

SCREEN SENSE

What the Research Says About the Impact of Media on Children Aged 0-3 Years Old



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INTRODUCTION

It is natural that today's parents and caregivers should wonder about the role that screens do, or should, play in the lives of the babies and toddlers they love. Because ultimately, babies today are born into a world where screens and human interaction are often seamlessly interwoven—a world where parents can use video chat to play peek-a-boo with their toddler while they travel for work, but where those same parents can be distracted by their emails during in-person play time.



Screen Sense—developed in partnership with leading researchers in the field of media and young children—describes what is known at this time about the effect of screen media on young children's learning and development. We hope this report, with the help of the [Screen Sense parent resources](#), will serve as a useful tool in guiding parents and professionals in making mindful, informed decisions about screen media use with children from zero to 3—so that if they choose to make screen media a part of children's lives, they can do it in a way that harnesses the potential of technology to enhance learning and development.

The developmental research tells us that creating a healthy screen media environment for children is about more than just screen time; it's also about selecting media experiences informed by the **individual child**, the

context in which the media is used, and the **content** of children's media exposure.⁶ With this in mind, we have organized this report to reflect these "3 C's"⁶, describing the latest research on each and summarizing each section with evidence-based guidelines to help caregivers make informed choices for their specific situations. We end by considering the research on screen time in childhood, using the 3 C's to help readers unpack the hidden nuance in these findings and apply them as appropriate. Throughout the report, we provide recommendations for parents and other adults in children's lives that reflect the current research on screen media use and young children's learning and development. With this report, we hope to empower caregivers with the information they need to build a **screen sense** that works for them and their families.

Spotlight on the 3 C's: The Child, the Content, and the Context⁶



An easy rule of thumb for choosing appropriate media for your child is to:

CHILD

Think about your specific **child**, including details like her age, specific interests, attention span, and even her current mood. Does this media exposure seem right for your unique child, right now?

CONTENT

Consider the media **content**. Does it engage your child in meaningful and active ways? Do you support the themes and topics that are introduced? Is it relevant to her real life?

CONTEXT

Consider the **context** in which your child is learning: For example, is your child alone or sitting with you when watching or playing something on screen? Young children learn more when an adult is with them to respond to questions and help them understand and apply what they are seeing and experiencing on screen.

So, remember to choose media content that you won't mind experiencing right along with your child, and when it's time, dive in with her!

THE CHILD

When evaluating screen media use for young children, it is always important to consider the individual characteristics of the particular child or children involved. For example, it may be helpful to consider a child's special interests, her mood, or her attention span at that moment. It is especially important to consider the [age and stage of the child](#), as research has demonstrated key developmental patterns in how young children respond to and learn from screen media as they grow.



Screens Under 3: Why young children struggle to learn from screen media

Every day, young children are learning about their world from a variety of sources. They then apply what they have learned to their day-to-day experiences. Consider a 2-year-old who reads a book about going to the doctor with her parent and is especially interested in a page where a nurse explains, "This shot will help you stay healthy." A few days later this toddler holds a toy syringe up to her doll's arm while saying, "Get a shot!" This is called **transfer of learning**, or the application of information from a 2-D object (in this case, a book) to a 3-D object (the actual toy). Transfer of learning is critical because it means that the child can apply knowledge to her real-world experiences. Another example might be a child learning numbers and then using them to count the crackers on his snack plate. Transfer of learning is quite

different from **rote memorization**, in which a child may memorize the name for objects, letters, or numbers, but is not able to apply that knowledge in a new situation.¹³

The Transfer Deficit

Children do learn from TV and tablets, starting very early. Research shows that babies as young as 6 months old can imitate simple actions they see on TV, immediately afterward and even up to 24 hours later;¹⁴ and by 18 months, toddlers can remember brief sequences that they saw on TV or in a book for 2 weeks. By 2 years old, they can remember these sequences for 1 month.¹⁵

Researchers who study how children learn have concluded, however, that it is easier for young children to learn from real-life interactions with people and objects, compared with information delivered via a screen. Researchers call this phenomenon the transfer deficit.¹³ For example, studies show that,

Screen Use by Infants and Toddlers

Typically, media guidelines for families are provided in terms of screen time recommendations. But nationally representative surveys demonstrate that screens are a very present part of many children's daily lives.

The American Academy of Pediatrics (AAP)¹² recommends using the following guidelines for children's use of screen media between zero and 3 years of age:



Birth through 18 months

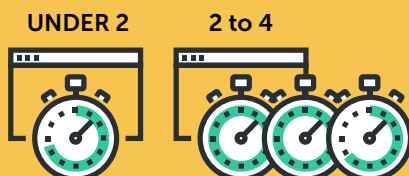
Avoid all screen media—phones, tablets, TVs, and computers. But it's fine to video chat with parents, grandparents, and far-away friends.



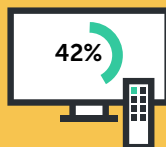
18 months to 3 years

If desired by the family, it is acceptable to introduce young children to high-quality children's media if parent(s) watch it with them (in moderation) and help them understand what they're seeing. Even with older toddlers aged 3 years and up, parents/professionals should limit screen use to one hour a day of high-quality programs designed for children.

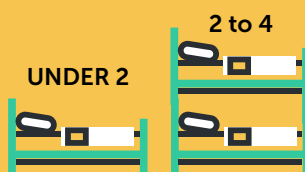
Screen Time. In 2017, Common Sense Media⁷ conducted a survey of media exposure in the United States and reported the following:



On average, children from birth to 23 months old spend 42 minutes with screens a day, and 2- to 4-year-olds spend 2 hours and 39 minutes a day. Most screen time (72%) is spent viewing televised content.



42% of parents report the TV is on "always" or "most of the time" in their home, whether anyone is watching or not.



24% of children under 2 years often or sometimes use screen media in the hour before bed and this rate increases to 49% of 2- to 4-year-olds.



98% of all homes have a mobile device. Use of mobile media starts young: Almost half (46%) of all children less than 2 years old have used a mobile device. Children under 2 years use mobile devices for 7 minutes per day but 2- to 4-year-olds use them for 1 hour 2 minutes per day.

