Chapter 4
Chasing Literacies Across Action Texts and Augmented Realities: E-Books, Animated Apps, and Pokémon Go

Karen Wohlwend

Technology innovations zip in and out of our daily lives in an endless stream of updates: 1.0, 2.0, 3.0, and so on. As educators and educational researchers, we must also update the pedagogies we offer to young children who are immersed in rapidly shifting technologies, literacies, and global innovation. Two decades into the twenty-first century, the notion of text has expanded from print- and page-based books to screen-based digital media on mobile phones, tablets, and a range of wearable devices (Kress 2004, 2010). With new technologies in our increasingly digitally mediated lives, play rises to a new level of importance for players of all ages, beyond early childhood. For example, in July 2016 at the time I'm writing this chapter, the launch of Pokémon Go (Nintendo) has introduced over 30 million players to augmented reality. In this treasure hunt app, players explore their local communities, looking through smartphone camera lenses to locate and collect cartoon characters superimposed on the surrounding landscape. Nightly news reports show Pokémon Go players who wander unaware into oncoming traffic, glass doors, and ponds, demonstrating the hazards of attending to a screen-sized sampling of the surrounding reality while walking amid everyday dangers in the physical world (Needleman 2016). While the game has just emerged, and with it a new kind of digital reading, the central role of play in the app is not a surprise to scholars in New Literacy Studies (Street 1995; Gee 1996). Play is a literacy that easily navigates the material/immaterial indeterminacy of the pretend meanings and digitally enhanced play, enabling players to imagine otherwise and slip the constraints of here-and-now realities—and in the case of Pokémon Go, perhaps a little too convincingly.

This chapter takes a panoramic view of computer literacy learning to capture the range of action-oriented exploration, collaborative innovation, and

K. Wohlwend (✉)
Indiana University, Bloomington, USA
e-mail: kwohlwen@indiana.edu

technology-augmented participation in children's play with iPads, to ask the following:

- What actions and social practices in young children's iPad play shape their cultural participation and literacy learning?
- How does an action-oriented lens make visible complex convergences of practices and dimensions of technology-mediated literacy learning?
- What additional dimensions might be needed in future models to explain multiplayer assemblages of bodies, machines, and environments that produce collective, emergent, and disruptive flows?

In this conceptual piece, I draw on mediated discourse theory to compare models of literacy learning that reflect and shape what we recognize as learning in iPad play. Through video analysis of children's classroom interactions with an e-book app and an animation app, I identify literacy practices that interpret, create, and share a range of *action texts* (Wohlwend 2011). An action text is an emergent played text that also supports an imaginary co-constructed context, negotiated among multiple players across digital screens and physical environments. Analysis of action texts created during app play identifies three prevalent models of literacies that circulate notions about who, what, and how children should use iPads. Each of these models is justified by educational discourse that prepares children to participate in particular spaces:

- *digital literacy* in the skills mastery discourse of educational standards in school cultures
- *participatory literacies* in the social practice discourse of situated and connected learning in digital cultures and global networks.

This analysis also forecasts practices in an emerging model:

- *socio-material literacies* in post-human discourse of entangled assemblages of actions, bodies, and machines in converging realities.

Three Models of Literacy Learning in iPad Play

Almost all aspects of everyday life are mediated by mobile technologies and mass media. Even very young children engage texts on screens on parents' mobile phones and devices (Rideout 2013; Sefton-Green et al. 2016). Meanwhile, teachers and parents still find a disconnect between the technology-dense lives of children at home and the print-centric pedagogies in schools (Wohlwend 2009) and in the educational app market (Shuler 2012; Guernsey and Levine 2012). This disconnect can be thought of as a site of contestation where incommensurate discourses and models of literacy learning intersect and influence how literacy is taught, who gets access, and what counts as literacy. For example, a skills

mastery discourse supports a mental model of literacy learning as individual skill-based, knowledge acquisition (Ivanič 2004). In the US, a skills mastery discourse drives state- and federally-mandated assessment despite widespread lip service to the importance of teaching within each child's zone of proximal development (Vygotsky 1935/1978), a social practice discourse which values scaffolding and emphasizes the need to assess what the child can do with assistance from more experienced cultural others. Instead, standardized assessments largely measure children's literacy according to their abilities to work in isolation. Such tests assess test-takers' abilities to decode print and to comprehend short passages by selecting a single 'correct' interpretation generating scores that can be compared against grade-level norms. App and iPad play emerges as a site of contestation when the work-focused skills mastery in this model conflicts with the game-focused participatory literacies of a peer culture and or when the need for certain digital skills become obsolete or questionable in the socio-material literacy of robotic readers.

