Year One Context Studies

A Report to the *Ready to Learn Initiative*

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SRI International is an independent, nonprofit research institute conducting client-sponsored research and development for government agencies, commercial businesses, foundations, and other organizations. SRI's Center for Technology in Learning (CTL) evaluates large-scale technology innovations, designs assessments that enhance teaching and learning, develops tools to help students master complex ideas, builds online communities of learners, and offers strategic learning consulting services.

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Introduction

In knowing hands, public-media resources can help young children growing up in socially and economically disadvantaged circumstances become better prepared to succeed in school. This vision, which has held steady since the original authorizing legislation for the program was written, continues to guide the work of the Corporation for Public Broadcasting (CPB), PBS, and other partners as they continue their Ready to Learn work with support from the US Department of Education's most recent program grant.

While the Initiative's overarching goal remains constant, the current project is unique in two important ways. First, the project has a sharp focus on early mathematics and literacy learning. Second, the Initiative is delivering resources on new and emerging digital platforms, such as tablet computers, interactive whiteboards, and smartphones, that complement better-established technologies such as computers, video displays, and gaming consoles. This approach not only takes advantage of the particular affordances of each platform but, more importantly, allows children and the adults who care for them to engage with content in a variety of contexts: across different settings, in different social arrangements, throughout the course of the school day and beyond it. This transmedia approach, when paired with concerted outreach efforts, is designed to provide enhanced support for preschool and early elementary children.

This report presents findings from the first year of the summative evaluation of CPB's Ready to Learn Initiative. The summative evaluation team includes researchers from the Center for Children and Technology at Education Development Center (EDC), and researchers from the Center for Technology in Learning at SRI International conducted the research.

Research Approach

Most research on the impact of technology in early education is focused on the number of computers in a classroom or time spent using technology, and only begins to explain the kind of training and support teachers in early childhood settings need to be confident and effective in technology integration (Chen & Chang, 2006) or how best to link experiences across platform and setting. This report, which fits within a coordinated program of summative (EDC/SRI) and formative (WestEd) research, provides insights about the learning environments in which the transmedia intervention will be implemented, uncovering information about structural characteristics of programs, current instructional practices, and the extent to which technology does and can support instruction. We report findings from two studies: the *Survey of Target Programs* and the *Program Quality Observation* study. The survey study

gathered responses from 106 preschool teachers and 86 summer–learning-program instructors, identifying current instructional practices in mathematics and literacy, current technology use to support those practices, staff perceptions of and attitudes toward the use of media for learning, and structural characteristics of programs that could affect implementation. The observation study 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 is currently being and might optimally be integrated into classroom practice. The study included classroom observations, teacher and program director interviews, and opportunities for teachers to experiment with and comment on early versions of *Ready to Learn* transmedia. Please see our full report for detailed information on our research methodology. We report the results from a third study, investigating the benefits of PBS LearningMedia Digital Learning Objects in preschool and out-of-school–time environments, separately.

Research questions include:

- What are teachers' current practices with respect to using digital media and technology to teach mathematics and literacy?

- What are the possibilities and points of entry for the use of digital media and technology to teach math and literacy?

- What features of the classroom environment are likely to support the use of digital media and technology?

- How can teachers' own experiences of digital media and technology, e.g., strategies they use and strategies they have heard about, help scaffold their use of digital media and technology for instruction?

- What kinds of evidence-based instructional strategies are teachers using with non-digital media artifacts (for example, with books) that might be augmented by digital media and technology use?

- What are some common barriers that might constrain teachers' instructional use of digital media and technology? What are some of the opportunities that might facilitate teachers' instructional use of digital media and technology?

Findings

This section presents findings based on the analysis of data collected during both the Survey of Target Programs and the Program Quality Observation studies. We describe the current state of technology infrastructure in target programs, the policies and procedures that influence their use, and how these factors constrain teaching and learning in preschool and summer learning programs. We highlight findings associated with three key dimensions of teaching: 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. We also describe how professional development and support influence teachers' readiness to use media and technology. Finally, we share feedback from teachers and directors of preschools and summer learning programs on the new transmedia interactives.

Availability of Media in Early-Learning Settings

We know from previous research that teachers and program directors grapple with what they want young children to know—from content knowledge that is specific to math and literacy, to the kinds of people they want their students to be—and with the best ways to support children's learning and development. As much autonomy as teachers appear to have (and often do have) in their individual classrooms, the daily decisions they make about how to meet learning goals are shaped by broader conditions over which they have little control. The availability of technology tools and the larger infrastructure that supports their use—hardware, software, and technical and instructional support—influence whether and how teachers are able to integrate media content into their teaching.