Tablet use. In a survey of parents with children aged 5 to 40 months, 75% of families used touchscreen technology such as tablets to view videos or photos, and 50% reported using tablet applications advertised to be used with babies.⁸ Parents see potential in using screen technology to support their children's learning. According to a 2016 survey, a majority of parents—61%—identified the ages of 2 to 2.5 years as being acceptable ages for their children to use technology, with some of those parents endorsing even younger ages.⁹



Video chat. Some research suggests that as many as one-third of young children (under the age of 6 years) use video chat at least once per week^{10,11} but nationally representative reports are lower.⁷ Interestingly, many



parents report video chat experiences as an exception to their screen time or media rules, perhaps because it is often used as a tool to maintain and strengthen valued familial relationships, such as those with remote grandparents.¹⁰

for children 12, 15, and 18 months old, the ability to imitate a multi-step sequence from TV lags behind their ability to learn from a live demonstration of the same action.¹⁶ Similarly, when 2-year-old children are told via a pre-recorded video where to find an attractive toy hidden in the room, they are typically unable to locate the toy, even though children are perfectly capable of doing so when given the same information in person.¹⁷ This finding has been replicated across many types of tasks—demonstrating the broad impact of this transfer deficit from video content on young children. The size or type of screen (television, phone, or tablet) does not change this finding.



Interactive Tablet Use and the Transfer Deficit. Children under the age of three years are capable of learning from interactive touchscreen tablets, but they still experience a transfer deficit.¹⁸ Research on the transfer deficit and tablets demonstrates that the relationship between how children interact with media and how they transfer learning

from media is actually quite complicated. For example, 3-year-olds learned STEM content about numbers and biological growth via video but not via an interactive tablet game.¹⁹ They did not transfer to novel 3D objects. Five-year-olds, on the other hand, learned from the video and the interactive tablet game. When they were tested with a new set of 3D objects, 5-year-olds were only able to transfer what they had learned from the video but not the interactive game. Researchers note that compared to video, the interactivity of the game probably placed cognitive demands on the children. These extra demands on attention, combined with complex content, may have overloaded their cognitive capacity and interfered with their ability to learn and transfer this knowledge to the real world. This research suggests that the complexity of the content and the complexity of operating the device needs to be considered at all ages, although cognitive overload can happen especially easily during early childhood.



TAKEAWAYS

Supporting the needs of very young children

- **Limit media time to ensure lots of time for interactive play in the real, 3-D world** because young children learn more quickly and efficiently through interactions that take place during exploration of their environment with parents, caregivers/teachers, and peers.³⁸
- **Be cautious about the amount of learning to expect** a young child can derive from screen exposure alone.

Technoference: How media can disrupt interactions

“Technoference” is defined as everyday interruptions to interpersonal interactions or time spent together that occur due to digital and mobile technology devices.²³⁻²⁵ Early childhood may be a particularly vulnerable time for technoference, as young children expect (and need) a great deal of social interaction from others.

Parents who report that their child has a more difficult temperament were more likely to use mobile technology as a calming device for their children. It is not possible to know whether parents with more difficult babies use mobile devices more for calming, whether parents who felt more overwhelmed used mobile devices, or if mobile devices were likely to result in more socioemotional difficulties. Frequent use of mobile devices for self-regulation may mean, however, that parents and children are less likely to develop other regulatory strategies.²⁶ In this case, technology may interfere with children’s emotion regulation.

Background television. A recent survey of U.S. families showed that, on average, young children under 3 years old are being exposed to an average of 5.5 hours of background TV per day (i.e. when the TV is on in the background, while no one in particular is watching it), which represents approximately 40% of a child’s waking life.²⁷ This is important because background television is typically not child-directed, is mostly incomprehensible to young children,²⁸ and may disrupt cognitive processing by distracting young children from focusing on exploration and play.²⁹

Several studies tracking children over time have shown that exposure to background TV is associated with a negative effect on children’s language development, cognitive development, and executive functioning skills.³⁰⁻³² **Executive functioning** refers to a set of mental processes that helps people apply past experience to present action, including the ability to plan, organize, strategize, and pay attention to and remember details.³³ The presence of background television is associated with poorer parent-child interaction. When the TV is on, both the quantity and quality (as measured by how actively parents and children play

together) of parent-child interaction decreases.^{28 29} This effect is particularly important, considering the significant body of research showing how critical healthy parent-child interaction is for optimum overall child development.

Exposure to entertainment programs. The negative effects of distracting sounds, pace, and content are present in both adult- and child-directed programming. Programs that are fantastical (or feature unrealistic characters and settings) have a more negative effect on executive functioning than shows that are more realistic in nature. It’s likely that children younger than 2 years find it difficult to comprehend the fantastical elements of the plot that are not grounded in their understanding of everyday life, so these programs may further tax their emerging executive functioning skills.³⁴ This phenomenon is similar to the mental exhaustion students can experience after taking a challenging exam. For example, research shows that exposure to entertainment shows that are not designed for preschoolers that include fantastical elements (such as *SpongeBob SquarePants*) has a negative effect on 4-year-olds’ executive functioning.^{34,35} It is not known how long this effect lasts.

This finding is especially important, given that current usage data show that 20% of children from birth to 23 months old and 48% of children 2 to 4 years old watch children’s entertainment shows.⁷ Interestingly, playing an interactive tablet game that has fantastical elements does not interfere with EF.³⁶

Researchers believe that when children are exposed to content that is not age-appropriate, their minds are busy trying to figure out what is going on. Because the scenes and characters are appearing quickly, are set in unfamiliar contexts, and contain complex language that children can’t fully understand,



Executive functioning refers to a set of mental processes that helps people apply past experience to present action, including the ability to plan, organize, strategize, and pay attention to and remember details.





this experience taxes their thinking skills. If this exposure is happening an average of 5.5 hours per day every day, cognitive functioning may be continuously taxed and result in negative effects.