Digital Literacy: This model explains online reading and word-processing practices: an individual reads or writes pages of digital print and images with a computer-as-typewriter mindset (Knobel and Wilber 2009). In the early twenty-first century, literacy researchers observed children's handling of computer tools to better understand how children were acquiring skills in moving a computer mouse to effect a change in images and print on a computer screen. These studies updated Clay's (1975) book-based concepts of print by identifying 'concepts of screen', computer-based conventions and skills that users needed for mouse handling and cursor–screen relationships (Labbo 2006; Merchant 2005). For young learners, the number, pressure, duration, and direction of finger touches on a tablet's touchscreen (Rowsell et al. 2013; Rowe et al. 2014) create text with printless or multimodal practices (Flewitt 2013). For example, squeezing two fingers together will shrink an image; on the other hand, a quick one-finger tap on a blank corner of a screen can reveal a hidden menu of options (Flewitt et al. 2015).

Participatory Literacies: This model explains multimedia sharing practice in social media and digital cultures: multiple players/designers collaboratively create and interact through games, photos, videos, and other multimedia across social media networks using Facebook, Instagram, YouTube, Twitter, virtual worlds, fan communities, and so on. On a daily basis, three-fourths of U.S. children use mobile devices (Rideout 2013; Shuler 2012) that, when combined with social media, allow children to participate in global digital cultures (Ito et al. 2013) by playing, collaborating, and sharing anytime-anywhere on handheld screens on mobile devices connected to 24/7 networks. Through tweeting, blogging, remixing, and other media-sharing practices, digital literacies intersect with insider ways of participating in digital cultures (Knobel and Wilber 2009; Jenkins et al. 2006). Through participatory literacies, players signal tech-savvy membership as they co-construct meanings in a sequence of back-and-forth moves in online games (Gee 2003) among other forms.

Socio-Material Literacies: New models are needed to explain emerging tools that enable machines to create texts as co-actants, as target audiences, or as readers and writers. *Socio-material literacies* (Mills 2016) are most visible in technological innovations that operate through increasingly blurred body–machine interactions: users' speech, gestures, and body actions link with wearable computers such as Google glasses or Apple watches; webs of non-human interaction among intelligent machines connect appliances that 'talk' to one another to coordinate their functions; 'litbots' read and remember digital texts (McEneaney 2011). Initiatives such as the Hour of Code (https://hourofcode.com/us) suggest a future where children will need to learn computer literacies to program and think *with* machines. The term *socio-material literacies* captures the embodied nature of these interactions without privileging the human and suggests the extended reach that is enabled by machine–human–material integration through connected networks and augmented realities. In this model, our smartphones and tablets are extensions of bodies that we look through to see more, act through to reach more, and connect through to engage more machine/person assemblages. In the same way, bodies extend the reach of machines and provide human input into co-productions by initiating ideas and actions or providing power or programming.

Each model is an oversimplified and discursive construction that legitimatizes particular sets of relationships among materials, humans, and realities. Models and their associated supporting discourses converge and collide whenever a new technology emerges, evident in transformative technologies from the printing press to the smartphone (Luke 1989, 2007). Thus new technological practices through their novel mergings of machines, humans, and meanings make visible the ways that literacy models and discourses overlap and produce sites of contestation. Contestation incites discourse, that is, discourse recruits and generates more discourse (Foucault 1978) as models are circulated through efforts to keep an extant set of practices securely in place. But what would be visible if we expanded our perspective to recognize change as the typical state of things (Latour 2005)? What pedagogies could emerge if we stopped trying to catch and capture mobile technologies?

Theoretical Framework for Examining Literacy Learning Models

To examine how literacy discourses converge in children's action texts with mobile technologies, I draw on mediated discourse theory (Vygotsky 1935/1978; Wertsch 1991) and actor network theory (Latour 2005).

Mediated discourse theory provides the construct of nexus of practice (Scollon 2001) framework that reveals how children's play with digital media engages embodied expectations for technical skills in digital literacy or cultural practices in participatory literacies or human/machine assemblages in *socio-material literacies*.