Among the 191 teachers we surveyed in the 32 early-learning and summer–learning-program classrooms we visited, the availability and reliability of digital resources, and therefore their use, varied widely. Constraints of time, space, Internet connectivity, institutional policies, and funding often shaped the availability and quality of technology that teachers and children may use. Program directors repeatedly told us budget constraints in particular are the main barriers to technology use in their classrooms.

Four Common Types of Technology Access

BASIC INFRASTRUCTURE	GATEWAY TECHNOLOGIES	PERSONAL DEVICES	FUTURE INFRASTRUCTURE
School makes available a monitor for video display, a desktop or laptop computer with a DVD drive, and perhaps a spotty Internet connection	Teacher has ready access to and mastery over CD player, a digital camera, and other 20th-Century technologies the school has provided	Teacher supplements school-supported basic infrastructure, such as a monitor and individual computer, with devices from home, including a smartphone and a tablet	School provides a robust infrastructure and the latest technology tools to teachers and students, including interactive whiteboard and tablets, allowing individual and collaborative play

Basic technology tools have found their way into many classrooms, but infrastructures and support systems tend to be limited.

Few classrooms that the Ready to Learn Initiative targets are well equipped with the latest technology tools, such as interactive whiteboards and tablets. Instead, classrooms tend to be outfitted with at least one working computer. Ninety-eight percent of preschool teachers and 82% of summer–learning-program teachers report having such a computer in their classrooms. However, computers are not necessarily accessible to children (since they are intended for adult use), and may not have up-to-date software or hardware. Tablet computers are far less common than labs, carts, and earlier-generation education technology tools.

The accessibility of stable Internet infrastructure also runs the gamut, raising questions about its reliability as a delivery mechanism for media content. Less than a third of the preschool programs (29%) have Internet connections that children can use to access games and other multimedia. Although summer learning programs report greater connectivity—61% of programs indicate that children may access online content—children may sometimes have to visit the on-site computer lab to get to activities delivered via the Web. Such computer-lab visits allow entire classes to use computers for 30–60-minute increments at least weekly. In the instances where an Internet connection is available for student use, children typically can access only those URLs on a pre-approved list, but sometimes not including PBS KIDS.

Many preschool programs (59%) have in-class Internet access for teachers, and many summer programs (80%) are in a similar situation, though access is more complicated. Summer learning programs typically operate in shared or rented spaces, such as public school classrooms vacated by the "regular" teacher during the summer. As guests in these classrooms, summer learning programs are not always granted access to the tech tools present in the space.

Software access is similarly influenced by site-specific circumstances. Nearly 90% of preschool teachers we surveyed indicated they use software or digital games in their classrooms, compared to 50% of summer–learning-program teachers. Most preschool teachers reported using

whatever software their agencies had installed on computers for them; the teachers had little say or knowledge about the media content with which children interact. But when summer–learning-program teachers were able to use technology, they tended to find the digital media they use on the Internet. Teachers told us the administrative process of reviewing and approving individual technology tools and specific digital content is a hurdle.

Tried-and-true media are a normal part of many teachers' everyday routines.

For many target preschools and summer learning programs, widely adopted technology tools are a regular part of the mix of resources used by teachers and students. Teachers we observed used familiar school-provided technologies, such as digital cameras, tape decks, CD players, and digital music players that they mastered through personal use, rather than more recently released educational tools, such as laptops and interactive whiteboards. All preschool teachers and three-fourths (76%) of summer–learning-program teachers play music in the classroom, often finding songs that relate to concepts children are learning. Over one-third of preschool teachers (35%) and 12% of summer–learning-program teachers use digital cameras, while listening centers are present in one out of every five preschool classrooms in our sample. Few—only 5% of preschool teachers and 3% of summer–learning-program teachers--report access to an interactive whiteboard or a projector.

Some teachers who use media and technology during their off-hours bring personal devices into their classrooms to support a range of learning activities.

