raw film footage using iPads, edit using digital apps such as iMovie and WeVideo, and present final productions to the class. Once filming began, they shifted the toys' original characters further, building upon the decisions made in the toyhacking process. Their

changes to the toys' identities became more apparent once the teachers began to name their puppets for filming.

Film One: Viral Videos and Mobile Apps

Through toyhacking, one group of six pre-service teachers altered the identities and changed narratives by creating hybrids of two or more toys to make Smiva, Merma-ducky, Franken-Mummy, Snoopy Centaur, Slinky Pony and Basketball Linus. While planning and filming, the group drew on their social media knowledge for an organizing theme for their film. In seamless decision-making, they chose to mimic a Harry Potter Puppet Pals skit, The Mysterious Ticking Noise, (https://www.youtube.com/watch?v=Tx1XIm6q4r4). Without much discussion, the group mutually agreed on using this viral video as inspiration for their film. Seeking popular culture and social media tropes that peers would easily recognize was evident across many of the filming groups in all classes during the Literacy Playshop.

The students combined several digital resources to guide the new film production, using two apps that closely aligned with their vision for recreating the Potter Puppet Pals skit: Acapella and an metronome app. The pre-service teachers used the Acapella app during production to precisely time the entrance of each character, mimicking the sequence of the characters in the Potter Puppet Pals skit. In essence, this group was actively editing while filming. The changing characters and repeated phrases were clearly influenced by the inspirational YouTube video. In the Potter Puppet Pals video, the characters entered the skit during specific times and repeated just one phrase. Throughout the skit, a ticking time bomb kept the characters' lines in sync. In order to recreate this feature the pre-service teachers used a metronome app to precisely time their characters' short phrases. In order to make their film closely match the viral video, they used a black backdrop to keep their own bodies out of the production.

Film Two: Playing and Singing in Music Video

Another group, consisting of three men and three women, created a music video with hacked toys including a stuffed kitty wearing a construction hat and vest, various insect-mammal hybrids, and a Pegasus. To create this diverse cast of characters, students relied on cultural capital and knowledge about the children in their field experiences, as well as available resources and suggestions from peers. For example, one student created an "American Pegasus" by gluing fringed duct tape feathers onto a toy horse and decorating it with red, white, and blue stars. She explained that her assigned student's father was in the U.S. military and was currently deployed overseas. This creation was encouraged by other group members who made comments such as, "Aw, patriotic!" Other pre-service teachers in this group also sought group feedback and approval to hack their toys, asking, "Should I put a skirt on [my toy]?" and "Do you think [my assigned student] will care that [the toy] is a girl?" Through these collaborative efforts and conversations, group members hacked toys such as the construction-cat, a Despicable-Me character with a lion head, and a horse-fly that that peers called "cute", "hilarious", and "creepy" respectively.

Toy descriptions also captured humor among group members that played on dominant narratives of disability, gender, and race. For example, when a hacked pony wobbled on the table, its maker laughed, "he just has a bum leg". Other group members laughed together when a student joked about the juxtaposition of a male toy's expression of anger and its hacked pink, sparkly costume. At times, jokes and narratives created by the students during the toyhacking worked to maintain sedimented stereotypical meanings in the commercial toys rather than disrupt them. Students frequently engaged in play themselves as they worked with the toys and exhibited

behaviors such as zooming toys around their friends to make them laugh and slapping the table with gummy sticky-hands.

After the session in the MILL, students took their toys outdoors to film. The group quickly decided to create a music video of the song "Roar" by pop artist Katy Perry. This strategic decision allowed each of the toys to be featured via a cinematic introduction while also allowing players to collaborate together. For nearly half an hour, group members laughed constantly while shooting footage. The filming, as well as the editing, revealed that students relied on genre in their storying and were motivated by humor. For example, characters were introduced through dramatically familiar scenes such as "rising from the ashes" via a large pile of leaves and suspensefully bursting out of a wooded thicket. Group shots were taken to create interesting camera angles from vantages on top of motorcycles or underneath cars. The rationale and decision-making were largely focused on producing an impression of randomness as students explicitly and implicitly worked to make their video humorous.

In one group shot, students placed their toys, headfirst, in a circle on the grass and used the iPad to capture an aerial shot of the figures that zoomed out creating a scene that a female quickly commented was just like a "12-year-old girls' soccer pic." Several group members also referred to media genres during filming. For example, one member commented, "this looks like a rap video" when the construction-cat's face was zoomed in on while being danced in front of the camera; others laughed immediately in response and recognition. Another members made suggestions such as, "take a classic, cool 90s shot, and just swerve in" and "we need another artsy shot" that were quickly taken up by the group. These examples indicated students' knowledge of film and video shots and demonstrates how filmmaking techniques such as camera angles, zooming, or panning transformed the surface appearance and dialog in hacked toys and

narratives through deeper intertextual meanings. The final film was a reproduced, remixed, and wholly new story that drew upon multiple film genres, a megahit music video "Roar," and most importantly, students' own interests and engagement.