I examine children's digital play as taps, swipes, and other small actions, situated in (1) interaction orders (Goffman 1983) such as student-with-teacher or player-against-player relationships, (2) historical bodies or engrained expectations for particular actions (i.e., habitus, Bourdieu 1977), and (3) discursive interpretations of co-players in peer culture and fan media cultures and teachers in school culture. Play is examined as both a literacy and a tactic (Wohlwend 2011), that is, social and semiotic practices that young children engage when they play together to create action texts such as animated films with digital puppetry apps on touchscreen tablets (Merchant 2015).

Actor network theory (Latour 2005) explains people and computers as actants that co-produce interaction, within flows that travel along constantly evolving networks. In this view, change is the constant; that is, we should expect continual change as the status quo. Rather than focusing tightly to identify a linear trajectory of development and measuring a child's growth as change over time, we should be noticing where people/thing assemblages are forced to be static. Thus, educational researchers should be cultivating a suspicion of immobility and looking at the stuck places in networks for evidence of institutions' or other actants' efforts to hold things in place. And in pushing learners toward a narrowed, common goal, what learning deviations (or rather innovations) are suppressed? For example, standardization works against the natural tendency of things toward variation. In educational systems governed by skills mastery discourse, huge investments of time and energy are expended to measure, sort, and keep everything securely the same. When co-actants (an iPad/game/players assemblage) meander away from a standard, what forces are mustered and what resources are expended toward redirecting learners back on track? What anchors the wandering trajectories of learning assemblages? Together mediated discourse theory and actor network theory support a nexus analysis approach for studying the trajectories of literacies, whether materialized on a page of print, in embodied play, or in digital animation, that can help illuminate how iPads function as paradoxically mobile and anchoring sites.

Methods

Nexus analysis, a version of mediated discourse analysis (MDA), (Scollon and Scollon 2004; Wohlwend 2011; Jones 2015) enables examination of technology-mediated interactions and their trajectories over time and space, microanalysis of tool-handling in digital literacies, interactional analysis of participatory literacies, and macroanalysis of literacies and augmented realities.

1. **Hand/Screen Actions and Nexus of Practice**: MDA makes visible a nexus of practice, identifying small high-frequency physical-mediated actions by hands with touchscreens that make up digital literacy practices. When literacy practices combine with valued ways of behaving at school, they become routine and expected as the appropriate way of pulling off a literate identity. Close analysis

of hands' handling of touchscreens locates the skills and expectations users bring to a moment of iPad play.

2. **Multiplayer and Multimodal Interaction**: MDA offers interactional analysis that explains children's collaborative production as movements among players, materials, meanings, and discourses. Close analysis of action-by-action turns within a multimodal context reveals moments of shifting participation and changing power relations. MDA locates how players wield meanings, modes, and actions within participatory literacies to negotiate, disrupt, or anchor their co-constructed shared texts or social spaces. In this article, MDA of children's composing on a digital puppetry app illustrates the conceptual and methodological tools that reveal complex flows of (1) touches, swipes, and other actions in digital literacy practices; (2) multimodal layers of colorful images, dialogue, sound effects, and movement in animated stories; and (3) negotiation and contestation among children around turn-taking and story ideas.

3. **More-than Human Assemblages and Trajectories**: MDA tracks trajectories across time scales and geographies to understand how transitory (con)texts enter into and flow from assemblages of iPad/user/environment in augmented realities. MDA locates timescales to understand a mediated action as a moment in a set of intersecting trajectories of historical bodies, interaction orders, and discourses of place. Any action, then, is a temporal and spatial location in an indeterminate cycle of prior events and meanings, which also carries histories that shape expectations for the present moment as well as anticipations for its future emanations.

In the following section, I use one MDA level of analysis to examine an example of iPad play and to interpret each vignette through the lens of one literacy model. The instances of technology play selected for the analysis are excerpted from classroom data in ongoing Literacy Playshop research that I have conducted in early childhood classrooms, working with 10 teachers and over 200 3–8-year-old children. Data sources included video of children's play and filmmaking activities, and children's toys, puppets, drawings, and films. Microanalysis enabled by video analysis software tracks hand actions during small group play with digital animation on iPads to identify literacy practices and peer culture relationships, while macroanalysis connects image, machine, and body interactions to educational theories and learning models that shift across time and space. The following example illustrates how close analysis of finger movements on touchscreens reveals literacy practices interpreted through a model of digital literacy.