Being a teacher calls for improvisation and resourcefulness, which sometimes includes supplementing school-issued materials with those from home. Added to the list of resources teachers have been bringing into their classrooms for years, from art supplies to special-occasion treats, are technology devices. Though not common, a few teachers we observed made their own devices, such as MP3 players, tablets, and mobile phones, available when schools were unable or unwilling to provide them. According to our surveys, use of these technologies—even when provided by schools—is rare: 6% of preschool and <1% of summer–learning-program teachers used cell phones in their classes, while 5% of preschool and 3% of summer–learning-program teachers used projectors.

Media for Teaching and Learning

Against this background of limited support and varied access to digital resources, a number of questions about how media and technology support learning are vitally important: To what extent is media integrated into teaching and learning activities? For what purposes do teachers use media and technology? How are children's media experiences structured and how do they unfold? How do teachers support students' media experiences? In the following subsection, we describe instructional practices relating to the use of media to support learning in three key dimensions: (1) the integration of media and technology into instruction to address learning goals; (2) grouping and social organization of media and technology use; and (3) teacher support for children's media experiences.

Integration of media and technology into instruction

Despite the challenges of access noted in the previous section, teachers' survey responses suggest that access to some kind of media and technology—mainly desktop computers--is widespread within the study's non-representative sample. Moreover, 83% of preschool teachers and 50% of summer–learning-program instructors reported using digital games and software in the classroom, and a majority of teachers reported using digital games and software for mathematics and literacy instruction.

The specific instructional uses of digital resources—why teachers choose to use a particular game, platform or website—varies widely and often grows directly from established routines and learning goals. Drawing from our observations of preschool and summer–learning-program classrooms, we describe a range of different approaches to integrating media into classroom practices.

Four Common Approaches to Classroom Use of Media

FREE PLAY	OPPORTUNISTIC	MEDIA-CENTRIC	SEQUENCED
Child-directed and separate from other class activities; a chance to have fun and explore away from structured lessons, and a way to log time with tech tools unavailable at home	Child-directed media use is related to concepts or skills already encountered; teacher engagement is spontaneous and short	Teacher-designed media activities tied to broader learning goals; each activity considers what a technology tool or media asset can do to support specific kinds of learning	Teacher- selected activities that take advantage of media and non-media experiences; play is part of a seamless instructional array that addresses key concepts and skills

Children's experiences with media often are independent of other teaching and learning activities.

Children's game play in the classrooms we observed was typically self-directed; children chose activities and worked on various skills according to their own interests. Especially in summer learning programs, where the program day is "super-structured," teachers view media use as an occasion for fun and free play. This is not play for play's sake. Gaining skills with the mouse and keyboard, and learning to navigate, are key objectives for media and technology use in both preschools and summer learning programs we studied. Teachers explained how computer use presents opportunities for creating awareness of technology and the chance to develop technology skills, which they view as important, especially in low-income communities where children have limited access to technology at home or in familiar community settings.

Teachers take advantage of children's experiences with media to extend learning, often focusing on discrete skills but in an opportunistic manner and not as part of planned instruction.

In this type of media integration, media experiences provide opportunities for children to review and practice concepts and skills that are important in preschool and early elementary grades. Children's media experiences are not a designed part of instruction; nevertheless, the teacher takes advantage of the opportunities inherent in the media to make connections with other learning concepts and activities, review ideas, and provide explanations or new information. Because preschools and summer learning programs favor the use of educational media that target ubiquitous concepts and skills, intersections between children's media experiences and other learning activities are inevitable. Children are able to revisit, and increase their familiarity with, concepts previously encountered in other contexts and with other representations. For example, in several classrooms we observed children using interactive and non-interactive media (e.g., computer games, songs, and audio books) to practice counting, number sense, sorting and classifying, letter knowledge, vocabulary knowledge, and comprehension, all concepts they had encountered in many previous activities. However, such connections between media content and other instruction tend to be spontaneous rather than systematic. Most instances of opportunistic child-adult joint engagement with media that researchers observed were brief, although there were a few notable exceptions of more sustained interactions.

Sometimes children's media experiences flow from planned instruction. Teachers intentionally select or develop media content to align with the goal of the learning activity.

A third approach we observed was teachers' making children's experiences with media an explicit and often a central focus of their planned instructional activity. Whether working one-on-one, in small groups, or as a whole group, the media experience was a principal component of the learning activity, and instruction capitalized on the affordances of media to emphasize specific concepts and address learning goals.

