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The Power of Play: A Pediatric Role in Enhancing Development in Young Children

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Children need to develop a variety of skill sets to optimize their development and manage toxic stress. Research demonstrates that developmentally appropriate play with parents and peers is a singular opportunity to promote the social-emotional, cognitive, language, and self-regulation skills that build executive function and a prosocial brain. Furthermore, play supports the formation of the safe, stable, and nurturing relationships with all caregivers that children need to thrive.

Play is not frivolous: it enhances brain structure and function and promotes executive function (ie, the process of learning, rather than the content), which allow us to pursue goals and ignore distractions.

When play and safe, stable, nurturing relationships are missing in a child's life, toxic stress can disrupt the development of executive function and the learning of prosocial behavior; in the presence of childhood adversity, play becomes even more important. The mutual joy and shared communication and attunement (harmonious serve and return interactions) that parents and children can experience during play regulate the body's stress response. This clinical report provides pediatric providers with the information they need to promote the benefits of play and and to write a prescription for play at well visits to complement reach out and read. At a time when early childhood programs are pressured to add more didactic components and less playful learning, pediatricians can play an important role in emphasizing the role of a balanced curriculum that includes the importance of playful learning for the promotion of healthy child development.

abstract

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INTRODUCTION

Since the publication of the American Academy of Pediatrics (AAP) Clinical Reports on the importance of play in 2007,[1,2] newer research has provided additional evidence of the critical importance of play in

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facilitating parent engagement; promoting safe, stable, and nurturing relationships; encouraging the development of numerous competencies, including executive functioning skills; and improving life course trajectories.[3–5] An increasing societal focus on academic readiness (promulgated by the No Child Left Behind Act of 2001) has led to a focus on structured activities that are designed to promote academic results as early as preschool, with a corresponding decrease in playful learning. Social skills, which are part of playful learning, enable children to listen to directions, pay attention, solve disputes with words, and focus on tasks without constant supervision.[6] By contrast, a recent trial of an early mathematics intervention in preschool showed almost no gains in math achievement in later elementary school.[7] Despite criticism from early childhood experts, the 2003 Head Start Act reauthorization ended the program evaluation of social emotional skills and was focused almost exclusively on preliteracy and premath skills.[8] The AAP report on school readiness includes an emphasis on the importance of whole child readiness (including social–emotional, attentional, and cognitive skills).[9] Without that emphasis, children's ability to pay attention and behave appropriately in the classroom is disadvantaged.

The definition of play is elusive. However, there is a growing consensus that it is an activity that is intrinsically motivated, entails active engagement, and results in joyful discovery. Play is voluntary and often has no extrinsic goals; it is fun and often spontaneous. Children are often seen actively engaged in and passionately engrossed in play; this builds executive functioning skills and contributes to school readiness (bored children will not learn well).[10] Play often creates an imaginative private reality, contains elements of make believe, and is nonliteral.

Depending on the culture of the adults in their world, children learn different skills through play. Sociodramatic play is when children act out the roles of adulthood from having observed the activities of their elders. Extensive studies of animal play suggest that the function of play is to build a prosocial brain that can interact effectively with others.[11]

Play is fundamentally important for learning 21st century skills, such as problem solving, collaboration, and creativity, which require the executive functioning skills that are critical for adult success. The United Nations Convention on the Rights of the Child has enshrined the right to engage in play that is appropriate to the age of the child in Article 21.[12] In its 2012 exhibit "The Century of the Child: 1900–2000," the Museum of Modern Art noted, "Play is to the 21st century what work was to industrialization. It demonstrates a way of knowing, doing, and creating value."[13] Resnick[14] has described 4 guiding principles to support creative learning in children: projects, passion, peers, and play. Play is not just about having fun but about taking risks, experimenting, and testing boundaries. Pediatricians can be influential advocates by encouraging parents and child care providers to play with children and to allow children to have unstructured time to play as well as by encouraging educators to recognize playful learning as an important complement to didactic learning. Some studies[15–18] note that the new information economy, as opposed to the older industrial 1, demands more innovation and less imitation, more creativity and less conformity. Research on children's learning indicates that learning thrives when children are given some agency (control of their own actions) to play a role in their own learning.[19] The demands of today's world require that the teaching methods of the past 2 centuries, such as memorization, be replaced by innovation, application, and transfer.[18]