Reading an E-Book, a Digital Literacy Illustration

Amy bent intently over the iPad, tapping through the pages of a personalizable e-book (i.e., JibJab Jr) featuring a cartoon character: a pizza chef with cutout of Amy's face. Using an integrated photo feature, Amy snapped a selfie with the iPad and the app inserted it into the main character. On each page, she chuckled as her personalized pizza chef moved

humorously through the steps of mixing dough, adding toppings, and baking a pizza. She paused frequently to show the pages to her friends at the table. However after a few readings, she lost interest in the pizza book and moved on to more interactive apps that allowed her to create or change characters, backgrounds, music, or sequences of events.

The touchscreen interface of iPads and other mobile devices has dramatically increased accessibility of digital media. Young children playing with iPad apps engage in a range of digital tablet-handling practices, supported by non-print multimodal affordances. Researchers note that navigation that leverages the affordances of modes of image and touch facilitates digital literacy learning (Matthews and Seouw 2007). Touchscreens enable navigation through large simplified icons that allow children who do not yet recognize printed words to navigate screens using images. In addition, iPads are highly responsive, giving instantaneous feedback that makes the effect of a finger tap immediately obvious. Elsewhere I have suggested that touchscreens on mobile devices require knowledge of *Concepts Beyond Print*, an expanded set of conventions for interactive modes including touch, image, and speech[1] (Wohlwend 2017). In this framing, e-book reading is literacy practice made up of a set of mediated actions with touchscreens and buttons on an iPad which engage modes of image and touch. These mediated actions— gazing, clicking, tapping, swiping—coordinate body action and sensory modal information with the images visible on a glass screen. Furthermore, e-book reading often involves digital literacy practices that make use of other iPad features such as speech recognition controls, the embedded digital camera, or the spatial layout of the touchscreen (see Table 4.1).

Spatial layout is another mode with relevance for iPads. A top or bottom left corner is a frequent location for a back arrow that when tapped retrieves the previous screen. And when no arrow is visible, tapping the empty space may cause an arrow to appear. In other apps, icons may be located elsewhere (Kucirkova 2014). This means that while digital literacy develops a set of practices, it also develops a set of learner dispositions such as flexibility in problem-solving, an attitude of experimentation, and a willingness to persevere. In addition to discerning the meaning of an e-book's text and reactions of interactive features, children need critical literacy skills to distinguish between actual content, advertising, and in-app purchases.

An iPad's interface seems 'intuitive', contributing to a cultural model that constructs young children as 'digital natives' (Prensky 2001) or natural experts who seem to 'just know' how to use new techno-literacies with little adult help. The model is circulated by social media fascination with technological precociousness in 'iPhone Baby' viral videos that draw millions of views on YouTube. This model relies on an individualistic view of learning that overlooks the hours of immersive demonstrations as children closely observe older members of their families actively engaged in daily living activities. From a mediated discourse perspective, digital

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[1]The notion of Concepts Beyond Print builds upon Clay's (1975) Concepts About Print for paper books and Merchant's (2005) Concepts About Screens for desktop computers.

Table 4.1 Key practices and mediated actions in a digital literacy model

E-book reading	• Tapping an icon to open e-book • Pressing a toggle button to increase volume on e-book • Tapping arrows to turn page • Tapping words to activate highlighting and read aloud features
Voice recording and recognition	• Talking to character, image, avatar with expectation of response (e.g., on-screen movement, action, verbal response including repetition of copied voice.) • Talking to other people synchronously or asynchronously (e.g., phone calls, recorded messages) • Talking to voice-recognition program (e.g., Siri)
Image uploading	• Tapping to take a selfie or other photo; tracing photo to create cutout • Tapping to import photo as personalizing content into e-book
Touchscreen navigating	• Swiping scroll bars to load more options • Tapping icons/words to launch an app • Swiping the screen to turn a page, return to a screen, or load the next photo • Pressing a button to go to the home screen with app menu to change apps • Tapping an icon (e.g., checkmark, 'x') to confirm and proceed or cancel an action or to close a page or application • Tapping arrow icons or lightly touching areas of screens where arrow icons are not visible but expected in order to open a new screen

literacy practices are learned in car seats, grocery carts, and parents' laps as children notice how people use mobile devices to shop, chat with friends, check Facebook, or share a video. These technology-mediated social practices signal a nexus of practice when enactments demonstrate a user's understanding and co-membership in performing insider practices valued by a particular group. A growing body of educational research shows that from infancy, young children learn imaginary play in families (Marsh et al. 2015a), and that touchscreens provide key mediators that support very young children's development in movie-making (Matthews 2006).