One instantiation of this approach to media use, quite common in preschool settings, involves activities that incorporate music and movement. All preschool teachers in the study sample report using music in the classroom, and during classroom visits researchers observed several preschool teachers intentionally using songs, especially during circle-time activities, to re-introduce and reinforce familiar but foundational concepts such as letter knowledge, counting, and vocabulary. In one preschool, for example, one teacher integrated a YouTube video—a "hip-hop" version of the alphabet song that paired each letter's name with a picture of the letter on the computer screen—into circle-time activities. Within the classrooms observed in target programs, this pattern of media integration appears more prevalent in preschools than in summer learning programs.

Though rare, teachers combine media-centered activities with activities that do not rely on media to create an instructional mix that addresses key concepts or skills.

A fourth approach teachers take to media is full integration, where technology is neither separate nor privileged; instead, technology is one of many resources from which teachers

draw. Because preschool instruction focuses on foundational learning and school readiness, a finite set of foundational concepts in math and literacy tend to recur across a number of activities and activity settings. Some teachers we observed see this as an opportunity to create classroom units that includes a variety of activities—some of which rely on media—to address learning goals, while other activities take advantage of other learning modalities. For example, in one preschool classroom, the use of a computer game to practice counting in 1's, 2's, and 5's was preceded by a hands-on activity where children manipulated the beads of an abacus to count in 5's and was followed by screening YouTube videos of songs that reinforced the same principles. With the exception of music, which most teachers reported using regularly, the integration of media into teacher-led classroom instruction was rare.

Social arrangements that shape children's experiences with media

Social relationships strongly influence children's computer game play experiences, and likewise their engagement with video and audio. In the classrooms we visited, children use media independently—on their own, or in pairs and small groups—and also in larger groups with the support of teachers and other adults, creating a range of opportunities for participating in and learning through media-based activities.

Three Common Ways Children Experience Media

SOLO	WITH CLASSMATES	TEACHER-LED
Independent media experiences rely on a child's prior knowledge, individual mastery, and technological fluency; the child controls the experience, using her own hands and judgment to navigate the activity	Using media in pairs or small groups creates the chance for turn-taking, cooperative learning, and social development, in addition to learning academic skills and content knowledge	Whether as a whole class, in small groups, or with an individual child, the technology tool is controlled by a teacher; typically part of an activity intended to focus children's attention rather than to provide a hands-on media experience

Children often use media on their own, relying on their prior knowledge, initiative, and technological fluency.

While using media in a one-to-one technology setting, either as timed turns at the class computer or on periodic (once- or twice-a-week) visits to the computer lab, a wide assortment of pre-approved computer games, software programs, and other interactive experiences were available to children in target programs. In addition to selecting from available options, children were able to exercise autonomy during engagement with the specific game or inter-

active they had chosen. Although teachers were at hand to lend support while children interacted with media, they typically did not guide children's choices during individual media use.

The autonomy to select games during individual computer time helps children extend their learning by giving them exposure to advanced concepts, acting as a resource to children struggling to grasp a concept by presenting the information in a different way, and providing a context where children must apply their still-shaky conceptual knowledge. Appropriately leveled content, clear instructions and game objectives, and an interface that young children can navigate with minimal adult support help create positive, productive learning experiences when young children use media on their own. However, when the goals of the game are not clear to children or when the media activity is poorly matched to children's age, prior understanding of concepts, technological fluency, or language abilities, children can find it difficult to remain constructively engaged in solo game play, and the resulting experience can be less favorable for learning.

Children commonly use media in pairs or small groups, which supports social and emotional development, academic skill-building, and content learning.

Because preschool classrooms typically have only one or, at most, two computers, children often gather around classroom computers in pairs or small groups. One child physically controls the media while others cluster close by, watching as the game is played, pointing to or touching the screen to direct their peers' attention, and offering suggestions for the player's next move. Shared use of media can create distractions when children compete with one another to control game play and conflicts when disagreements occur, overshadowing media's potential for learning. On the other hand, media can act as a springboard for cooperative experiences that foster children's academic learning as well as their social development, an important goal for several teachers in target programs. Though rarely observed during the study, in one target preschool program, researchers observed two boys, both beginning English-language learners, grow captivated by the computer during an interactive reading of an ABC e-book. As they alternated turns using the touchscreen to "flip the page" from Aunt Annie's alligator to bubbles and babies, the boys repeated the target words to each other in English, smiling and laughing at the accompanying computer animations.

Teachers regularly use technology to lead hands-off, minds-on lessons.