Students' written reflections about the toyhacking and digital storying experiences by the pre-service teachers overwhelmingly voiced positive attitudes toward maker literacies. Across classes, pre-service teachers' written reflections suggest they feel it is possible to support young children's literacy understanding through play and digital engagement. The collaborative encounters with digital tools and hacked toys allowed pre-service teachers an opportunity to engage with maker literacies in an unrestricted way. Using the artifacts to anchor the meanings of a media text opened the door for pre-service teachers to investigate more progressive and innovative ways to explore literacy education.

Affirmations about using one's imagination, being creative, and "doing something different" were frequent, and students described the sessions with comments such as, "It was a blast!" and "I was surprised by how much fun I had." One student explained,

Meaning can be expressed in a thousand ways: art, literature, visually, music, etc. Why are these forms of literacy discounted? Why are they left out in the classroom? To me, this project helped me better understand the limited perspective of literacy and it gave me ideas of further use in the classroom. I loved the maker movement workshop because it widened the idea of literacy involvement.

For this student, the maker experiences legitimized an alternative conception of meaning making while causing him to question what is included and excluded from daily classroom work. The legitimating effect of this hands-on experience was significant; many of the pre-service teachers noted that they were initially hesitant about maker literacies and their place in literacy

instruction. One student reflected, "Had I seen [the MILL] before this class, I would have probably thought that it seemed out of place [in a college of education]. After the assignment, however, I realize its huge potential." This potential, for literacy instruction, student engagement and involvement, and collaboration, was referenced by a majority of responses by participants, and often was accompanied by reflections of surprise and transformed understandings. Many of the students finished this project with reflections that expressed strong commitments to utilizing maker and digital literacies more comprehensively in their future careers.

The pre-service teachers in this study largely demonstrated evolving conceptions of what it means to teach digital media production through their own experiences with playshop. Through collaborative play, hands on explorations of maker literacies, and digital storytelling, the pre-service teachers redesigned various artifacts and reworked media narratives to incorporate media literacy resources and expertise from their daily lives, including social media, popular culture, and social mores. They actively worked to manipulate the toys' sedimented identity texts to make them humorous or engaging to children or peers. In this way, media toys became puppets and avatars embedded with the voices of their makers.

Students' post-project reflections revealed a) children's increased interest during elementary tutoring in filmmaking sessions with toys and b) university students' planning considered young children's literacy strengths, funds of knowledge (Moll et al 1992), and learner interests in popular media narratives and toys. A significant level of excitement and active participation, not visible at other points during the semester, was expressed through students' maker literacies as well as their writing. There was palpable pleasure in students' disruption and redesign of narratives and in the ease of creative storying provided by digital technology. Maker

literacies afforded pre-service teachers new ways of engaging student interest and engagement in classrooms.

Learning from Maker Literacies and Literacy Playshops

In this section, we look across the pre-service teachers' Literacy Playshop experiences with maker literacies to generate several teaching points relevant for early literacy teacher education.

Maker literacies with popular media make children's literacy resources accessible and enable children to show what they know

Interestingly, retro toys with nostalgic appeal to parents also appealed to the pre-service teachers, providing literacy resources (e.g., potential characters, settings, storylines) for university students who remembered My Little Pony and Smurf toys from their own childhoods. A long-standing adage for composition is that writers write best when they write what they know. This is also true for digital filmmakers. The groups' shared film knowledge such as viral videos and hit songs or MTV and rap genres provided templates and techniques that the pre-service teachers could draw upon to enhance the meanings of their films. In the same way, popular culture toys and media provide rich literacy resources for children who know the narratives and songs by heart. When children are able to play and film the stories they know best, their storytelling is more elaborate and engaging, with characters more likely to resonate with the audiences that matter to them.

Makerspaces allow students to bring their own maker literacies and media texts, and educators need to understand peer cultures in order to appreciate and understand the complexity of texts students produce.

We planned opportunities for students to engage some maker literacies, but students also brought their own: remixing children's media narratives with viral videos, smartphone apps, and music genres. Their remixes merged in synergistic ways as when students synced their voices to match the rhythmic ticking tempo of the Potter Puppet Pals viral video. Nexus analysis looks for thickenings of textual practices to see how merged practices strengthen meanings and participation among members within a nexus of practice. When this film is viewed from an outsider's perspective, we see a grid of characters chaotically popping in and out of view, accompanied by meaningless cacophony. From a perspective inside the students' media savvy peer culture, we see their almost instantaneous agreement on a viral video as a template for their own produce. Their shared recognition is the hallmark of nexus of practice as cultural insiders enact their membership through shared norms. In this way, the Potter Puppet Pals and Roar videos and rap genres were social markers that provided a way to create inside jokes that would entertain peers and acknowledge their makers as cultural insiders. In the same way, young children's play, media affinities, and humor create group cohesion, social boundaries, and insider/outsider identities in peer cultures.