Multiplayer Collaboration with an Animation App, a Participatory Literacy Illustration

Heads together, three players hunch over an iPad as they intently create an animated video using the PuppetPals app (Polished Play), voicing and recording dialogue and animating a stock set of fairy tale characters in a castle scene: a princess, a knight, and a fairy godmother. The player in the center directs the action, announcing to the girl on her left, "You can be the princess and I'll be him [knight]," as a third girl looks on. The girls laugh as they quickly move their hands around the screen, each player manipulating a different character: sliding their fingers across the glass touchscreen, turning a princess upside down, spinning the knight in rapid circles, squeezing and spreading the images to resize their characters in quick transformations, now gigantic, now tiny. Now and then a player gestures in a

directorial move that suggests where a particular character should move on the screen layout. As the filmmaking progresses and action picks up, their hands crowd together on the screen. Participation moves intersperse with animation moves as hands brush, nudge, and rest on top of one another's hand to gently alter the movement of someone else's character. Often these hand actions are nonverbal and subtle accompanying dialogue, sound effects, singing, laughter, and action. At other times, the action is more physical with elbows blocking another character competing for the same space and arms pushing intruding hands out of the way. "True love," sings the princess, and all three players laugh.

In the PuppetPals digital puppetry app, children select up to eight cartoon characters and either photos or drawings as background scenery. After pressing a red record button (which activates the iPad microphone and video screen capture within the selected background frame), they drag and drop characters on stage or off stage, positioning, rotating, and resizing characters with their fingers while simultaneously voicing dialogue or narrating story action. Pressing the red button again stops the recording and changes the button to a green triangle for immediate playback of their enacted story. Furthermore, this example of playful composing shows children actively exploring the meaning potentials of the modes that touchscreen tablets and interactive media such as apps offer. They do this while managing participation in a cramped space that keeps everyone at the table and that merges their ideas into a single, shared text. Mobile tablets support collective imagining, which can be contentious as well as collaborative. As children vie for physical space on the glossy surface of a 9.5-inch screen, they must also work through their disparate visions for the unfolding story. The result is collective imagining made from mediated actions, modes, and meanings:

1. actions: touches, swipes, and other embodied actions that make up digital literacy practices
2. modes: sensory aspects of context such as colorful images, dialogue, sound effects, and movement that enliven animated stories
3. meanings: directions and storylines negotiated and pooled into a shared pretense

Play is a leading example of a participatory literacy in which multiple players co-construct meanings to create, negotiate, enact, revise, and share an action text, while they also learn how to become an active cultural participant. Participatory literacies include ways of interpreting, making, sharing, and belonging in increasingly globally and digitally mediated cultures. Jenkins et al. (2006) define participatory cultures as open digital spaces where people congregate online to create and share.

> Participatory literacies reflect new ways of thinking about learning to read and write with technology that moves away from the model of an individual reading or typing print on a computer screen. Instead, participatory literacies reflect the principles of social media like Twitter, YouTube, or Facebook or video games and virtual worlds: global participation, multiplayer collaboration, and distributed knowledge. These principles enable participation in vast digital networks through posting, blogging, recording, remixing, uploading, and downloading. (Rowsell and Wohlwend 2017: 72)

When dramatic play combines with the portability and modal affordances of touchscreens on mobile devices, the potential for collaborative text-making grows. However, many educational apps fail to offer features that can realize the potential of digital literacy play. To evaluate how well mobile apps support fluid, collaborative, and meaningful production, we studied children's actual iPad play and identified several dimensions of participatory literacies, including multiplayer, productive, multimodal, multilinear, and connected (Rowsell and Wohlwend 2017).

1. **Multiplayer**: This dimension enables groups of co-players and teams who negotiate a shared play text or scenario as they cooperatively keep play going. Co-players decide who can play, who gets the next turn, who will play whom, and what the next action will be. Apps that enable co-playing are joint productions, with dynamic meanings that emerge in an action text that is a sequence of interactions, moves, and counter-moves. Unlike a computer mouse which accommodates one hand, the touchscreen interface on a tablet accommodates multiple hands, as long as the app can sort through the chaos of multiple simultaneous taps and slides sent by a jumble of players' hands moving around the touchscreen.