Although this pattern was not extensive in study classrooms, researchers observed teachers in a few target preschool classrooms use media, usually in a shared display format, to lead a lesson or an activity with the whole class or small groups, to investigate or introduce important learning concepts. The purpose of these activities was to use media to convey something the teacher wants to emphasize rather than to invite children to touch something, namely the media tools. In this adult-led pattern of media use, media functions as a shared object toward which the teacher and children can direct their attention. In one preschool classroom we visited, the teacher's slide presentation, styled as a photo-essay documenting the various activities of the Fish unit, helped anchor a small-group activity by providing a concrete representation to evoke prior experiences, elicit children's responses, and contextualize the teacher's questions and comments.

Teacher support of children's media experiences

The presence of multiple caring adults creates possibilities for educators and volunteers to step in and support children's use of media, providing technical, pedagogical, and social support to help children successfully navigate and learn through media experiences. Because much of students' media use occurs during "center time" at stand-alone stations in preschool classrooms, early childhood teachers support students' media experiences in the way they support other student-driven center activities—that is, while attending to overall classroom management and interacting differentially with children engaged in activities around the room. Teacher support for children's media use takes a different form in summer-learning classrooms, when digital games are usually separated in time and space from teacher-led instruction and are seen as an opportunity for independent practice. We have identified four primary patterns of teacher supports for students' media use.

Four Common Roles Teachers Take in Supporting Children's Media Use

TECH SUPPORT	POP-UP GUIDE	SHERPA	CREATIVE DIRECTOR
The teacher jump-starts children's media use, keeps them from getting stuck when a technical problem arises, and helps them move to another activity when it is time to transition	The teacher makes welcome, surprise visits to children's media play, turning an otherwise stand-alone technology experience into a stand-beside engagement	Teacher sticks with a media experience a child is having, nimbly making use of the tool's format and functions to draw the child into a rich exchange and guide them through it	Teacher helps children use media tools to generate content and express themselves, often over a longer period of engagement

Teachers facilitate children's use of stand-alone media, helping them with practical and technical matters.

When computers are available for child use, either as a center in the classroom or in a separate computer lab, teachers provide structural support that ensures that children are able to use media and technology on their own. We observed how teachers' support can be particularly helpful at the moments when children first get started at stand-alone stations or when they transition from one interactive to another. Beyond helping children with the basics of computer use and troubleshooting when problems arise, teachers sometimes help students choose games and manage the process of taking turns when others are waiting.

Teachers support children's learning experiences with stand-alone media by "dropping in" and engaging with children during brief-but-substantive interactions.

Many learning moments during classroom media use stem from quick, spontaneous adult-child interactions initiated by either adults or children. They may or may not address the media's core content, but these interactions do promote learning and engagement. Teachers facilitate these interactions during independent media use by watching children's progress, asking questions to promote understanding, repeating key ideas, or explaining a concept. Teachers also may model curiosity and forms of inquiry in ways that prompt children to engage the experience more deeply. During our classroom visits, it was common for children to invite conversations with teachers that led to supportive learning experiences with media: They ask for help with cognitive challenges, verify whether they have completed a task or activity correctly, and seek praise by displaying their work.

When possible, teachers use media as the basis for sustained interactions, leveraging specific media formats and features to engage children and support learning.

In addition to supporting child-driven explorations with media, we saw teachers help children develop their understanding of an idea or support skill building by intentionally selecting and presenting media resources. Teachers who are familiar with a range of media artifacts aligned with focal content and skills are able to select resources for classroom use that introduce and reinforce key ideas for their students. In such instances, teachers harness media's unique features—the simultaneous presentation of audio and visual input, interactive simulations, repeated opportunities for practice, and immediate feedback delivered in various forms—to support children's learning in ways that would be challenging for them to orchestrate without the use of media. Teachers contribute in ways that enhance learning, adding a second layer of narration or adding activities to augment a media-based story. Such sustained interactions with a teacher can profoundly change a child's experience of media, in some cases enabling children to complete activities that they could not have done independently.

Occasionally teachers engage children in creative activities, using media tools to create user-generated content as a way of expressing ideas.