Embedded texts in toys and media genres and narratives are both durable and fluid, creating an intertextual complexity that is engaging and challenging.

The identity texts in toys could be physically and digitally jumbled and recombined in remixing and other maker literacies. But this does not necessarily ensure critical response or rupture dominant discourses. We often saw that student play and making opened opportunities for students to reproduce stereotypical actions or joking that went unchallenged in their groups. However, we also observed that toyhacking powerfully opened a way to make media character identities and narratives malleable and open to revision.

It may be that pre-service teachers are more willing to revise media characters than children who have stronger emotional attachments to their favorite media characters (Marsh 2005). Children's attachments to media toys can be passionate, complicating their collaborations when the fluidity of play requires undoing the stories they know by heart (Leander and Boldt 2013). Data from playshop research, shows that when children play, make, and revise popular media characters in Literacy Playshop classrooms, passionate debates often emerge around which revisions are appropriate and who can play with which toys (Wohlwend 2009, 2011; Wohlwend et al 2013).

Play is unruly and engages us on an emotional level.

Playshops run on laughter and joy in imagining otherwise and escaping the here and now. The university students in both groups played throughout the activities, laughing as they tried on new personas as characters, makers, and players. Pre-service teachers also played, in a way, at teaching as they imagined what their assigned student might think of or do with the hacked toy or imagined future selves teaching in their own classrooms, "I'm so going to do this!" But they also played to ease the discomfort of destroying toys. Toyhacking makes visible and visceral the destruction that happens when in remixing a text. Remixing seems innocent but when we ask students to deconstruct and critique media, we are really asking them to hack away cherished memories and the beloved characters of their childhood.

Finally, students played and laughed together in ways that intersected with belonging, group friendships, and peer culture status. Inside jokes and humor assumed everyone shared the same nexus and thus shared an understanding of what's funny.

Conclusions/Implications

Multiple and fluid transformations occurred through maker literacies that altered toy physical features but also the character texts, and thickened film scripts in on-the-spot improvisations. Students negotiated and merged multiplayer ideas into plot threads during both collaborative play and digital filmmaking, remixing popular media characters and film genres (e.g., music videos, game quests) during filmmaking and video editing.

As teacher educators, we know that it is critically important to engage pre-service teachers in the activities that will matter to the children that they will teach. Visiting a makerspace, toyhacking, collaborating creatively, and producing digital stories allowed university students to experience the value and potential of expanded literacies. These experiences were instrumental in helping students shift their definitions of literacy beyond print to include maker literacies. This shift involves engaging university students in activities where they can experience playing, crafting, collaboration, and technology, just as their students would. Opportunities to reflect remain key. Upon reflection, university students wrote about their surprise, excitement, and pleasure while creating literacy artifacts and producing digital stories, often noting that the playshop project significantly expanded their notions of literacy.

We close with some practical guidelines for teacher educators and classroom teachers interested in moving toward maker literacies and makerspaces:

- Expand what counts as literacy. What does literacy mean for children today and tomorrow? Children are reading the world in powerful ways that don't necessarily involve reading printed texts or even screens. Shifts in technology, society, and access to information have changed the boundaries around information and the ways that they understand the world. Consequently, our classroom curricula and practices must also shift (Sefton-Green et al 2016).

- Accept students as creators and innovators. Innovation needs a classroom atmosphere that invites exploration and tinkering. In makerspaces, teachers empower children and allow noise, messiness, and freedom to decide and make and play. Recognizing students as capable includes positioning students as problem-solvers when inevitable glitches occur.
- Start small. We know the challenges of rethinking how we teach. Each technology offer fresh affordances and potential challenges. Taking on just one or two activities like this project in the first year provides teachers with time for planning and reflection as well as implementation.
- Be ready to mediate. A curriculum that runs on learner-generated ideas, characters, and stories will engage the children in intense ways. They may not care about a book that the whole class hears for read-aloud, but wait until they have a say in the creation the narrative! When children care about the curriculum, collaboration brings contestation as well as cooperation.
- Consider and prepare for safety issues. In this class project, university students used real saws, Exacto knives, and hot glue guns to hack their toys. Adult supervision is of course a necessary precaution when young children are cutting or hot glue guns. We have observed preschools where young children use saws, hammers, and nails; with supervision and safety guidelines, they successfully used these tools. Teacher education classes should include safety discussions so that pre-service teachers know how to provide young children with creative experiences with authentic tools, but with reasonable safeguards.

Maker literacies, toyhacking and digital storytelling open up opportunities to update teacher education. This was evidenced by the student reflections, which detailed the fun,

enhanced engagement, knowledge gained, and humor that they found within this project. By participating in a maker literacies playshop, the pre-service teachers were able to visualize new possibilities for their teaching and to see dramatic play with toys and digital technologies as worthwhile and engaging literacy curricula.

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