2. **Multilinear**: The open-ended dimension provides for multiple storylines, revising, or hypertext that allows divergent endings. Dramatic play is multilinear, with players' divergent ideas braided together in a shared text. When players disagree, play can break down as players decide which strands make sense to them and how ideas should be integrated into their shared pretense. In collaborations on apps, games and films unfold in an unpredictable sequence, with unexpected challenges as each player contributes moves (actions) and ideas (meanings) through their hand motions or manipulation of materials and space (modes). The immediacy and responsiveness of mobile devices combined with its facility for revision adds to this fluidity of story directions, encouraging DIY dispositions to follow meandering texts under construction (Buchholz 2015). Hypertext capability enables loops and alternate paths (as in the choose-your-own-adventure books, popular in the late twentieth century).

3. **Multimodal**: The dimension of multimodality expands a verbalized idea into an immersive pretend context through iPad features that enable multiple modes (sound, touch, image, music, spatial layout) and allow players to manipulate sound, images, live-action video, or animation. Multimodality recognizes that materials mean differently according to design logics, shaped by culture and histories (Kress 2004, 2010). Apps for iPads vary in modal complexity (Norris 2004) or amount and intensity of sensory experience and the degree to which these integrate to create an immersive engagement. This multimodality provides greater accessibility to literacy for learners when it alleviates the need to transduce or reduce reality to a single verbal mode such as print or speech, with benefits for children who are emergent literacy users or who are learning English as a new language. Multimodality opens action and image alternatives for conveying information that provides crucial support to very young literacy learners. For example, play allows young children to imagine a character's perspective

and 'walk around' inside the story, deepening comprehension (Rowe et al. 2003). In this way, apps that combine dramatic play with action texts in multiple modes open alternative pathways that scaffold meaning-making and participation.

4. **Productive**: The productive dimension supports players' production of original content as in digital paint programs, photography, filmmaking, or editing a text through editing, dubbing, remixing clips, images, or music. In order to learn the purposes, features, and identities associated with these social practices, players need to actually create and engage texts in a cultural context (Buckingham 2003; Burnett and Merchant 2013; Marsh et al. 2015b). Young children, particularly in low-income families, have few opportunities to make and share their own media and most often engage books and games that adults have produced for them (Rideout and Katz 2016). Productive experiences help children develop the critical realization that e-books, apps, and other digital texts are not magically given, but made by people, and thus motivated and malleable (Wohlwend et al. 2013).

To understand participatory literacies as a nexus of practice, each dimension can be analyzed for observable mediated actions, modes, and shared meaning:

- Multiplayer: mediated actions of two or more players touching the screen in collaborative filmmaking teams (blue coding)[2]
- Multilinear: changing meaning trajectories in revising characters, scenery, or changing storylines to create multi-linear strands with repetitive loops or alternate directions (green coding)
- Multimodal: shaping shared meanings and participation through

  – auditory modes by adding or manipulating voice, sound effects, music (orange coding)
  – visual modes by adding or manipulating print, image, color, screen layout (purple coding)
  – embodied and environmental modes by adding or manipulating gaze, posture, movement, spatial layout (yellow coding)

- Productive: creating an action text by operating digital equipment features to create and record text through camera framing, touchscreen navigation, iPad operation (black coding)

The boxes marked in color-coded bands in the video timeline in Fig. 4.1 show coded instances of multiplayer collaboration (rows 1–3), multilinearity (rows 4–5), multimodal complexity (rows 6–13), and technical production (rows 14–18). The excerpt of about eight minutes of iPad play in Fig. 4.1 shows the modal density (overlapping codes) and the modal intensity (frequency of modes) as well as the overall complexity in these play practices where all these dimensions of participatory literacies overlap. In such instances, the small screens of iPads are sites of

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[2]Color-coding used in video analysis software (To see color-based coding, see electronic version of this book with color version of Fig. 4.1).
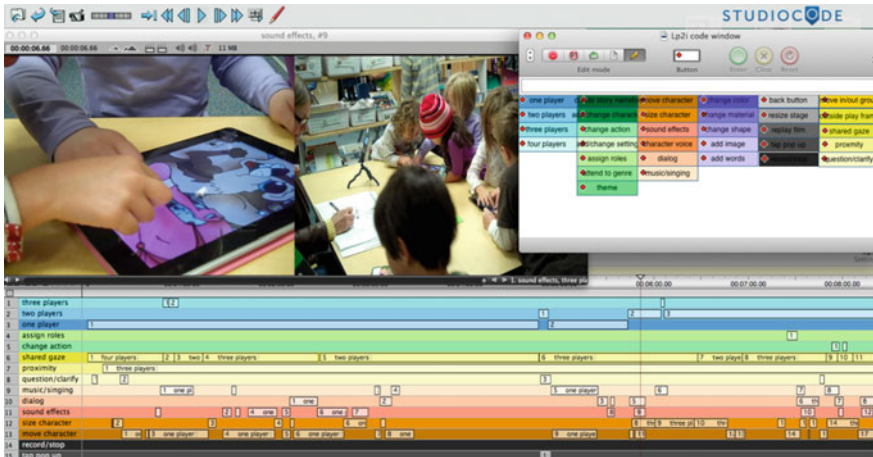
Fig. 4.1 Coded instances of multiplayer collaboration