One distinct way we saw teachers supporting students' sustained engagement with media is through activities involving content *creation*, using media tools to produce original text and images. This type of teacher support is particularly important for illustrating how teachers can support students in using multiple forms of literacy, including media literacy, as vehicles for the expression of thoughts and ideas. Common tools for content creation include word processing and multimedia software, but digital cameras are also prevalent in target learning environments. One illustration of this type of media use comes from an early-learning classroom where a teacher worked with a child to make a star-shaped ornament in preparation for preschool graduation. The child choose a star shape and identified his digital picture, which the teacher copied and pasted into the center of the star. The teacher then elicited a description of a "preschool memory" from the child, recasting it into a sentence as he typed it on the star.

All of these dimensions of teaching with media and technology are shaped by the training and support that teachers receive. The following section describes, briefly, how professional development, or lack of the same, influenced the teachers we interviewed and observed.

Professional Development for Using Media and Technology

The extent to which teachers are able to identify and take advantage of opportunities for using media to extend learning is contingent on the extent to which they have been trained and supported to enhance learning and teaching using media and technology. In the sample we studied, professional development related to media and technology was uneven. Though 67% of preschool teachers and 44% of summer–learning-program teachers reported receiving some form of professional development relating to using media and technology in the classroom, survey and interview responses reveal that this professional development tends to be narrowly focused on very basic uses of specific technologies, such as turning the device on/off, and rarely focused on strategies for incorporating media into teachers' instructional repertoires and expanding their instructional practices. To effectively design and implement instructional sequences that include media-based activities, teachers need professional development not only in using technology but also in "learning how to use technology in the context of their teaching" (Fishman, 2006). Many of the Future Considerations in the section below relate to the supports teachers will need if they are to integrate the kinds of transmedia resources developed within the Ready to Learn Initiative.

Early Reactions to Transmedia Suites

In the course of our Program Quality Observation study activities, researchers shared early versions of PBS transmedia resources directly with teachers. Their reactions highlight important goals for future development of transmedia for classroom use.

Teachers' wish list for transmedia included:

- Resources that address a broad range of content areas, including but not limited to math and literacy

- Resources that fit with the themes that often guide instruction in early-learning classrooms (e.g., learning about fish, learning where food comes from, "Dr. Seuss Week")

- Use of familiar characters and attractive (but not overwhelming) graphics to attract and sustain children's attention

- Easy-to-use controls and instructions that are clear, even in a noisy classroom environment

- Incorporation of movement; teachers were enthusiastic about the ways that children could use their bodies to interact with some of the new interactives.

- Increasing levels of difficulty as children progress

- Ability to select level of play or content/skill focus based to particular students' needs

- Accessibility in non-Internet-connected classrooms, for example, via USB thumb drive or CD

- Accessibility to interactives even when Java- or Flash are blocked on school computers

Teachers believe that providing individualized learning experiences is best for children, and that transmedia interactives could support this goal.

Teachers report that their classes typically include children of different ages, English-language learners, and also children with vastly different levels of school preparedness, language comprehension, literacy, and math skills. They strive to differentiate instruction so every student has a learning experience best suited to supporting their learning and expect the same flexibility from the digital resources they opt to use. Teachers spoke about picking particular interactives for particular students, depending on what they need to practice, or scaffolding use of the interactives by having children tell them what they were doing as they worked, introducing concepts before play, or having a teacher present at the computer to assist children who need additional support with the concepts.

Most teachers envisioned using PBS transmedia as they use the games currently installed on computers in their classrooms, rather than in new ways.

These views probably reflect teachers' limited access to other technologies, such as interactive whiteboards and projectors, but also their professional judgment about the role digital media should play in the classroom.

Future Considerations

Producers, public media stations and other support agencies, and educators all have roles to play in ensuring that digital media is used to best advantage to improve the odds of school success for children from economically disadvantaged circumstances.

Towards this objective, we have developed a set of recommendations aligned with the findings in this report and designed to help key players do what they can to support the goals of the Ready to Learn Initiative. Our findings indicate a set of bedrock principles for designing digital transmedia that take into account the everyday conditions for teachers and students in early-learning settings. These findings help make evident that:

- Producers, support agencies, and educators can take steps to increase the use of media by creatively matching the existing technological assets in classrooms to the most useful digital media that will run in those settings.

- Media is at its most potent when integrated with instruction by being both aligned with typical instructional routines and appropriately targeted at important content and skills.

- Effective integration depends on an appreciation of how teachers can and do use media in their everyday practice, using this appreciation to design and develop new possibilities.