NATURE OF LEARNING AND PLAY

Bruner et al[20] stressed the fact that play is typically buffered from real-life consequences. Play is part of our evolutionary heritage, occurs in a wide spectrum of species, is fundamental to health, and gives us opportunities to practice and hone the skills needed to live in a complex world.[21] Although play is present in a large swath of species within the animal kingdom, from invertebrates (such as the octopus, lizard, turtle, and honey bee) to mammals (such as rats, monkeys, and humans),[22] social play is more prominent in animals with a large neocortex.[23] Studies of animal behavior suggests that play provides animals and humans with skills that will help them with survival and reproduction.[24] Locomotor skills learned through rough-and-tumble play enables escape from predators. However, animals play even when it puts them at risk of predation.[25] It is also suggested that play teaches young animals what they can and cannot do at times when they are relatively free from the survival pressures of adult life.[26] Play and learning are inextricably linked.[27] A Russian psychologist recognized that learning occurs when children actively engage in practical activities within a supportive social context. The accumulation of new knowledge is built on previous learning, but the acquisition of new skills is facilitated by social and often playful interactions. He was interested in what he called the "zone of proximal development," which consists of mastering skills that a child could not do alone but could be developed with minimal assistance.[28] Within the zone of proximal development, the "how" of

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learning occurs through a reiterative process called scaffolding, in which new skills are built on previous skills and are facilitated by a supportive social environment. The construct of scaffolding has been extrapolated to younger children. Consider how a social smile at 6 to 8 weeks of age invites cooing conversations, which leads to the reciprocal dance of social communication even before language emerges, followed by social referencing (the reading of a parent's face for nonverbal emotional content). The balance between facilitating unstructured playtime for children and encouraging adult scaffolding of play will vary depending on the competing needs in individual families, but the "serve-and-return" aspect of play requires caregiver engagement.[29]

Early learning and play are fundamentally social activities[30] and fuel the development of language and thought. Early learning also combines playful discovery with the development of social–emotional skills. It has been demonstrated that children playing with toys act like scientists and learn by looking and listening to those around them.[15–17] However, explicit instructions limit a child's creativity; it is argued that we should let children learn through observation and active engagement rather than passive memorization or direct instruction. Preschool children do benefit from learning content, but programs have many more didactic components than they did 20 years ago.[31] Successful programs are those that encourage playful learning in which children are actively engaged in meaningful discovery.[32] To encourage learning, we need to talk to children, let them play, and let them watch what we do as we go about our everyday lives. These opportunities foster the development of executive functioning skills that are critically important for the development of 21st century skills, such as collaboration, problem solving, and creativity, according to the 2010 IBM's Global CEO Study.[33]

CATEGORIES OF PLAY

Play has been categorized in a variety of ways, each with its own developmental sequence.[32,34]

Object Play

This type of play occurs when an infant or child explores an object and learns about its properties. Object play progresses from early sensorimotor explorations, including the use of the mouth, to the use of symbolic objects (eg, when a child uses a banana as a telephone) for communication, language, and abstract thought.

Physical, Locomotor, or Rough-and-Tumble Play

This type of play progresses from pat-a-cake games in infants to the acquisition of foundational motor skills in toddlers[35] and the free play seen at school recess. The development of foundational motor skills in childhood is essential to promoting an active lifestyle and the prevention of obesity.[36–39] Learning to cooperate and negotiate promotes critical social skills. Extrapolation from animal data suggests that guided competition in the guise of rough-and-tumble play allows all participants to occasionally win and learn how to lose graciously.[40] Rough-and-tumble play, which is akin to the play seen in animals, enables children to take risks in a relatively safe environment, which fosters the acquisition of skills needed for communication, negotiation, and emotional balance and encourages the development of emotional intelligence. It enables risk taking and encourages the development of empathy because children are guided not to inflict harm on others.[25,30,40] The United Kingdom has modified its guidelines on play, arguing that the culture has gone too far by leaching healthy risks out of childhood: new guidelines on play by the national commission state, "The goal is not to eliminate risk."[41]