Parents' own media use. What about when parents use their own personal devices, like smartphones and tablets, when they are with their young children? Researchers at Boston Medical Center conducted an observational study of 55 parents and their young children eating at fast-food restaurants. They reported that 40 of the 55 parents used a mobile device during the meal. Furthermore, the researchers found that the more time that parents interacted with mobile devices, the more likely their children were to act out, apparently trying to get the parents' attention, which often led to angry reactions by the parents, including shouting and, in one case, kicking a child's foot.³⁷

Although this was an observational study, it suggests that many parents may be missing valuable opportunities for positive social interaction with their children when using their mobile devices, and that parental absorption in their mobile devices can result in increased negative child behaviors.

Could interruptions from texts or calls also interrupt language learning? Researchers³⁸ asked mothers to teach their 2-year-olds two novel words. Mothers received a call that interrupted them while teaching one of the words, but not the other word. Children were significantly more likely to learn the uninterrupted word than the interrupted word. This finding remained despite the child hearing the novel word the same number of times in both conditions.

Parents are often not aware of their own media usage or that it can interrupt an ongoing activity with their child. As with other forms of media it is important to consider the 3 C's: While it's quite likely that media interruptions in parent-child interactions—whether it's a phone call during play time or a parent's use of their smartphone during a meal—would lead to challenges, it's important to remember that the effect of these interruptions may differ based on the individual child (How old is the child? Does she need the parent urgently?), the context of the interruption (Is this unusual or a repeated pattern? Is the parent including the child in the media use?), and the content the parent is using (Is this absentminded absorption in a device, a call from work, or a sharable Skype call from a parent away on a work trip?).



TAKEAWAYS

Reducing technoference

- **Be mindful about mobile device use throughout the day.**
 - Consider whether it is possible to carve out times when you don't have to multitask between your child and demands/notifications from devices. The "do not disturb" or silent setting on your phone can be useful during one-on-one time.
- **Avoid background media.**
 - Turn off the television when children are playing and during daily routines like mealtime.
 - Turn the TV off when no one is watching.
 - Reserve time to watch adult-directed TV when children are not present.
- **Use daily routines (mealtime, bath time, bedtime, diapering) as opportunities to connect with children** through conversation and playful serve-and-return interaction.

CONTENT AND CONTEXT

The Four Pillars of Quality Media Content

Maximizing Learning: Content and Context

A Spotlight on the Four Pillars of Learning (“E-AIMS”)³⁶

In 2015, scientists summarized decades of work from the Science of Learning into four guidelines describing how children learn best, which they called “The Four Pillars of Learning.” These four pillars can be used by parents, teachers, and other adults to help identify high-quality children’s media. They can be easily remembered by the acronym E-AIMS: Engaging, Actively Involved, Meaningful, and Social.³⁹ Adults can use the three C’s along with these guidelines to judge the value of using different media to support young children’s learning.



E: Children learn best when they are **ENGAGED** with the material and undistracted by features that are unrelated to the main content. The engaging features should have a purpose: to focus the child’s attention on a consistent learning goal. Is the child staying on task? Are they following a story or learning activity? Or are there lots of irrelevant details? More bells and whistles aren’t necessarily better. Any feature—no matter how entertaining or exciting—that does not support children’s focus on the learning goal can run the risk of distracting children from the educational content.



AI: Learning is supported when children are **ACTIVELY INVOLVED** in the educational content. The key here is that content should be “*minds-on*,” i.e., the child is mentally active, putting mental effort into participating in the content. Is the child so familiar with the content that they can participate mindlessly, or are they being challenged to explore something new (but accessible)? Is the task to passively tap or swipe at shapes repeatedly, or is the child asked to actively build something new with those shapes? It is important to remember that physical and mental involvement do not always align: Physical activities that require little mental effort (like tapping in response to a sound) can be “*minds-off*,” conversely, activities that require purposeful consideration—like searching for a shape that fits into a hole—may be less physically active, but are deeply “*minds-on*.”



M: The educational content is learned best when embedded in **MEANINGFUL** experiences and settings that children can relate to. Meaningful content is all about making connections: Content should be integrated in a context that is relevant to children’s lives, linking new information to what is already familiar. For example, learning farm animal vocabulary “by rote” (out of context, like on flash cards) is not as meaningful as learning those words through a story about farm animals. And stories like these are even more powerful for learning when they include a familiar context or characters, to help them make links between what they already know and what they are learning.



S: Children learn best when the learning is **SOCIAL**. This can take many forms, including media content that mimics social interaction or encourages high-quality interactions between children and other people in their own environment. But children’s learning from media is also supported by their context, when the people around them engage right along with them in the screen content.

ENGAGED

Engaging content is media content that is designed to help children focus on a specific learning goal without distractions unrelated to the learning objective. The importance of this pillar is demonstrated well in the research on e-books for young children.



E-book Interactivity: Finding the right balance

Over the past several years, e-books have appeared on the market to be used by families to share stories with their young children, though 90% of parents continue to prefer print books over e-books.⁴⁰ Indeed, children 2 years and younger spend an average of 20 minutes per day with print books, but only 1 minute on average reading e-books⁷. Parents report that e-books tend to be used in specific situations—such as when they are unavailable to read to children or when families are outside the home—and they appreciate that e-books can be both inexpensive and can be delivered directly onto mobile devices and computers. This suggests that they have the potential to greatly expand the available literacy resources for many families.



Emerging research has begun to explore the ways in which e-books can be most—and least—supportive of early development. Getting the balance of interactivity right is crucial. Both children and parents can be distracted from the storyline by clicking different hotspots (interactive areas on the screen). One study showed that when using early versions of e-readers, parents tended to focus more on the technology and less on the story, guiding their children to click on e-readers' different features, such as touching a picture to make a sound. This type of interaction resulted in children recalling very little about what was read, reducing their story comprehension.⁴⁰ Similarly, when children activate extra features in storybook apps, they become distracted from the narrative. For example, when an activity—asking children to find things that begin with the letter C—popped up in a storybook app about Clifford the Dog, researchers found that 3-year-olds' understanding of the story's plot decreased.⁴¹ In contrast, another study found no difference in comprehension levels between an e-book and a paper book

and reported that children's engagement levels were actually higher for e-books⁴². These different results may be a result of the number of distracting "bells and whistles" present, or the amount of interactivity integrated in the e-book.

