Young Children's Learning with Digital Media
Front Porch Series: Broadcast Calls

Bill Penuel: So again, this webinar is brought to you from this National Center on Quality Teaching and Learning, which is housed at the University of Washington and funded by the Head Start Office at U.S. Department of Health and Human Services. And my institution, the University of Colorado, is a proud part of that effort. And we're involved in developing courses related to early childhood and technology, a tool to help coaches in Head Start, and literature reviews related to media and science learning in early childhood.

My goals for today are threefold. First, I want to share with you some research evidence related to young children's learning with digital media, including television and computers. Also, second, to distinguish effective uses of digital media from maybe less effective ones. And third, to identify the critical roles that adults can play in supporting learning with digital media.

Now, for purposes of our conversation today, I want to define what I mean by digital media. Most of what I'll be talking about is how to choose and make effective use of the things on the right-hand side of this slide, or what's traditionally known as software. Software used to be only programs that you installed on a computer, but today we can install applications on smartphones and tablet PCs, some of which are games that run on these devices. We might play games on specialized devices like PlayStations, or we might interact with a website without having to install anything at all on a computer.

Even so, all software requires some hardware to – to run it. And if you want to make use of digital media in a preschool setting today, you still need hardware to use it. The good news is there's a lot of different kinds of hardware today, and the cost of making at least some computers available to young children in their classrooms is much lower than it used to be.

It's important to begin by acknowledging that there's considerable controversy surrounding the use of media among young children. Much of it has been centered on the very youngest children, from birth to age two. The American Academy of Pediatrics is so concerned about the lack of evidence that media can promote learning and development, as well as the potential adverse effects of media on learning for children at this age, that they've issued numerous policy statements advising against all kinds of screen time for this particular age group. And while their position is different for children of preschool age, we know that many educators are concerned that media take away from opportunities to learn through play and social interaction that are critical for healthy development.

There are also legitimate concerns about how much media children are already using. This table comes from the Kaiser Family Foundation's 2010 study of children's media from ages eight to 18. While not focused on the preschool age group, these statistics have alarmed many parents and educators. It's likely, moreover, that our preschoolers are exposed to a large amount of media in ways that should concern us as educators. The figures are alarming here both because of the amount of the media – 10

hours and 45 minutes on average – as well as the increases that have happened in the past decade. Television going – viewing has gone up, but so have all other categories of media use.

Fred Rogers got into television because he saw that television was a powerful medium and he didn't like what he saw. Children's television programming was full of demeaning behavior, he thought, and he wanted to convey a different message, one he shared in testimony before the U.S. Senate more than 40 years ago. It's a vision of child development that I think those of us who share in the responsibility of educating young children share, and it might be a possible way – path forward for us to think about how to productively use media to support learning at the preschool age.

Fred's approach is reflected in the latest thinking of the National Association for the Education of Young Children and the Fred Rogers joint – Center's joint statement last year on the appropriate use of technology to support learning. Theirs is essentially a positive position around the potential of technology, though the statement is clear, too, about the need for preschool educators to use judgment about whether and how to integrate digital media into their classrooms.

The world we live in presents young children with far more opportunities to engage with digital media today than when Fred Rogers started his television show some 40 years ago. It's not a simple matter of parents or teaching regulating whether or how much television to allow at home or in school. Technology is all around us; it's pervasive. Still, and given that, I think Fred Rogers' basic question for all of us of how educators can use digital media in ways that support the basic and enduring goals of development is important.

Today, my focus is going to be on evidence-based approaches to promoting learning with media within the key domains of the Head Start's Outcomes Framework. I'll focus on some of what the research says both about what kinds of technology applications can promote learning and development and on the specific roles that adults can play to support learning.

In recent years, there've been a number of outcome studies that have examined the impacts of technology, but some domains have been the focus of more research studies than others. The largest number of studies have been conducted of technologies aimed at promoting literacy knowledge and skills as well as language development. There have also been a larger number of studies focused on social and emotional development. Many of these focus on interventions that use fairly simple technology – for example, video playback of social interaction or games to teach basic skills – and a number of these studies focus on mathematics knowledge and skills as well.

But we don't have as many studies in other domains, which doesn't mean that digital media can't be effective in those domains, but it does mean we don't have a strong evidence base to help make selection of what kinds of technologies might benefit students. I'm going to focus in today on some applications in literacy, mathematics, and science that illustrate how technology can support learning in each of these domains. Two of my examples will draw on research that I've done with my colleagues at

the Education Development Center's Center for Children and Technology and SRI International's Center for Technology in Learning, which is also a partner in the Head Start center.

Across a number of studies, the best evidence suggests that certain software programs and television shows can improve foundational skills in literacy for preschoolers. These include teaching children to identify letters and the sounds associated with them; identifying beginning and ending sounds of words; and learning story comprehension. More than 1,000 studies have been conducted on the show "Sesame Street." Nearly all that have looked at outcomes have found a positive impact of watching this program on preschool-aged children.