1.0 Availability of Media in Early-Learning Settings

Teachers depend on the availability of technology tools and infrastructure as a precondition for integrating digital media content into their teaching. A complex array of factors—from institutional policies, to funding priorities, to the availability of IT support—affect whether or not technology is a resource for a particular teacher. Given these constraints, several of our recommendations address the issue of making digital media more available to be integrated into the types of early-learning settings we observed.

For public media producers

Recommendation #1: To get valuable digital media content into teachers' hands quickly, take advantage of the range of platforms and technologies available in classrooms by designing for DVD players, stand-alone computers, smartphones, tablets, and other devices supporting interactivity.

> **Recommendation #2:** Distribute transmedia (including all necessary software so that educators can easily install any necessary plug-ins) via CD-ROM, flash drive, or in other ways that do not depend on constant Internet access.

In many cases, by better assessing the technological assets on site and matching these to the content resources available, educators and those supporting them can better capitalize on the technology currently available in most classrooms. As important as it is to be realistic about existing capacities, new cultural norms that would better support the integration of technology can be nurtured by alliances of leading-edge practitioners, which in turn can lead to greater support for developing the capacity for further integration.

For public media stations, outreach partners, and other support agencies, and also
For administrators and educators

> **Recommendation #3:** Assess what technologies are available to meet the demands and learning needs of children, recognizing the physical and virtual challenges and obstacles present in specific learning environments.

> **Recommendation #4:** Build on the existing technology infrastructure that exists at school sites and select options that are well matched to the resources at each setting.

> **Recommendation #5:** Consider strategic approaches to building digital tool capacity within a school, or across a program, and engage early adopters in the process.

2.0 Integrating media with instruction

2.1. Aligning with typical instructional routines

Among the many rich and engaging activities in the classrooms we visited, early numeracy and literacy were a key focus, with teachers drawing on any and all resources available to them to support children's learning. The key to supporting teachers' efforts to increase the diversity of means for children to develop vital skills and grasp critical concepts is developing media resources that can be integrated into the dynamic and purposeful rhythms of classroom life. We emphasize the value of designing to fit these routines in order to provide options for fitting media to instruction, rather than instruction to media. This does not mean that media cannot be front and center, but that teachers can develop their practices incrementally and according to their best judgment based on the best resources available.

For public media producers

> **Recommendation #6:** Develop transmedia segments that align with and can be integrated into teachers' typical instructional routines, for example, at sign-in when children enter a classroom, daily calendar activities, during shared book readings, or at morning meeting.

Recommendation #7: Design games that target basic skills children are exposed to in other classroom activities, including letter naming, pattern recognition, and mathematical skills such as counting, shape recognition, measurement and other standards from the Ready to Learn math and literacy frameworks.

Recommendation #8: Play to teacher and student preference for thematically linked content—across characters (e.g., Dr. Seuss), concepts (e.g., sea life), or activities (e.g., cooking).

Recommendation #9: Build into media features that can encourage interactions among teachers and students, including tips for teachers, pause points, and discussion prompts to encourage conversation about the topic at hand.

Outreach partners can help change the role of transmedia by providing professional development that allows teachers to experience new possibilities. These professional development experiences can focus on new transmedia resources while countering misconceptions that media activities stand apart from purposeful and valuable classroom instruction.

For public media stations, outreach partners, and other support agencies

Recommendation #10: Share guidance on and model how transmedia address learning and socialization goals to help directors and teachers see the value of integrating them within existing policy and time constraints.

Recommendation #11: Provide professional development outreach on specific ways to use transmedia and digital tools:

- Offer complimentary face-to-face events at partner sites to support awareness of how to integrate digital and non-digital activities for supporting learning.
- Model approaches that include media as an explicit part of the curricular sequence that supports learning goals and content-area learning in mathematics and literacy.
- Give teachers an opportunity to see, explore, and practice with new tools before using them in the classroom.

Educators will be involved in a change process that could shift their views about the possibilities for integrating new media resources into their classrooms and result in plans and actions for actually using media in their instruction.

For classroom educators

Recommendation #12: Create explicit plans for the integration of transmedia into existing instructional sequences that include diverse media-based and non-media activities.

Recommendation #13: Seek and mobilize available resources for integrating media and technology into the curricular sequence to engage it as a component that supports learning.

2.2 Targeting important content and skills appropriately

Teachers' efforts in the preschool and summer learning programs we visited focus on important instructional objectives, ones that center on capacities to identify, classify, represent, and meaningfully use the fundamental elements of mathematics and literacy to understand and communicate ideas about their worlds. Teachers also are working to create environments that enrich children's encounters with the world. Media can help supplement and extend children's classroom experiences of important content in ways that help deepen and balance instruction across target areas.