A study from the Joan Ganz Cooney Center⁴³ examined the impact of various degrees of e-book interactivity. The researchers asked 32 pairs of parents of 3- to 6-year-olds to read either a traditional print book and a basic e-book, or a traditional print book and an enhanced/highly interactive e-book to their child. The enhanced e-book was less effective than the print and basic e-book in supporting the benefits of co-reading. Children who read the enhanced e-books also recalled significantly fewer narrative details than children who read the print version of the same story. Researchers speculated that because the enhanced e-book prompted more non-content related interactions between parents and children (such as discussion about how the device functions or pushing hands away from the device), its features may have detracted from positive co-reading experiences and may have distracted children from the storyline.

In contrast, a meta-analysis of 29 studies⁴⁴ showed that when adults read well-constructed e-books and traditional books to children, comprehension was equivalent across book types. The authors⁴¹ propose that e-books should be designed without irrelevant hotspots or distractors, in such a way as to engage the reader and even sometimes allow for the child to read alone and enhance comprehension.

For parents, teachers, and caregivers, finding a "just right" balance of interactivity is critical when selecting e-books and other screen media for young children.

Too much interactivity is distracting to children and shifts attention away from comprehension, hindering children's learning. On the other hand, when interactive features are crafted to support the learning goal, they can enrich preschoolers' learning.^{44,45,46} Well-designed e-books can be useful tools in early learning, when parents and caregivers guide their children to focus on the story.



ACTIVELY INVOLVED

Media that encourages children's active involvement engages children in "minds-on" experiences, sparking their motivation to engage fully.



Research shows that the more active children are as they engage with screen media, the greater their learning. When preschoolers actively attend for longer periods of time to educational programming, they learn more from it.⁴⁷ Indeed, programs like *Dora the Explorer* and *Blue's Clues*, in which characters speak directly to the child and pause for the child's reply—actively eliciting their participation—have been found to encourage expressive language production and vocabulary.⁴⁸



To study younger children, researchers sometimes use an "object retrieval task" to explore the question of whether children can learn from screens. Imagine an experimenter hides an object, like a sticker, from view while 2-year-olds watch on video or on a tablet. The children are then asked to search for the object on another screen or with real props that are identical to those used in the video. In general, the research shows that the more interactive the touchscreen experience is, the more successful children are at finding the hidden item when they transfer from the tablet to real props.⁴⁹

In one study on object retrieval⁵⁰, children 30 to 36 months old viewed a scene in a laundry room in which puppets popped out from baskets or from behind pajamas hanging on the clothesline. These children were randomly assigned to view this scene in different ways: The first group watched the puppet show in person; the second group watched on a video monitor; and the third group also watched on a video monitor, but had to touch a computer keyboard whenever they wanted the puppets to appear from their hiding place.

After viewing the scene, each child entered the actual room to find the puppets. The children who had watched the video searched for some time before they were able to find the real puppets; but the children who watched the in-person demonstration and those who played the interactive game were each much more likely to head directly to the correct place where the puppets were hidden. These results were observed even with the younger, 2½-year-old children, suggesting that actively interacting with the content—in this case, pressing that space bar on a computer to make puppets appear from their hiding places—can improve children's ability to learn from the screen, even when they are toddlers.⁵⁰

A child's recent experiences also play a role in the way they learn from interactive experiences. For example, the study of 2-year-olds⁵¹ in the object retrieval task discussed above found that the more time toddlers had spent the previous day engaged in **interactive** media activities, the more successful they were likely to transfer learning and to find the hidden object. The key feature seems to be the **interactivity** of the media experience, since time spent engaged in non-interactive (e.g., viewing only) media was not associated with children's ability to find the hidden object.

It's also important to consider characteristics of the child, like the child's age, when evaluating the role of interactivity. For example, in one study, 2-year-olds who engaged with interactive videos on touchscreen tablets demonstrated increased word learning as compared to toddlers who viewed non-interactive videos on tablets.⁵² But the way they learned best from this interactivity was different for children of different ages: at 2 years of age, children benefited most when they were directed by the app to interact with specific information on the screen, whereas older 2.5-year-olds did better when they could choose for themselves where to interact on the screen.



Similarly, recent research suggests that children's recent experience with video chat may diminish the transfer deficit. For example, children who engaged in a five-minute video chat interaction with an adult partner **prior** to the object retrieval task (mentioned above) were able to successfully use the information given to them on screen to find the toy.¹⁷

MEANINGFUL

Meaningful media content is embedded in **MEANINGFUL** and familiar experiences and settings that children can relate to. When facts are presented out of context, disconnected from the contexts or goals that make them relevant for children's lives, deeper learning is difficult to accomplish. Meaningful content is all about making connections: Content should be integrated in a context that is relevant to children's lives, linking new information to content that is already familiar or to real-world applications that children care about.



There are many ways to help make learning meaningful, but most of them involve some kind of **scaffolding**. Just like a physical scaffold on a building under construction, scaffolding learning is a way of bolstering the next step in a child's learning with temporary supports, which can be removed once the child can accomplish the learning independently.^{53,54} For example, a parent often holds a toddler's hand when he climbs stairs for the first time, but as the child grows and is able to climb the stairs safely alone, the parent will gradually give the child more space to do so independently. Similarly, scaffolding, whether created by parents or the media content itself, can be used to help young children make connections between new and familiar content, supporting the next step in their learning. The key is to help build or connect to a framework within which children can understand new information.