We sometimes forget that television is a potentially powerful digital medium for learning. But in many ways, the research on "Sesame Street" reminds us that it can be one of the most consistently effective digital tools for learning. With so many different platforms for viewing today, moreover, we can make educational television more widely accessible, including within preschool settings, even as cable shows compete with PBS for the attention of our young children at home.

One effort that I helped to lead was the development and study of a literacy supplement that incorporated content from three television programs: "Sesame Street," "Between the Lions," and "SuperWhy!" All of these appear on the PBS Kids lineup. The supplement incorporated some viewing of clips from these programs as well as incorporation of games available on the PBS Kids website and traditional literacy activities like book reading. In contrast to many past studies of public television viewing's impact on children's literacy skills, this study took place in preschools, and our team provided extensive professional development and coaching to support implementation.

A large study conducted in 80 preschool classrooms serving primarily low-income children found that the supplement had a positive and large impact on some key early literacy skills: letter naming, letter sounds, and concepts of print. A really important design principle for effective software programs, and – and one to look for in other products, is the ways that children interact with media. They should be consistent with how you might teach these skills if you were working one-on-one with children as their teacher.

The idea behind the games is that they should complement these kinds of activities you do with children, and they help kids to stay motivated when repetition is so critical for their learning – not that young children, as we know, need much motivation for repeated practice, unlike adults. For example, the Alpha Pig's Lickety Letter – Letter Bingo, which is on the PBS website – and children in that game have to identify a letter that Alpha Pig, one of the characters from "SuperWhy!," says, much as a teacher might say a letter name and then students might have to pick it out or write it down. In the Spectacular Sounds Bingo, the character from that same show, Princess – Princess Presto, makes a sound that a letter makes and children have to click on the letter that makes that sound, choosing from several possible letters that are presented.

Two other design features that are important to this particular supplement are the intensity and duration of the – of the supplement. The intervention took place over 10 weeks, with roughly 2.5 hours per week. It takes significant time for children to learn with technology or without technology, but this is an aspect of digital media and learning that people often seem to forget when implementing it. Also, many research studies find that teachers don't give children adequate time with computers that they need to have a positive impact. Even the best digital tools can't improve learning if students have too few opportunities to use them.

Finally, an important feature of this intervention that we believe was critical to success was the professional development provided to teachers on implementation in the form of on-site coaching. A number of studies show that preschool – preschool teachers have difficulties with integrating technology into classroom instruction. Needed are both technical and pedagogical supports for teachers to make effective use of technology in preschool. We also found that coaches provided valuable emotional support to teachers to help them through the technical and pedagogical challenges of implementing a media-rich curriculum supplement.

One of the most widely researched technology-supported mathematics curriculum for preschool is the Building Blocks curriculum developed by Doug Clements and Julie Sarama, both researchers at the University of Buffalo. The curriculum teaches preschool-aged children geometric and spatial ideas and skills and ideas and skills related to number and quantity. Children work with and learn about patterns, sorting and sequencing, and measurement and data. Well-designed, large-scale studies show that Building Blocks has a positive impact on learning, including with children from low-income families.

The Building Blocks program is based on the idea of a learning trajectory. A learning trajectory is a theory or idea about how children develop understanding in a particular domain, such as mathematics. The usefulness of a trajectory is that it spells out key transitions on the way to learning big ideas – like counting in number, depicted here – and tasks that can be helpful in supporting children's learning. This table shows part of a learning trajectory for counting developed by Clements and Sarama. The middle column shows the level of understanding of counting typical for ages three and four. The right-hand column shows the kinds of tests that help children at the level to deepen their understanding of counting. This partial list shows one important design principle of Building Blocks, namely, that there are a variety of different kinds of activities that can support learning.

Note also that the tasks have a couple of important features. They involve children in the doing of mathematics, and they are intended to be assigned to children on the basis of their current skill level. As this picture of a child interacting with a computer activity in the Building Blocks curriculum shows, the computer parts are intended to be just as interactive as the parts involving children in direct manipulation of real objects.

Some of the advantage of using computers, though, is that the computer can record the child's movement and progress and provide feedback to the teacher on the progress that she is making. To underscore, technology in Building Blocks doesn't replace either activities that use real manipulatives or

that provide children with rich social interactions. Rather, these complement those activities and provide additional feedback to teachers. Plus, the activities have children do the same kinds of mathematical activities they do in the real world to teach specific skills.

