

Designing Digital Media for Meaningful Learning

May 7, 2024

When designed well, virtual programming and online experiences can facilitate meaningful learning moments in early childhood. This ACM Trends report focuses on these digital media as one educational tool in the museum toolkit. Several well-regarded early childhood organizations have endorsed particular uses of media even for very young children, and we explore the principles and the research behind them before turning to criteria that can help identify when media is the right tool. ACM Trends 7.2 will build on this report by looking at empirical questions that must inform design: how often children use media, which children use media, and where children use media.

This report is based on a review of the research literature. We read dozens of reports and peer-reviewed articles about the current state of early childhood media use, from university researchers and organizations like Sesame Workshop, PBS KIDS, Common Sense Media, the National Association for the Education of Young Children, the Fred Rogers Institute, and the American Association of Pediatrics. One challenge in reviewing this research is a lack of consensus definitions. That means we took a broad view and included **any research about media content for young children delivered over the internet**, from synchronous digital programming and live video calls to games and apps. (For recommendations about games specifically, we recommend a recent UNICEF (2024) report.)

Digital media for young children stirs contentious arguments about screen time and hands-on experience. Researchers recommend paying attention to specific content, not just the amount of time children are spending with screens. They encourage interactive uses of media, rather than purely passive ones, and they offer specific guidelines to support interactivity in media content. They also affirm that educators already have the professional judgment needed to assess whether content is truly educational.

This Trends report reviews the research findings and concludes with practical advice for children's museums seeking to design meaningful digital media experiences for young children.

ACM TRENDS

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Endorsements of Appropriate Media

In 2012, the National Association for the Education of Young Children and the Fred Rogers Center for Early Learning and Children's Media (now the Fred Rogers Institute) put out a joint statement affirming that digital media and technology have potential for supporting young children's learning, and putting forth specific recommendations (NAEYC & FRC, 2012). Since then, other notable child development and early childhood-focused organizations, including the American Association of Pediatrics and the U.S. Departments of Education and Health and Human Services, have released further guidelines (Donohue & Schomberg, 2017).

All of these guidelines agree on key points:

- Blunt measures of quantity of screen time are insufficient; appropriate screen time depends on the nature of the content. In particular, all guidelines encourage educators to use their professional judgment regarding the developmental appropriateness of individual resources.
- They almost exclusively recommend interactive uses of media for children ages zero to five, as opposed to passive ones. As the initial statement puts it, **"Effective uses of technology and media are active, hands-on, engaging, and empowering; give the child control; provide adaptive scaffolds to ease the accomplishment of tasks; and are used as one of many options to support children's learning"** (NAEYC & FRC, 2012, p. 6).

Interactivity Defined

Interactivity generally includes feedback or dialogic interaction (Chi, 2009). That can mean a few different things in a media context: the **media itself may respond to children's choices**. Media can also **support interactivity with adults or peers**, who might talk about what they're doing or seeing, or help each other understand it. Last but not least, media can **extend interaction with the world around us**, by encouraging us to notice things or helping us learn about them. These types of interactivity are not mutually exclusive, and media can include all three.

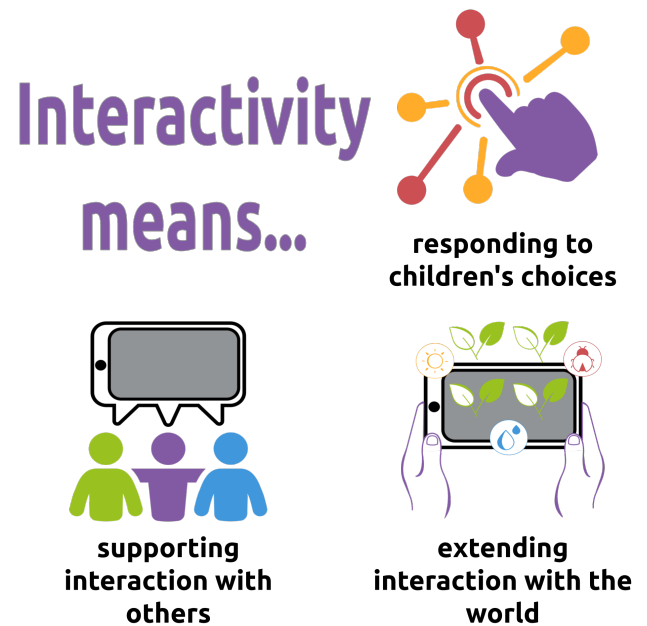


Figure 1. Three major aspects of interactivity when using digital media.