Meaningful video content. Parent-child interactions are a critical part of early development and make up an enormous part of children's everyday experiences. Content that portrays warm adult-child interactions should support children's learning, especially in the youngest children, because it is one of the most present and important parts of their daily lives. Surprisingly, however, when researchers reviewed all of the commercially available infant-directed DVDs and coded them for language-promoting strategies, pacing, and the quality of interactions depicted, they found that the vast majority (80%) of the baby DVDs did not show examples of quality interactions or language-promoting strategies.⁵⁵ It is not surprising, therefore, that another study on TV viewing revealed that watching commercially produced DVDs targeted at babies was associated with poorer language in babies 8 to 16 months old, but viewing educational children's TV was not.⁵⁶

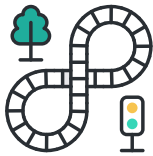


Video content can also be made meaningful by incorporating learning into an engaging storyline. For example, it is easier for children under the age of 3 years to learn from stories.⁴⁸ Content creators can also provide accompanying resources for families and schools that guide adults in making explicit connections between the content, the learning goal, and meaningful contexts in children's lives. For example, the PBS Ready to Learn initiative provides content for



parents and teachers across multiple media platforms to help families support children's learning from the *Peg + Cat* program. For example, the *Peg + Cat* app's content complements the content on the *Peg + Cat* television show and provides related activities for parents to do at home with their children. When studied, this interconnected, scaffolded learning approach led to enhanced math knowledge, understanding, and ability among the preschoolers who were tested.⁵⁷

Familiar characters. Another way to scaffold learning in screen media is to use characters that are well-known and, therefore, meaningful to young children. Toddlers learn more from screens when the person or character on screen is familiar and loved (like a friend, relative, or beloved TV character like Elmo⁵⁸). In one study, a known character (Elmo) or an unknown character that was popular in another country demonstrated an early math concept. Two-year-olds learned the math concept from the known character, overcoming a transfer deficit that was observed with the unknown character.



Repetition. Young children love to view the same episode or to read the same paper picture book over and over. Repetition of screen experiences can also act as a temporary scaffold for early learning from screen media, and it has been shown to reduce the transfer deficit. Research shows that repeated exposure to specific actions in videos leads to greater imitation and learning in children 1 to 5 years old.²² The same pattern is seen with repetition of paper books. It may be that learning from face-to-face interactions requires fewer repetitions because it is easier for toddlers to process more complete information in real life: Many aspects of face-to-face interactions are familiar and meaningful to the child, which allows them to focus on processing what is novel in the encounter.²²

When young children first view a page of a paper book or an image on screen, on the other hand, they may focus on only one aspect of it and may need support to reach deeper learning. When the book or program is repeated, children have the opportunity to focus on different features of what they are viewing and, over time, they begin to build a more complete memory by piecing together information from the multiple repetitions. When a more complete memory has formed, young children are better able to use information they take in from the screen and transfer it to real-world situations. Once they reach this point, repetition of the same content may be less useful (i.e., that scaffold may be removed); instead, it may be beneficial to move on to media content that covers similar issues applied in a new context.⁵⁹





SOCIALLY INTERACTIVE

Media content that is socially interactive is designed to engage the child in an interaction with a peer or parent as part of the screen experience. A growing body of evidence shows that learning from TV and touchscreens can be enhanced when parents participate with their children to create a social, interactive experience.

How can adults engage with children during media experiences to maximize learning? With today's technologies, it means going beyond just co-**viewing** with children. Joint media engagement (JME) describes the actions adults and children take when interacting with media and one another, while using traditional, mobile, and digital devices. JME may involve: asking questions; labeling objects; providing descriptions of what is on the screen; and/or talking about or performing actions related to the storyline.⁶⁰

JME involves social contingency, or serve and return interactions. These back-and-forth, responsive interactions have long been a hallmark of high quality interaction for very young children.⁶⁹ JME between young children and adults can help children make sense of a particular screen media experience and transfer learning beyond the screen.⁶⁰ Parents' behavior choices and media choices can impact each other. One study showed that mothers providing more activities in the home for children predicted more educational media being shown in the home at a later time. However, the reverse relationship was weaker—those mothers who screened more educational media did not necessarily offer more activities in the home.⁶¹

Television and JME

When parents engage their babies in verbal interaction while watching age-appropriate, educational programming together, there is a positive effect on children's language development.⁶² In fact, one study of low-income, immigrant mothers and their infants showed that this kind of language-rich interaction around media use can reduce the negative impact media has been shown to have on language development.⁶² In another study, toddlers learned a word from video only when a parent provided verbal scaffolding, or tailored support provided to the child during the learning process.⁶³ Among young babies, research shows that children 6 to 18 months old are more responsive and engaged with the media they are using, rather than just passively watching, when parents provide descriptive language that matches the televised content.^{53,64}

Parent involvement is incredibly important while very young children are watching television. Yet one recent survey reported that parents watch videos with their children for only about half the time the child is watching.⁷ Another study reported that parents only co-view and interact with their children during half of the child-directed programs their children view, missing the opportunity to expand their children's learning.⁶⁵ By prioritizing these viewing times as opportunities for rich interaction, parents can support their child's development.

Tablets and JME

Parents may believe that they can be less involved when their young children use tablets. In fact, only 25% of parents report co-engaging with their children during tablet use.⁷ Yet one study⁵⁴ found that high-quality parent JME increased 15-month-old infants' ability to transfer learning from the touchscreen to an object in the physical world. In other words, parents' simple explanations and labeling of key features, their attempts to organize the task for the baby, and praise and encourage enhanced transfer of learning, even among very young children typically affected by a transfer deficit. These strategies are the same ones that parents typically use when reading picture books to their young children.⁵⁴

Adults also help guide children when learning a new game on a tablet.⁶⁶ In one study, 2- and 3-year-old children were tasked with assembling a three-piece puzzle. All children in the study learned to assemble the puzzle



beforehand by watching a demonstration first, on a touchscreen tablet. Some children learned to assemble the puzzle from a “ghost demonstration” on the tablet, in which the pieces moved **themselves** into place on the tablet screen. Another group of children watched an adult assemble the puzzle on the tablet screen. The children who watched the adult demonstration were able to assemble the puzzle on the screen, but those who watched the ghost demonstration were not able to assemble the puzzle. This study demonstrates the important role that JME can play in early learning from tablets.



difficulties may benefit more from joint media engagement with an adult. This study provides an important reminder of the importance of considering the individual strengths and weaknesses of each child in order to effectively tailor media use to his or her individual needs.⁶⁸⁻⁷⁰

Video Chat and JME

There are many inherent features of video chat that make it well suited to the developmental stage of very young children. For example, while traditional (audio-only) telephones can be challenging for very young children to use,⁷¹ video chat provides a promising alternative because it contains two important elements of face-to-face interactions. First, it allows young children to see the relatives or friends with whom they are interacting, a feature that audio-only telephone calls lack. This visual element could make video calls more meaningful for babies and toddlers, who are highly attuned to faces; and it also means they can use and see non-verbal communication, which is a critical part of early interactions with young children.⁷² Second, video calls include social contingency, a feature that traditional, one-way videos and television also lack. In fact, some recent studies demonstrated that when toddlers could interact with a parent via video chat, they remained content to play alone in a room for a longer period (on average) than when they were completely alone—i.e., with no access at all to the parent—or had access to a parent through audio-only telephone.^{73,74}



E-books and JME

Adult scaffolding was explored in a study⁶⁷ on e-books with 4-year-olds. Children were randomly assigned to one of three book-reading conditions to see whether they could learn about the biological concept of camouflage. All children read an e-book with prompts regarding camouflage, but the type of prompt differed across groups. In one group, the e-book auto-read the prompts; in a separate group, an adult read the prompts; and in the last group an adult used his own words to present the prompt information, but did not read the prompts.