Outdoor Play

Outdoor play provides the opportunity to improve sensory integration skills.[36,37,39] These activities involve the child as an active participant and address motor, cognitive, social, and linguistic domains. Viewed in this light, school recess becomes an essential part of a child's day.[42] It is not surprising that countries that offer more recess to young children see greater academic success among the children as they mature.[42,43] Supporting and implementing recess not only sends a message that exercise is fundamentally important for physical health but likely brings together children from diverse backgrounds to develop friendships as they learn and grow.[42]

Social or Pretend Play Alone or With Others

This type of play occurs when children experiment with different social roles in a nonliteral fashion. Play with other children enables them to negotiate "the rules" and learn to cooperate. Play with adults often involves scaffolding, as when an adult rotates a puzzle to help the child place a piece. Smiling and vocal attunement, in which infants learn turn taking, is the earliest example of social play. Older children can develop games and activities through which they negotiate relationships and guidelines with other players. Dress up, make believe, and imaginary play encourage the use of more sophisticated language to communicate with playmates and develop common rule-bound scenarios (eg, "You be the teacher, and I will be the student").

Play has also been grouped as self-directed versus adult guided. Self-directed play, or free play, is crucial

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to children's exploration of the world and understanding of their preferences and interests.[19,32,44] Guided play retains the child agency, such that the child initiates the play, but it occurs either in a setting that an adult carefully constructs with a learning goal in mind (eg, a children's museum exhibit or a Montessori task) or in an environment where adults supplement the child-led exploration with questions or comments that subtly guide the child toward a goal. Board games that have well-defined goals also fit into this category.[45] For example, if teachers want children to improve executive functioning skills (see the "Tools of the Mind" curriculum),[46] they could create drum-circle games, in which children coregulate their behavior. Familiar games such as "Simon Says" or "Head, Shoulders, Knees, and Toes" ask children to control their individual actions or impulses and have been shown to improve executive functioning skills.[47] Guided play has been defined as a child-led, joyful activity in which adults craft the environment to optimize learning.[4,48] This approach harkens back to Vygotsky[28] and the zone of proximal development, which represents the skills that children are unable to master on their own but are able to master in the context of a safe, stable, and nurturing relationship with an adult. The guidance and dialogue provided by the adult allow the child to master skills that would take longer to master alone and help children focus on the elements of the activity to guide learning. One way to think about guided play is as "constrained tinkering."[14,48] This logic also characterizes Italy's Emilio Reggio approach, which emphasizes the importance of teaching children to listen and look.

According to Vygotsky,[28] the most efficient learning occurs in a social context, where learning is scaffolded by the teacher into meaningful contexts that resonate with children's active engagement and previous experiences. Scaffolding is a part of guided play; caregivers are needed to provide the appropriate amount of input and guidance for children to develop optimal skills.

DEVELOPMENT OF PLAY

How does play develop? Play progresses from social smiling to reciprocal serve-and-return interactions; the development of babbling; games, such as "peek-a-boo"; hopping, jumping, skipping, and running; and fantasy or rough-and-tumble play. The human infant is born immature compared with infants of other species, with substantial brain development occurring after birth. Infants are entirely dependent on parents to regulate sleep–wake rhythms, feeding cycles, and many social interactions. Play facilitates the progression from dependence to independence and from parental regulation to self-regulation. It promotes a sense of agency in the child. This evolution begins in the first 3 months of life, when parents (both mothers and fathers) interact reciprocally with their infants by reading their nonverbal cues in a responsive, contingent manner.[49] Caregiver–infant interaction is the earliest form of play, known as attunement,[50] but it is quickly followed by other activities that also involve the taking of turns. These serve-and-return behaviors promote self-regulation and impulse control in children and form a strong foundation for understanding their interaction with adults. The back-and-forth episodes also feed into the development of language.