intense negotiations as children make use of the narrative meanings of characters, storylines, but also their social meanings. In other play groups in this ongoing study, children incorporated photos of friends or classroom objects into their animated films. Like the personalization feature of the e-book app, the puppetry app's photography feature allowed children to create their own characters by taking a photo with the iPad and tracing around the image to create a digital cutout as puppet. In this way, meanings move among bodies, classroom space, and virtual text, blurring material/immaterial dimensions in ways that push multimodal explanations to go further.

Playing Pokémon Go, a Socio-Material Literacy Example

> A family of four young children crowd around a cell phone as they play the Pokémon Go app for the first time, setting up and learning to "swipe up" to capture a Pokémon. The two younger children struggle with seeing a Pokémon character superimposed on their phones' screens, "Wait, is this really real?" "I thought we were actually going to find them, like drive around and find them.," "He wasn't really—like—here". The oldest child explains that "It's kinda like he's invisible right there but then you can see him through the camera."

At the end of the video, the father, narrating for an imagined YouTube audience (realized in over 470,000 views), notes that the children while initially interested had 'more fun just playing outside' https://www.youtube.com/watch?v=BSdwP9J8Ag0. A quick perusal of YouTube reveals pages of similar walkthroughs, let's play playthrough demonstrations, and other fan videos for Pokémon Go, usually featuring adults narrating a screen capture of their game images. Clearly, players were fascinated by the mix of pretense and realities, reading and interacting with an animated character apparently an arm's length away.

Fleer (2014) introduced the concept of *flickering* to conceptualize the small and fluid moves children make between collective and individual imagining, in and out of imaginary scenarios, and between concrete objects and virtual representations on computer screens. Looking closely at collective and individual imagining makes visible how children flicker between concrete realities and collectively imagined spaces. Fleer uses the example of pretend fighting to illustrate how children remain physically present and aware of concrete consequences while carrying on an imagined fight.

However, other researchers (e.g., Lenz Taguchi 2014; Burnett and Merchant 2013) draw on new materialisms (Barad 2003; Latour 2005) to challenge sharp delineations between material and immaterial (Burnett et al. 2014), a move that seems particularly important for researching augmented realities. Where is the boundary between real and imaginary? Is the character imagined because it appears superimposed on a photographic image onscreen? Or is the screen image of a Pokémon always already just as physical as the grass that the Pokémon appears to stand on, the GPS and server that transmits it, the hand that swipes it, and the coding for haptics that read the speed and pressure of a finger touch, and so on. Each component is an actant that engages imagination and sensation, both initiator and responder at some point in the sequence of moments in the capture, so that intra-action among actants co-produces the 'capture'. A materialist lens allows examination of the assemblage of characters, bodies, natural and built environment, touchscreen images, game mechanics, and GPS as a flow that travels along networks where it intertwines with other flows of media, fandom, and commerce in the Pokémon Go phenomenon.

Understanding new technologies as assemblages and flows stretches dimensions of participatory literacies further if we begin to understand technologies as co-producers. Of course, a socio-material lens also expands and ruptures how we understand literacy practices in all sorts of contexts, including the most mundane engagements with a single sheet of paper (Thiel and Wohlwend 2017). How does the concept of assemblage differ from the concept of coordination in the already challenging convergence of dimensions in participatory literacies: managing a filmmaking team, negotiating roles and turns, teaching media production skills to peers, improvising to include friends or to keep play going, and combining multilinear stories with multiple potential directions? This complexity is magnified as more challenges appear in more-than-human interactions that consider machines not as tools but as co-producers: imagining with machines as co-actants while coordinating body actions to manipulate the digital in an unfolding, material text.

