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Paper Title Digital Learning in Early Childhood Education: Possibilities and Points of Entry

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Objectives

The ubiquity of digital media is prompting early childhood educators to rethink their views about the role of media and technology in the education of young children. As media use among young children soars (Rideout & Hamel, 2006) tech-savvy educators are incorporating digital resources into early learning lessons. Their efforts are bolstered by policy documents and research studies indicating that the thoughtful, developmentally appropriate application of media and technology in learning environments can benefit children aged 3 through 8 (Barron et al., 2011; Penuel et al., 2012).

In this context, what constitutes thoughtful adoption and how to ensure developmentally appropriate integration are important questions. A position statement issued by the National Association for the Education of Young Children (NAEYC) and the Fred Rogers Center (2012) offers a balanced approach regarding the use of digital tools in early childhood settings. Technology integration and adoption of media-rich pedagogies that are consistent with NAEYC's position require a consideration of current conditions and practices, including descriptions of how exactly digitally-enriched activities might be incorporated into the curricular activities and instructional repertoires of the preschool classroom.

Our paper presents findings based on two years of data collected from preschool classrooms serving low-income, urban communities. First, we undertake a careful description of the factors affecting the use of media and technology among participating preschool classrooms, such as access; current instructional practices and how they are supported with digital resources; and perceptions related to the educational use of media and technology.

Second, we outline the lessons learned from a design-based research study of 16 teachers implementing a media-rich curricular supplement. The supplement design was informed by a consideration of the contextual factors described above and the pedagogical points of entry they offer for the integration of media and technology into teaching and learning. The account of teachers' experiences, including their successes and challenges, helps clarify key principles for integrating media-rich pedagogies into preschool classrooms, and the professional development teachers require.

Theoretical framework

Developmentally appropriate media and technology promote early learning in various domains, including literacy, mathematics, and science learning (Clements & Sarama, 2007, 2008; Linebarger & Piotrowski, 2009; Neuman, Newman, & Dwyer, 2011; Penuel, et al., 2012; Starkey, Klein, & Wakeley, 2004). Media offers several affordances to augment learning: multiple, dynamic representations of content; opportunities for repetition; interactivity; timely feedback; powerful modeling of language and activities; and opportunities for fostering children's interest and motivation (Townsend, 2011). Educational technology and media also foster the "communication of ideas and collaboration among members of a learning community, visualization and reflection on thinking of children and teachers, and the extension and communication of consolidated learning" (Hong & Trepanier-Street, 2004, p. 88).

Benefits and affordances for learning notwithstanding, the role of media and technology in early childhood has been controversial (Guernsey, 2007). Early childhood educators have expressed concerns that media and technology can impede social interactions that are critical for early development (Bayhan, Olgun, & Yelland, 2002). Recently, however, the discussion has shifted from *whether* media should be

integrated into early childhood education settings to *how* they can be thoughtfully integrated, in a developmentally appropriate manner. The joint position statement (2012) issued by the National Association for the Education of Young Children (NAEYC) and the Fred Rogers Center offers important guidance: it emphasizes that digital resources should provide active, engaging, hands-on experiences; promote social interactions between adults and children and among children; and expand children's access to content. Media and technology should be integrated into the environment, curriculum, and daily routines of the preschool classroom and, as *one* of the available options to support children's learning, they should be used in conjunction with hands-on activities, experiences, and materials.

The integration of media and technology is predicated on a number of conditions, requiring an appreciation of preschool settings and the proclivities of early childhood educators. In addition to educators having access to technology infrastructure, including the Internet, media use requires an openness towards integrating digital tools into teaching activities, and to the belief that media and technology – used in moderation and developmentally appropriate ways – has the potential to enhance learning (Ertmer & Ottenbreit-Leftwich, 2010).

In this context, the notion of a “hybrid innovation” –new disruptive approaches in combination with familiar approaches to create a sustaining innovation (Christensen, Horn, & Staker, 2013) –is salient. An important way in which research can support innovation is by illustrating (and substantiating the perception) that media-rich pedagogies are compatible with current philosophies of teaching, “support and extend traditional materials in valuable ways” (NAEYC, 2012), and contribute to children's learning. Understanding the current state of digital media use in early childhood classrooms and identifying the pedagogical “points of entry” for the integration of media and technology into preschool settings offers one point of departure. Research addressing these aims is likely to illuminate, in a grounded fashion, how media might fit into a preschool instructional day; how it might be introduced, described, and used by adults; how it might change or augment children's conversations; and what support teachers might need to enact instruction that integrates media and technology (Guernsey, 2007).

Methods/ Data

In this paper, we highlight research carried out during the first two years of a five-year initiative to investigate the efficacy of media and technology integration in preschools serving children from low-income communities. During Year 1, researchers collected data on the structural characteristics of preschool programs, current instructional practices, and the extent to which technology does and can support instruction. Data sources included (a) a survey study, which gathered responses from 106 preschool teachers on current instructional practices in mathematics and literacy, current technology use which support those practices, staff perceptions of and attitudes toward the use of media for learning, and contextual aspects of programs that could affect implementation; and (b) an observation study, which examined a subset of 32 classrooms, focusing on prevalent modes of teaching and learning, enhancements that could improve current practice, and the times and places where technology was currently being and might optimally be integrated.