Interactivity with Media

More recent research affirms these principles. In a review of research on young children learning from video, Lovato and Waxman (2016, p. 3) note that **"children's difficulty does not seem to come from screens themselves; what seems to be key is whether they have an opportunity to engage with the screen"** in a meaningful way. Two- to three-year old children are roughly equally successful at finding a hidden object when they see someone hide it in person, through a one-way

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mirror, through a video call with someone who has responded to their commentary, or through an interactive video game that maps to the physical space. Only static video falls short. Similarly, two-year old children succeeded at word learning tasks in live interaction, video interaction, and a video that responded to their choices via touchscreen, but not in static video or a video where the pacing was predetermined or where the children's interaction was limited.

Many of the same studies find that by age three, children successfully learn generally applicable skills from a broader range of video content. Further studies published since this review have found that children as young as 12 months are able to learn from video chats (Myers et al., 2017). These studies also consistently show that the type of interaction matters: pausing and playing alone do not provide enough interactivity to support young children's learning, whereas meaningful choices do. Even choosing the order of activities can help children learn.

Interactivity via Joint Media Engagement

The other chief strategy for interactivity is via the social dimensions of children's media use. In 2011, Lori Takeuchi and Reed Stevens coined the term "**joint media engagement**" (JME) to describe "**shared attentional focus on media in real time**" (p. 4). The term is deliberately broad, and includes media co-use with peers, caregivers, and teachers. Most importantly, they note that JME "**can support learning by providing resources for making sense and making meaning in a particular situation, as well as for future situations**" (p. 9).

Other evidence demonstrates the importance of using media *with* others who can support sensemaking. Two recent studies suggest that parents tend to use media with children when the goals of use are educational. One 2019 survey of 326 parents with children under age 3 found that parents are more likely to use mobile media jointly with their children when the parents' motivations are educational, while they let children use mobile media alone for soothing and distracting purposes (Levine et al., 2019). An observational study of ten families corroborates the finding that adults do not frequently intend children's

solo media use to be educational: parents of very young children end up using digital devices as a "**pacifier**" or "**babysitter**" because they are overwhelmed (Bar Lev & Elias, 2020).

Another recent review (Barr et al., 2019) suggests that adult scaffolding helps children both learn *from* media and technology and learn *to use* media and technology. Even the most high-quality, interactive, and meaningful media content is still enhanced by adult social engagement. Adults might ask questions about what's happening on the screen, name on-screen phenomena or children's actions in a game or encourage kids to share their thoughts and feelings afterwards.

Studies have illustrated different ways of engaging jointly with phones and tablets. A study of twenty parent-child pairs using art apps saw parents and children watching playback together, co-creating the artwork, and playing in parallel, as well as parents sometimes taking on coaching or spectator roles (Bindman et al., 2021). One potential downside of the small size of devices is that children can fairly easily take control and relegate their parents to spectatorship. Children can also support one another in making meaning from media, as illustrated by an ethnographic study of children that identified three roles: the device "**owner**" who made final decisions about what to do, a "**co-participant**" role who engaged jointly, and a "**spectator**" role (Aarsand & Sørenssen, 2023). In these roles, children share what they have learned about how to use devices and problem-solve together.

Interactivity with the World

Media can also support children to notice and learn from the world around them. One clear example is the number of cellphone apps asking the public to gather data for scientific efforts by observing and taking note of phenomena in the world. An evaluation study of one such set of digital tools found that children noticed more things about nature, asked more questions, and shared more ideas with their families (Paulsen et al., 2021). That is, the app helped increase children's environmental science habits of mind and content knowledge, as well as changing family behavior in nature.

Key Takeaways

Children's museums already know that powerful learning experiences engage children to interact with other people and with the world around them. The kinds of digital media that lead to impactful learning work the same way. This means that children's museums are well positioned to create the kinds of media that will engage children in meaningful learning anyplace and anywhere.

Children's museums have the opportunity to shape and influence the children's media landscape to create experiences that support children's learning. Some ways to take advantage of this opportunity include:

- Design media experiences that give children the opportunity to make choices, and that respond to children's choices and actions.
- Design media experiences that prompt conversations between children and others.
- Design media experiences that encourage children to notice things in the natural world.

If media is new for your institution, you don't have to do it alone. Consider partnering with local public media producers who may already be working in this space.

About This Research

Data for this report was collected through a review of existing literature. This research was supported by the Institute for Museum and Library Services.

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This study was made possible in part by the Institute of Museum and Library Services.

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Knology Publication #IML.145.842.02

Recommended Citation:

Barchas-Lichtenstein, J., Reich, C., Voiklis, J., Field, S., Bowen, E. (2024). *Designing Digital Media for Meaningful Learning*. ACM Trends 7(1). Knology & Association of Children's Museums.