Reciprocal games occur with both mothers and fathers[51] and often begin in earnest with the emergence of social smiles at 6 weeks of age. Parents mimic their infant's "ooh" and "ah" in back-and-forth verbal games, which progress into conversations in which the parents utter pleasantries ("Oh, you had a good lunch!"), and the child responds by vocalizing back. Uncontrollable crying as a response to stress in a 1-year-old is replaced as the child reaches 2 to 3 years of age with the use of words to self-soothe, building on caregivers scaffolding their emotional responses. Already by 6 months of age, the introduction of solid foods requires the giving and receiving of reciprocal signals and communicative cues. During these activities, analyses of physiologic heart rate rhythms of infants with both their mothers and fathers have shown synchrony.[49,52]

By 9 months of age, mutual regulation is manifested in the way infants use their parents for social referencing.[53,54] In the classic visual cliff experiment, it was demonstrated that an infant will crawl across a Plexiglas dropoff to explore if the mother encourages the infant but not if she frowns. Nonverbal communication slowly leads to formal verbal language skills through which emotions such as happiness, sadness, and anger are identified for the child via words. Uncontrollable crying in the 1-year-old then becomes whining in the 2-year-old and verbal requests for assistance in the 3-year-old as parents scaffold the child's emotional responses and help him or her develop alternative, more adaptive behaviors. Repetitive games, such as peek-a-boo and "this little piggy," offer children the joy of being able to predict what is about to happen, and these games also enhance the infants' ability to solicit social stimulation.

By 12 months of age, a child's experiences are helping to lay the foundation for the ongoing development of social skills. The expression of true joy and mastery on children's faces when they take their first step is truly a magical moment that all parents remember. Infant memory, in Piagetian terms,

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develops as infants develop object permanence through visible and invisible displacements, such as repetitive games like peek-a-boo. With the advent of locomotor skills, rough-and-tumble play becomes increasingly available. During the second year, toddlers learn to explore their world, develop the beginnings of self-awareness, and use their parents as a home base (secure attachment), frequently checking to be sure that the world they are exploring is safe.[55] As children become independent, their ability to socially self-regulate becomes apparent: they can focus their attention and solve problems efficiently, they are less impulsive, and they can better manage the stress of strong emotions.[56] With increased executive functioning skills, they can begin to reflect on how they should respond to a situation rather than reacting impulsively. With the development of language and symbolic functioning, pretend play now becomes more prominent.[57] Fantasy play, dress up, and fort building now join the emotional and social repertoire of older children just as playground activities, tag, and hide and seek develop motor skills. In play, children are also solving problems and learning to focus attention, all of which promote the growth of executive functioning skills.

EFFECTS ON BRAIN STRUCTURE AND FUNCTIONING

Play is not frivolous; it is brain building. Play has been shown to have both direct and indirect effects on brain structure and functioning. Play leads to changes at the molecular (epigenetic), cellular (neuronal connectivity), and behavioral levels (socioemotional and executive functioning skills) that promote learning and adaptive and/or prosocial behavior. Most of this research on brain structure and functioning has been done with rats and cannot be directly extrapolated to humans.

Jaak Panksepp,[11] a neuroscientist and psychologist who has extensively studied the neurologic basis of emotion in animals, suggests that play is 1 of 7 innate emotional systems in the midbrain.[58] Rats love rough-and-tumble play and produce a distinctive sound that Panksepp labeled "rat laughter."[42,59–64] When rats are young, play appears to initiate lasting changes in areas of the brain that are used for thinking and processing social interaction.