Year 2 emphasized a design-based approach. Turning our attention to mathematics, we explored the potential of using technology—interactive whiteboards (IWBs) and laptops—and media resources—digital videos and interactive games—to enhance instruction. Informed by findings from Year 1, we developed and field-tested a 10-week media-rich curricular supplement and teacher professional

development program in 16 preschool classrooms. Researchers collected a range of implementation data, including weekly logs completed by teachers and coaches supporting these classrooms, and classroom observations (3 per classroom; a total of 48 observations). Our goal was to better understand the landscape of early mathematics instruction and, through the experiences of teachers implementing the curriculum supplement, illuminate possibilities and constraints shaping the use of technology and media resources in present day preschool classrooms.

Findings

This paper presents (a) *context* findings drawn from Year 1, describing preschool educators' access to, use of, and attitudes towards digital resources; and (b) *field test* findings, drawn from Year 2, outlining teachers' experiences with enacting a media-rich mathematics curriculum supplement.

Context findings describe the current state of technology infrastructure in participating preschool programs, policies and procedures influencing their use, and how these factors constrain teaching and learning.

The availability and reliability of digital resources in participating preschools, and therefore their use, varied widely. Few low-income preschool classrooms are well equipped with the latest technology tools, such as interactive whiteboards and tablets. Instead, classrooms tend to be outfitted with a single working computer, which was not necessarily accessible to children (since they are intended for adult use), and may not have up-to-date software or hardware. The accessibility of stable Internet infrastructure also runs the gamut, raising questions about its reliability as a delivery mechanism for media content. Despite challenges of access, teachers' survey responses suggest that some kind of media and technology—mainly desktop computers—is available for instructional use. Moreover, 83% of preschool teachers reported using digital games and software in the classroom, the majority highlight mathematics and literacy instruction as contexts for the use of media and technology.

Findings related to the use of media and technology fall into three main categories: the integration of media and technology into instruction, the social arrangements that shape children's experiences with media, and the ways that teachers support children's media experiences. Instructional uses of digital resources—why teachers chose to use a particular game, platform or website—grew directly from established routines and learning goals. Because students' media use occurs typically during “center time”, early childhood teachers support students' media experiences while attending to overall classroom management and interacting differentially with children. On rare occasions when teachers are familiar with a range of media artifacts aligned with focal content and skills, they are able to select resources for classroom use that introduce and reinforce key ideas for their students.

Field test findings shine a light on the classroom enactment of the math curriculum supplement, highlighting how the activities were integrated into the environment and routines of preschool classrooms; teachers' overall successes and challenges with implementing the curriculum supplement; and their professional development and coaching needs. Although study findings encompass all types of activities in the mathematics curriculum supplement, this paper attends specifically to activities using media and technology.

Teachers noted that children were excited about, and engaged with the media used in the curriculum supplement. The IWB games in particular appeared to be a powerful context for mathematics learning, given the combination of teacher scaffolding, opportunities for children's active participation, the media's affordances for practicing math skills, and the whole-class setting in which the activity was implemented. The interactive large screen offered important supports, including unique representations of concepts, opportunities for tactile manipulation, built-in scaffolds for learning and practicing math skills, and instant feedback.

Supplement activities and materials that hewed to well-established preschool instructional formats tended to be well received by teachers. When media-rich activities embodied instructional philosophies or incorporated practices traditionally valued in early childhood education, they tended to have greater uptake among teachers. For example, the IWB games offered opportunities for tactile play that resonated with early childhood educators' views regarding the importance of manipulative materials (that children can touch, feel, and move) and play and physical movement for children's learning.

Teachers stressed the importance of combining media-rich activities with hands-on activities that included manipulative materials, in order to ensure that developmentally appropriate resources were available to support children's math learning. Unfamiliar activities and those requiring several different materials were a recurring challenge for teachers, as they required time to organize and set up. Teachers reported not having enough time to prepare for supplement activities, resulting in some teachers "winging it," even though they acknowledged that it was a less-than-ideal practice. Despite these challenges, preschool teachers and preschool center directors are willing and able to endure the disruption of a large-scale technology deployment, especially when it also brings the promise of powerful new learning tools well suited to existing routines.

Significance

A significant problem with technology-supported educational reform is its tendency to emphasize infrastructure—using inventories and census-like reports as progress indicators. To tackle the more important, but more difficult, question of how technology can change teaching and improve learning (Fishman, 2006), we must take into account the culture of the community where the reform will be deployed. In the context of media-rich pedagogies, this includes the philosophy of teaching and instructional approaches prevalent in preschool classrooms.

Given the trend toward broad, rapid adoption and use of digital resources by early childhood educators and abiding concerns about risks, research that (a) describes the context into which new technologies are being introduced and (b) begins to point the way as to how best to incorporate digital resources is sorely needed. This paper addresses these needs, using a design-based approach to explicitly examine innovations in context to address real world implementation questions. Findings from this paper are relevant to researchers conducting design-based studies, practitioners interested in using empirical research to guide instructional decisions, and those responsible for setting early learning policy at the school or district levels.

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