Interestingly, children were able to learn about camouflage in all of the e-book conditions, including the condition that only included prompts from the e-book. But, as with all media research, it is necessary to consider the three C's when interpreting such findings. In this case, there were individual differences between children: Children who had lower vocabulary executive functioning scores performed better with adult-prompting, suggesting that children who are at-risk for reading

But video chat may present some new cognitive challenges for young children as well: there may be audio or video delays; there is no physical contact with their social partner; and eye contact is misaligned, based on the location of video cameras. These components can make it more challenging for young children to share attention with their social partner on video chat.⁷⁵ But, just like with e-books and videos, adults can help young children by scaffolding the child's participation in the interaction. Families can use creative methods to share play activities, read together, and engage in other highly interactive, joyful interactions with the adult partner on video chat. For example, a parent holding a toddler while he speaks to his grandparent can kiss or tickle the child, on behalf of the grandparent, at the end of a shared rhyme. Parents can also explain Internet delays and help mediate confusion

caused by eye contact misalignment.⁷⁵ By using many of the same warm, engaging interaction methods that support high-quality face-to-face interactions, families can make use of video chat to maintain long-distance relationships between their children and their remote loved ones.^{10,75,76}

Furthermore, when young children engage in video chat interactions, they may not experience the same transfer deficit evident in pre-recorded videos. In one study, for example, toddlers between 24 and 30 months of age were able to learn new verbs via video chat interactions as well as they did in traditional face-to-face interactions.⁷⁷ These findings reinforce the critical role that responsive, serve-and-return interactions play in early learning. In another study, babies and toddlers aged 12 to 25 months old learned novel words, actions, and patterns from adults more effectively in video chat versus pre-recorded videos.⁷⁸ Children who interacted with adults via video chat learned more novel patterns and words than those who viewed a pre-recorded video; and only those children who used video chat responded contingently to their adult partners, and recognized and preferred

their adult partner one week later.⁷⁸ These findings demonstrate that, while children under 2 years of age learn better in-person than from video, they do show learning from video chat, probably because video chat retains the back-and-forth (“serve and return”) responsiveness of in-person social interaction.

Just as JME is important for learning from video and tablets, new research shows it is also important for learning through video chat. Adults who are physically present with young children during video chat play a critical role in this learning process because they can model the relevance of the on-screen information to the child. In a recent study,⁷⁹ children (24-30 months) looked to their co-viewer during video chat more often, remained engaged longer (e.g., looked, vocalized, and imitated more), and learned more when their co-viewer was responsive, versus unresponsive. The findings of these studies suggest that children depend strongly on the social cues of their co-viewers to make sense of their video chat experiences.



TAKEAWAYS

Ensuring Media Experiences Embody the Four Pillars of Learning (Engaging, Actively Involved, Meaningful, and Social)

- **Choose content (TV, apps, e-books) carefully.** Be sure that content is appropriate for the child’s age and that it reflects the child’s experiences in the real world.
 - **Look for content that both actively involves children while also helping them stay focused.** Features that give children control over their experience can help keep children in minds-on mode.
 - **Look for content with familiar settings, strong storylines, and characters that your child can relate to.** These features focus children’s engagement on the learning goal. Avoid content with many “bells and whistles” that may distract children from the educational content or from understanding the story.
 - **Use repetition wisely.** Repetition can be useful when the content is well chosen. Just as children like to choose the same book many times, they also enjoy viewing other media content repeatedly. When interacting with media on repeated occasions, adults can point out different aspects of the touchscreen activity or TV show. For example, if the show is focused on counting fruits, focus on naming and describing the fruits during one viewing and on counting the next time you watch. Be cautious of auto-play options on streaming services.
 - **Look for content that encourages social interaction.** This can take many forms, like programs or apps that encourage children’s interactions with people in their own home.

- **Seek out high-quality media content for children.** Public television stations and media outlets (e.g., PBSkids.org or Sesame Workshop) can be trusted to provide quality content that is both meaningful and engaging. These outlets also utilize curriculum advisors when developing media content. Websites like commonsense-media.org also provide suggestions for quality media content at various ages that is both meaningful and engaging.
 - **Check your local library to access quality content.** Many libraries are experimenting with free “check-out” systems for e-books, video content and paper books. Another free source is the International Children’s Digital Library: <http://en.childrenslibrary.org>.
- **Use Context to make media more Meaningful.**
- **Help children make the connection between what they see on a screen and the real world.** If a game allows your child to move a ball by dragging their finger across the screen, play games afterward that involve rolling, throwing, and bouncing different balls. Point out and label objects in real life that children have seen on TV or touchscreens, such as animals and flowers. Or, parents might use color names (that the child practiced in a game-based app) to describe the family’s clothes as they sort laundry together.
 - **Connect media experiences to daily routines.** If an app involves counting, incorporate counting into your everyday routines, like counting napkins together as your child helps set the table or counting the steps to the car.
- **Use JME to support all 4 Pillars of Learning.** Remember that joint media engagement (JME) enhances learning from television, tablets, e-books, and video chat. In fact, JME can power up all four pillars of learning: When adults engage with media along with children and find relevant ways to interact with the child and extend the content into their lives, they **ENGAGE** the child’s attention toward the learning goal, they **ACTIVELY INVOLVE** the child in a minds-on experience; they make the content more **MEANINGFUL** and relevant to the child; and they provide a warm, **SOCIAL** context in which to learn. Media are just tools. Like any other tool (like a spoon), children need to learn to use media. JME, with an adult, teaches them how.
- **When children are watching TV, playing an app on a tablet, video chatting, or sharing an e-book, make it a language-rich, SOCIALLY interactive experience.** As with paper picture books, adults can gauge the child’s level of understanding by providing prompts and scaffolding the screen media experience. Parents can help children make **MEANINGFUL** connections in their learning by: asking questions; labeling and providing descriptions of what they are seeing; and talking about the storyline.
 - **Be responsive, warm, and engaged** with your child during video chat, e-book reading, games on apps, and television viewing to support a more **ACTIVE, SOCIAL** learning context.
 - **Focus on the story when sharing e-books with children to provide a more ACTIVELY INVOLVED, MEANINGFUL experience.** Talk to your child about the story. Ask children about what they think will happen next in the story; help them connect what they are seeing in the story to their real-life experiences.
 - **Be creative during video-chat.** Consider creative play opportunities that will **ENGAGE** children in rich **SOCIAL** interaction—including play activities (e.g. playing with puppets or stuffed animals, playing peek-a-boo), imaginary physical interactions (e.g. playing hide-and-seek, dancing to music, sharing a snack through the screen), and other activities the child and remote loved one enjoy doing when they’re together (e.g., reading a favorite book).