Perhaps one answer lies in moving away from cohesion and coordination as goals. In some Vygotskian interpretations, attention is focused and singular, grounding linear models of coordination and harmonious storymaking. Can a model of collaborative production incorporate the design logics of machines while embracing chaotic and temporary connections? Play could inform such a model. Children's play texts are transitory, their action trajectories shifting moment to moment within an emerging story moment to moment, adding and deleting characters in a fluid text, or building on one's own and other co-actants' actions.

Finally, it's important to keep children's lived experiences of digital play at the forefront. How different is Pokémon Go that catches virtual characters with a screenshot from an e-book personalized with a selfie shot? The content is pre-packaged and the interactions are largely limited to aiming the camera and swiping the screen. Children's reactions are telling: if they don't play after the novelty wears off, the game has little learning potential. Games and apps that have staying power allow players to learn and engage deeply through open-ended discovery, production of original content, and collaborative sharing that engage learners over time and space.

Literacy Models as Waves and Ripples

Table 4.2 summarizes this chapter's exploration of three learning models of mobile literacies and the components in each model's nexus of practice, including overarching assumptions about literacy texts, pedagogical models, literacy users, goals, and disparities as well as potential research questions, methods, and theories that align with each. The models in the chart are discursive approaches to understanding digital interactions, ways of interpreting changes in literacies. It is also important to note that the forms—e-book, app, or augmented realities—in this chapter are illustrative and suggest a particular model. However, each form could be combined

Table 4.2 Comparison of three models of technology-mediated literacy learning

	Digital literacy	Participatory literacies	Socio-material literacies
Literacy Practice Illustration	Reading E-book App: JibJab Jr.	Video Sharing Social Media: YouTube App: PuppetPals	Navigating Augmented Reality App: Pokémon Go
Theorization of Literacy Learning	Autonomous literacy Digital skills	Ideological multiliteracies Social practices (Street 1995; New London Group 1996)	(Im)Material Assemblages More-than-human intra-actions (Lenz Taguchi 2014)
Anticipated literacy user(s)	Single reader/writer	Teams of player/producers	Networks of machine/person co-actants
Literacy Goal	Knowledge Acquisition	Cultural representation	Integrated experience Extended reach
Disparity	Achievement gap	Participation gap	Disconnect/stasis
Research questions	What competencies are mastered?	Who is doing what with discourse?	Who–whats are becoming/doing/undoing?
Methods Theories	Standardized assessment Cognitive	Critical Discourse Analysis, Sociocultural	Actor network Post-human Nexus analysis Post-structural

into different assemblages that would support a different set of uses, actions, and goals if interactions were framed by a different model.

In this chapter, I have examined iPad action texts in three models of technology-mediated literacy, using mediated discourse as a tool to make practices visible for comparison. Constantly evolving technologies and expanding digital networks drive new practices that disrupt comfortably established theories of learning, in successive waves across time: first as Digital Literacy, then Participatory Literacies, and now Socio-Material Literacies. But these waves are also ripples that overlap one another, creating blurring and ambiguities that offer alternate explanations beyond dominant models and discourses.

Despite widespread availability of mobile technologies, early childhood education remains a digital desert, or perhaps an oasis, depending upon your discursive perspective. On one hand, visions of developmentally appropriate practice privilege 'natural' materials, creating oases in our classrooms from a daily barrage of popular media and glowing screens. On the other hand, a vision of young children as 'digital natives' and teachers as 'technology laggards' blames teachers for turning the early childhood education landscape into a widespread technology desert. In some ways, each model is a collective cultural imaginary (Medina and Wohlwend 2014) that circulates visions of childhood and legitimatizes the familiar and comfortable print-based literacy of our own childhoods while making screen-based mobile literacies off-limits for young children. However if we recognize that our imaginaries of childhood are dynamic and negotiated ideas, we can open up possibilities to look critically at these visions, question our assumptions, and reconsider ways of doing things.

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Author Biography

Karen E. Wohlwend is Associate Professor of Literacy, Culture, and Language Education at Indiana University. She reconceptualises young children's play as an embodied literacy, produced through popular media and digital technologies in online spaces and classroom cultures. She is the author of *Playing Their Way into Literacies: Reading, Writing, and Belonging in the Early Childhood Classroom; Literacy Playshop: New Literacies, Popular Media, and Play in the Early Childhood Classroom*; and with colleague Carmen Medina *Play, and Globalization: Converging Imaginaries in Children's Critical and Cultural Performances*.