The dendritic length, complexity, and spine density of the medial prefrontal cortex (PFC) are refined by play.[64–67] The brain-derived neurotrophic factor (*BDNF*) is a member of the neurotrophin family of growth factors that acts to support the survival of existing neurons and encourage the growth and differentiation of new neurons and synapses. It is known to be important for long-term memory and social learning. Play stimulates the production of *BDNF* in RNA in the amygdala, dorsolateral frontal cortex, hippocampus, and pons.[65,68–70] Gene expression analyses indicate that the activities of approximately one-third of the 1200 genes in the frontal and posterior cortical regions were significantly modified by play within an hour after a 30-minute play session.[69,70] The gene that showed the largest effect was *BDNF*. Conversely, rat pup adversity, depression, and stress appear to result in the methylation and downregulation of the *BDNF* gene in the PFC.[71]

Two hours per day of play with objects predicted changes in brain weight and efficiency in experimental animals.[11,66] Rats that were deprived of play as pups (kept in sparse cages devoid of toys) not only were less competent at problem solving later on (negotiating mazes) but the medial PFC of the play-deprived rats was significantly more immature, suggesting that play deprivation interfered with the process of synaptogenesis and pruning.[72] Rat pups that were isolated during peak play periods after birth (weeks 4 and 5) are much less socially active when they encounter other rats later in life.[73,74]

Play-deprived rats also showed impaired problem-solving skills, suggesting that through play, animals learn to try new things and develop behavioral flexibility.[73] Socially reared rats with damage to their PFC mimic the social deficiencies of rats with intact brains but who were deprived of play as juveniles.[66] The absence of the play experience leads to anatomically measurable changes in the neurons of the PFC. By refining the functional organization of the PFC, play enhances the executive functioning skills derived from this part of the brain.[66] Whether these effects are specific to play deprivation or merely reflect the generic effect of a lack of stimulation requires further study. Rats that were raised in experimental toy-filled cages had bigger brains and thicker cerebral cortices and completed mazes more quickly.[67,75]

Brain neurotransmitters, such as dopamine made by cells in the substantia nigra and ventral tegmentum, are also related to the reward quality of play: drugs that activate dopamine receptors increase play behavior in rats.[76]

Play and stress are closely linked. High amounts of play are associated with low levels of cortisol, suggesting either that play reduces stress or that unstressed animals play more.[23] Play also activates norepinephrine, which facilitates learning at synapses and improves brain plasticity. Play, especially when accompanied by nurturing caregiving, may indirectly affect brain functioning by modulating or buffering adversity and by reducing toxic stress to levels

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that are more compatible with coping and resilience.[77,78]

In human children, play usually enhances curiosity, which facilitates memory and learning. During states of high curiosity, functional MRI results showed enhanced activity in healthy humans in their early 20s in the midbrain and nucleus accumbens and functional connectivity to the hippocampus, which solidifies connections between intrinsic motivation and hippocampus-dependent learning.[79] Play helps children deal with stress, such as life transitions. When 3- to 4-year-old children who were anxious about entering preschool were randomly assigned to play with toys or peers for 15 minutes compared with listening to a teacher reading a story, the play group showed a twofold decrease in anxiety after the intervention.[24,80] In another study, preschool children with disruptive behavior who engaged with teachers in a yearlong 1-to-1 play session designed to foster warm, caring relationships (allowing children to lead, narrating the children's behavior out loud, and discussing the children's emotions as they played) showed reduced salivary cortisol stress levels during the day and improved behavior compared with children in the control group.[81] The notable exception is with increased stress experienced by children with autism spectrum disorders in new or social circumstances.[82] Animal studies suggest the role of play as a social buffer. Rats that were previously induced to be anxious became relaxed and calm after rough-and-tumble play with a nonanxious playful rat.[83] Extrapolating from these animal studies, one can suggest that play may serve as an effective buffer for toxic stress.

BENEFITS OF PLAY

The benefits of play are extensive and well documented and include improvements in executive functioning, language, early math skills (numerosity and spatial concepts), social development, peer relations, physical development and health, and enhanced sense of agency.[13,32,56,57,84–88] The opposite is also likely true; Panksepp[89] suggested that play deprivation is associated with the increasing prevalence of attention-deficit/hyperactivity disorder.[90]

Executive functioning, which is described as the process of how we learn over the content of what we learn, is a core benefit of play and can be characterized by 3 dimensions: cognitive flexibility, inhibitory control, and working memory. Collectively, these dimensions allow for sustained attention, the filtering of distracting details, improved self-regulation and self-control, better problem solving, and mental flexibility. Executive functioning helps children switch gears and transition from drawing with crayons to getting dressed for school. The development of the PFC and executive functioning balances and moderates the impulsiveness, emotionality, and aggression of the amygdala. In the presence of childhood adversity, the role of play becomes even more important in that the mutual joy and shared attunement that parents and children can experience during play downregulates the body's stress response.[91–94] Hence, play may be an effective antidote to the changes in amygdala size, impulsivity, aggression, and uncontrolled emotion that result from significant childhood adversity and toxic stress. Future research is needed to clarify this association.