SCREEN TIME

After exploring the 3 C's—the characteristics and needs of the individual child, the context of the media experience, and the content of the media—we will now turn back to the research exploring the impact of screen time—that is, the quantity not the quality of screen exposure—to better understand its nuances.



Nearly all research on very young children and screen time looks at television exposure because it is still by far the greatest screen presence in the lives of young children, and because not enough time has elapsed to examine long-term outcomes of smartphones, tablets, and video chat. Therefore, research on screen time has examined associations between TV exposure time and poorer language and cognitive development, higher child weight, and sleep problems. But many of these studies do not evaluate the content or context of the media use. In other words, they do not consider whether the content children were viewing was developmentally appropriate, educational, or of high quality. Nor do many of these studies evaluate the context, such as whether a parent was jointly engaged in that media use or not. These factors are critical to the interpretation of these findings, as it is well established that both content and context can make a significant difference in the quality of the viewing experience, can mitigate some of the potential negative effects of screen use, and can even support the positive effects of high quality, educational media.

Quantity of TV Exposure and Effects on Language and Cognition

Research on TV exposure time has demonstrated an association between higher levels of TV exposure and poorer cognitive and language development. For example, one study, based on a nationally representative sample, found that more TV exposure before children reach 3 years old was associated with poorer memory and reading scores when they were 6 to 7 years old.⁸⁰ But even the authors of this study acknowledged that the screen time itself was probably not the main factor in this outcome. The researchers postulated:

It might be that children younger than 3 years who spend more time watching television spend less time in other activities, such as imaginative free play, interactions with adults, and so forth, that would be beneficial to their cognitive development. Or, it may be that the content of the television they watch is deleterious to their cognitive development. Finally, it may be that the medium itself is deleterious, whether because of aspects of the production (e.g., the pacing and rapid scene changes) or the simple fact of looking in a single direction at a single stimulus for a long time. (p.623)⁸⁰

Another study of 6-month-olds from low-income families found that duration of daily TV exposure predicted lower scores on tests of cognition and on expressive and receptive language development at 14 months.⁸¹ Researchers hypothesized that the reason for this negative effect may be due



to TV viewing time replacing parent–child interaction that includes back-and-forth conversations and playing and reading together. In other words, the context of this media exposure was probably not ideal.



However, a study with children living in middle-class homes showed that the amount of TV viewing between birth and 2 years old was not associated with scores on tests of language ability at 3 years old.⁸² It is difficult to interpret these differences without knowing the content and context of the children’s media experiences in this study and the availability of other resources in the home.⁸³ Differences like these reflect what we know about child development generally: that the context or environment in which a child develops is important to their growth, and differs based on a number of family factors, including demographics.²



Quantity of TV Exposure and the Effects on Children’s Capacity to Pay Attention

The findings on the association between TV exposure and attentional problems are also mixed. One study of 1- and 3-year-olds found that children who were exposed to TV more than 5 hours a day had a greater incidence of attention problem behaviors (as reported by their parents) at 7 years old than children who were exposed to TV for less than 5 hours per day.⁸⁴ However, researchers who conducted a re-analysis of the same data reported that negative effects on attention were only associated with very high media usage—more than 7 hours per day.⁸⁵

These researchers also found that content matters. When they examined the programs children were watching during the study, they reported that the

viewing of “entertainment” TV—both violent and nonviolent—before 3 years old was associated with more attention problems 5 years later. However, viewing educational TV programming was not linked to attention problems.⁸⁶

Once again, media content plays a significant role in moderating the impact of the screen experience.

Quantity of TV Exposure and Effects on Sleep

Studies on screen time have also shown a relationship between quantity of TV viewing and sleep problems. For example, in a study of 2,068 children under 3 years, more TV watched per day was associated with an increase in both irregular naptime and bedtime schedules.⁸⁷ Several studies have shown that children with TVs in their bedrooms watch more TV and are more likely to have sleep problems. One study of 495 school-age children looked at the association between TV viewing habits, sleep habits, and sleep disturbances. Findings revealed that the amount of TV viewing overall, and especially at bedtime, for children with TVs in their bedrooms (which was the case for 25% of the children in the study), had the strongest association with sleep problems. The sleep domains that appeared to be affected most consistently by TV were: resistance to bedtime, later bedtimes, anxiety around sleep, and less overall sleep.⁸⁸

However, as with many studies on screen time, these studies did not consider the content of the programming children were watching before bedtime, which is likely to be an important variable. For example, other research has established an unsurprising association between exposure to violent content on TV and an increase in sleep problems in children 3 to 5 years old.^{89,90}

Effect of blue light. The content of the media exposure before bedtime plays a role in sleep problems, and we now know that blue light emitted from all screens (TVs, tablets and smartphones) also disrupts the onset of sleep.⁹¹ What is blue light? Blue light is part of the visible light spectrum, and is emitted from computer monitors and flat-screen televisions, tablets, e-readers, smartphones, fluorescent and LED lights—and the sun. However, the light from screen devices has a concentration of blue light that is similar to the concentration from the sun



when we wake up in the morning, tricking the body into thinking it is early in the day. While blue light from personal electronic devices does not damage the human eye, exposure at bedtime can impact the regulation of circadian rhythms. Blue light prevents special photoreceptor cells in the eye from triggering the release of melatonin, a hormone to signal to the body that it is time to fall asleep. In short, exposure to blue light—via screen media exposure—before bedtime can make it more difficult to fall asleep, negatively impact sleep quality, and impair alertness the following day. Therefore, it is important to consider the context/time of day when screens are used, not just the quantity of exposure. There are currently a variety of apps and screen settings that will reduce/eliminate blue light exposure from devices and using these is a good practice for both children and adults.