To illustrate another important principle of what makes learning with digital media effective, I draw on a third example of a program for which there's some evidence of effectiveness, this time in the domain of science. Like the first example, this example is a curriculum supplement that makes use of PBS Kids content. The focus is on the program "Sid the Science Kid," a program in which the main character, Sid, engages in investigations in a preschool of different phenomena in the natural world. The program's curriculum focuses both on science content and on key science skills of posing questions, developing hypotheses, making observations, and drawing conclusions from investigation.

The focus of a special study being undertaken by researchers at SRI International, who are part of the LIFE Center, which is housed also at the University of Washington, is on how adults can guide viewing of segments and game play in ways that promote learning from media. The idea that we're studying here is pretty old, actually, and was part of the original thinking behind the design of "Sesame Street." "Sesame Street" was designed to be enjoyable to children and adults alike. Some of the humor was intentionally designed to be funny to adults so that adults would watch alongside their kids. The idea was simple. The creators of "Sesame Street" believed that learning could be augmented by co-viewing.

As one of the researchers involved in the early development wrote, Gerald Lesser, "No single set of television programs or any single educational approach can be expected to produce a substantial effect by itself unless the experiences are tied to other aspects of a child's life. Whenever a parent or older sibling talks with a young child about what they have seen or done together and encourages them to elaborate upon the experience, a multiplier effect is set into motion." And that's what has been found in the research then and today when we talk about the new co-viewing, which includes many more different kinds of media and opportunities for adults to interact with their children, alongside them as they engage with media.

Here's where this webinar aims to get pretty practical here, because some of these tips may be valuable not just in science but in literacy and in math. And these are what we might call a set of talk moves, or talk tools, that educators could use to promote more interactivity when viewing video and playing games. And I draw on these examples from our program and "Sid the Science Kid." These moves are simple and not very hard to master, but they're also potentially really important to making sure that engagement with media is an interactive and not just a passive form of learning.

Take this example, which illustrates an attempt by a preschool teacher to focus attention on something that's happening that's central to the learning goals of the program. Notice that the teacher here talks over the screen, something that the children get used to over time, and points out that Sid is asking viewers a question. The teacher then facilitates a real discussion about Sid's answer. If children were watching alone, Sid's question to them might just be an attempt to call up a memory of a related

experience. In the classroom, it can become a real interaction around Sid's question prompted by the program. It connects what's on the television screen with their real-life experience.

Let's look at a second example. In this one, Teacher Susie, one of the characters in the program, is conducting an experiment with the class on television that's related to freezing and melting. Here, the classroom teacher – the real classroom teacher – pauses the video before – before the television teacher does what she says she will, and she has the children make a prediction about what will happen. Predictions are very important in science, and they're also good at boosting children's language comprehension skills. Here, again, an interaction onscreen is transformed into a rich opportunity for discussion in ways that are prompted by the activity on the screen.

These specific moves can be thought of as belonging to different families, or purposes for interaction. Each of them can help children attend to what's important or what can be learned from interacting with media. Attention is critical, because it is difficult for children to learn from something they don't pay attention to. On their own, children may pay attention to things that are peripheral to the learning, so a valuable talk tool or move is for a teacher to focus the children's attention on the content learning.

Making connections to real-life events helps children see the relevance of learning about science to their own lives, which helps them to identify with the enterprise of science and develops their interest. Probing for understanding – that is, trying to get kids to think about what they are seeing and talk about it – is a way to extend learning as well. Some of the earliest research on co-viewing with "Sesame Street" found that this was a powerful tool for promoting more literacy learning from "Sesame Street."

Finally, a key goal of "Sid the Science Kid" is to provide children with some foundational academic language – that is, a language for science in which children can talk comfortably about things like hypotheses and scientific observation. Pointing to these special words and how they are used can reinforce what the television program is intending to teach.

To summarize what I've presented today, I hope you'll take away three things about the evidence related to digital media and learning in literacy, math, and science. First is that some interventions that use digital media have shown positive impacts on children's learning and development. Second, the effective interventions use interactive digital media and formats for teaching skills that are often like human teaching. That is, they ask students to perform tasks and – and practice skills that might be done in a face-to-face manner but are done interactively with the computer in a way that can provide additional feedback to the teacher. Third, teachers can play a very important role in strengthening learning from media specifically by engaged co-viewing or joint media engagement.

Finally, I want to close with some recommendations for you, especially those who might be considering purchasing or using technology. The first is really to evaluate all technology before purchasing and making sure that you understand the costs of all hardware, software, and support. One of the most important expenses is that support expense, and you want to be sure that the teachers are ready to be able to make use of the technology that you buy. Consider carefully the alignment and integration with

your curriculum. Certain one-off activities may be engaging and exciting, but they don't actually promote the key goals that your curriculum is trying to promote, so that alignment is really critical in selecting technology.

And finally, it's really valuable to provide professional development in the pedagogical uses, or the teaching, with media. And specifically, we think that the best way to do that is to promote professional development through joint engagement.