For public media producers

Recommendation #14: Design media that capitalize on what media do best: creating learning experiences that are difficult or impossible for teachers to create in the classroom otherwise. These would include experiences that span impractical spatial or time scales, require expensive or unusual materials, or would be prohibitively time consuming for teachers. In this way, media could increase the types of resources available to teachers and children for classroom learning.

Recommendation #15: Design media to supplement and enhance, not displace, children's physical interactions with concrete, physical objects by structuring their use in conjunction with the media and by modeling and encouraging children to try new uses of materials.

Recommendation #16: Using multiple representations and approaches, design precursor experiences that serve as early developmental on-ramps, preparing the way for children's future learning of more sophisticated content, such as mapping, graphing, and measurement, and otherwise layer experiences that can be drawn on as important resources later on.

Stations and outreach partners will be best situated to assist in prioritizing and customizing the use of media resources to the needs within specific schools and classrooms.

For public media stations, outreach partners, and other support agencies

Recommendation #17: Provide professional development that helps teachers tailor the selection and integration of media into classroom practice to match the particular math and literacy learning needs teachers identify as most important at their sites.

Educators have a critical role to play in identifying specific capacities and needs in the areas of mathematics and literacy among their students. By communicating to partners the strengths and areas for growth they have identified, they can work with these partners in co-design processes during professional development to plan for integration of media in instructional sequences.

> ***Recommendation #18:*** Identify students' particular math and literacy learning needs and work with stations and support agencies to integrate specific media resources into instruction to help address these needs.

3.0 How teachers can use media to support learning

Our work with teachers shows that they use media to support children's math and literacy learning for many different purposes: to introduce a topic, to teach new content, to help students practice skills, to gain their attention or help them remain engaged, to differentiate instruction, and to reward them for positive effort. They also use media in a variety of social groupings and arrangements to suit particular purposes and in relation to the role the teacher is assuming at the time. Teachers assume different roles in order to optimize the instructional value of media and its practical usability, all in response to children's needs and the many demands on their time and attention.

For public media producers

> ***Recommendation #19:*** Take into consideration that media are used for many different purposes and in many different types of classroom and grouping situations, e.g., at individual computer stations to practice skills and explore independently, within small instructional groups to deepen learning, and on occasion within whole-class meeting time to introduce new content.
>
> ***Recommendation #20:*** Design all media to use multiple sensory modalities, including touch, audio, and visual experiences, and develop media resources that give children the opportunity to learn skills or content in multiple ways, including through games, music, and repetition.
>
> ***Recommendation #21:*** Design games that inspire rather than inhibit a range of social interactions, encourage turn-taking and talking about choices in the game, consider different social groupings, and take strategic advantage of adult supervision to ensure success.
>
> ***Recommendation #22:*** Design games that children can navigate without extensive support, so that teacher involvement can focus on learning, rather than navigation:
>
> - Present clear instructions, an understanding of the activity's objectives, and a simple, functional interface.
> - Offer appropriately leveled content with gradually increasing task difficulty.
> - Provide supportive, clear, action-oriented feedback and hints, including constructive, progressively more direct suggestions (e.g., "Try again to find a word beginning with a C sound").
>
> ***Recommendation #23:*** Design games that fit with classroom routines and teachers' responsibilities:

- Fit rounds of play within the typical short cycles of children's free-choice computer time.
- Allow teachers easily to set levels based on (a) the child's past performance and (b) instructional goals.
- Help teachers make quick assessments of progress by including an easily observable progress bar or a record of activity.

In relation to the practicalities of how media is integrated into classroom practices, stations and support agencies must think of incorporating specific types of co-design into professional development, and educators should clearly be given the options of participating in programs of this type.

For public media stations, outreach partners, and other support agencies, and also
For classroom educators

Recommendation #24: Stations and outreach-and-support agencies providing professional development programs should work with teachers to reflect on existing media practices, building on strengths and addressing areas for growth:

- Create a supportive community across classrooms or among centers or schools that can foster technology use.
- Explore what kinds of additional digital tools can fit within classroom constraints.

Recommendation #25: Leverage teachers' familiarity with commonplace technologies (digital cameras, CDs, music players, iPods, stereos) by co-developing activities that integrate these resources and build on what these technologies can offer.

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