Quantity of TV Exposure and Effects on Child Weight

Media exposure (screen time) has been found to be a risk factor for obesity in young children due to an increase in food intake, a reduction in physical activity, and exposure to poor quality food and advertising; however, as with most research on screen time, many studies in this area do not consider the content or context of this media exposure, and how those factors may impact the outcomes.

Many studies do not account for the **context** of screen use. For example, one study showed that the odds of obesity were 23% lower in 4-year-old children whose screen time was limited to less than 2 hours per day.⁹² Another study measured physical activity and body fat in middle-class

preschoolers and showed that more television viewing was linked to higher body fat. Of note, this relationship did not change when the researchers took into account children's physical activity rates. But, as in other studies on screen time, the authors then concluded that TV viewing time itself was unlikely to be the main factor in the obesity increase: Instead, they concluded that the key variable contributing to obesity was most likely to be food intake while viewing.^{92,93}

TV and computer use have also been associated with an increase in body mass index (BMI). A study of 4- to 7-year-olds whose BMI was above the 75th percentile demonstrated that a reduction in TV viewing and computer use was related to decreases in BMI. The intervention was most effective for children living in low-income homes.⁹⁴

A TV in a child's bedroom is also a demonstrated risk factor for obesity: Children who have a TV in their bedroom are more likely to be overweight and to have viewed more TV (more than 4½ hours more per week) than children without a TV in their bedroom.⁹⁵

Furthermore, many of these studies do not consider the **content** of the media exposure when they consider obesity and weight gain outcomes. Children are not capable of distinguishing between television program content and advertising until the age of 4 or 5.⁹⁶ This is also likely to happen with in-app advertising. A review of the research found consistently that children exposed to television advertisements are significantly more likely to choose advertised food products than children who are not exposed to them, even down to the advertised brand.⁹⁷ For example, in one randomized, controlled experimental study using 2- to 6-year-olds from a Head Start program, children viewed a popular children's television show either with or without commercials distributed throughout the program. After viewing the show, children exposed to the advertisements were significantly more likely to choose the brands advertised (relative to a similar product) than were children who were not exposed to the commercials.⁹⁸ These findings indicate that televised advertisements can and do have an influence on young children's food preferences.

A review of the literature also found consistently that higher amounts of television exposure is related to both the number of



child purchase requests for specific foods and the presence of those foods in the home.⁹⁷ In other words, children not only come to prefer advertised foods, they are also likely to be successful in persuading their parents to purchase those foods. Indeed, a survey given to mothers of children between the ages of 3 and 8 found that 40.3% of the children asked their parents to purchase the products they saw on television advertisements, and that 8.9% of them insisted on buying the products and cried while watching the ad. Requests were more likely from the younger children and

for heavily sweetened products.⁹⁹ In other words, the content of children's media exposure (especially whether they were exposed to commercial content) is likely to play an important role in obesity outcomes. In fact, an Institute of Medicine report concluded, "Statistically, there is strong evidence that exposure to television advertising is associated with [body fatness] in children" (p 279).¹⁰⁰ This content is rarely accounted for in screen time studies and should be considered carefully when interpreting research outcomes.



TAKEAWAYS

Applying findings from the screen time research

- **Devise a family media plan.** Limit exposure to background media and be mindful of media use in your family. Use screen sense and as you build this plan consider the content and context of media usage in your family.
- **Avoid using screens as part of the bedtime routine.** Instead substitute gentle, calming routines such as book-sharing, lullabies, massage with lotion after bath time, etc.—all in a slightly darkened, quiet room.
- **Limit media in the hour or two before bedtime,** as it can be stimulating, making it hard for children to calm themselves to go to sleep. Power down screens before bedtime.
- **Avoid placing screen media (TVs, tablets, mobile phones) in children's bedrooms.**
- **Use a blue-light blocking app or setting** on your computer, tablet, and smartphone screens. Cell phones now have a blue light blocking feature as a standard option.
- **Do not expose young children to violent screen content.**
- **Choose healthy snacks. Avoid snacking and eating meals while using screens.**
- **Avoid media content on all devices (such as children's entertainment content) that features advertisements for unhealthy foods.**
- **Offer daily opportunities for physical play.** Active play with children—inside or outside—is vital for their physical and cognitive development.¹⁰¹



Conclusion

The potential for rich learning opportunities can be maximized when adults—parents, caregivers, and teachers—first focus on the child and what media experiences best align with her current interests, abilities, and emerging skills.

Next, adults should consider the content of media. This means selecting screen media experiences that are age-appropriate and educational in nature, and unfold within settings that are meaningful and familiar to the child. Ideally, these media experiences also offer opportunities for the child's engagement, active involvement, and social interaction. Finally, adults should consider the context of the media experience—and whenever possible, seek to engage in the experience with their child, asking questions, providing narration, labeling, and making connections from the screen content to the

child's daily life. In this way, adults take the role of thoughtful guides, assisting young children in harnessing the potential of media for learning and shared enjoyment.

Early experiences are profoundly important to children's learning and development. When it comes to screen experiences, all of the evidence reinforces the recommendation to consider the individual child, as well as the content and context of media experiences for young children, to maximize opportunities for learning.

Portions of this report were adapted from an earlier version:

Lerner, C., & Barr, R. (2014). *Screen sense: Setting the record straight: Research-based guidelines for screen use for children under 3 years old*. Washington, DC: ZERO TO THREE.

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