Opportunities for peer engagement through play cultivate the ability to negotiate. Peer play usually involves problem solving about the rules of the game, which requires negotiation and cooperation. Through these encounters, children learn to use more sophisticated language when playing with peers.[95,96]

Play in a variety of forms (active physical play, pretend play, and play with traditional toys and shape sorters [rather than digital toys]) improves children's skills. When children were given blocks to play with at home with minimal adult direction, preschool children showed improvements in language acquisition at a 6-month follow-up, particularly low-income children. The authors suggest that the benefits of Reach Out and Play may promote development just as Reach Out and Read does.[97] When playing with objects under minimal adult direction, preschool children named an average of 3 times as many nonstandard uses for an object compared with children who were given specific instructions.[98] In Jamaica, toddlers with growth retardation who were given weekly play sessions to improve mother–child interactions for 2 years were followed to adulthood and showed better educational attainment, less depression, and less violent behavior.[3]

Children who were in active play for 1 hour per day were better able to think creatively and multitask.[22] Randomized trials of physical play in 7- to 9-year-olds revealed enhanced attentional inhibition, cognitive flexibility, and brain functioning that were indicative of enhanced executive control.[99] Play with traditional toys was associated with an increased quality and quantity of language compared with play with electronic toys,[100] particularly if the video toys did not encourage interaction.[101] Indeed, it has been shown that play with digital shape sorters rather than traditional shape sorters stunted the parent's use of spatial language.[102] Pretend play encourages self-regulation because children must collaborate on the imaginary environment and agree about pretending and conforming to

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roles, which improves their ability to reason about hypothetical events.[56,57,103–105] Social–emotional skills are increasingly viewed as related to academic and economic success.[106] Third-grade prosocial behavior correlated with eighth-grade reading and math better than with third-grade reading and math.[17,107]

The health benefits of play involving physical activity are many. Exercise not only promotes healthy weight and cardiovascular fitness but also can enhance the efficacy of the immune, endocrine, and cardiovascular systems.[37] Outdoor playtime for children in Head Start programs has been associated with decreased BMI.[39] Physical activity is associated with decreases in concurrent depressive symptoms.[108] Play decreases stress, fatigue, injury, and depression and increases range of motion, agility, coordination, balance, and flexibility.[109] Children pay more attention to class lessons after free play at recess than they do after physical education programs, which are more structured.[43] Perhaps they are more active during free play.

Play also reflects and transmits cultural values. In fact, recess began in the United States as a way to socially integrate immigrant children. Parents in the United States encourage children to play with toys and/or objects alone, which is typical of communities that emphasize the development of independence. Conversely, in Japan, peer social play with dolls is encouraged, which is typical of cultures that emphasize interdependence.[110]

BENEFITS TO ADULTS OF PLAYING WITH CHILDREN

Playing with children adds value not only for children but also for adult caregivers, who can reexperience or reawaken the joy of their own childhood and rejuvenate themselves. Through play and rereading their favorite childhood books, parents learn to see the world from their child's perspective and are likely to communicate more effectively with their child, even appreciating and sharing their child's sense of humor and individuality. Play enables children and adults to be passionately and totally immersed in an activity of their choice and to experience intense joy, much as athletes do when they are engaging in their optimal performance. Discovering their true passions is another critical strategy for helping both children and adults cope with adversity. One study documented that positive parenting activities, such as playing and shared reading, result in decreases in parental experiences of stress and enhancement in the parent–child relationship, and these effects mediate relations between the activities and social–emotional development.[111–113]

Most importantly, play is an opportunity for parents to engage with their children by observing and understanding nonverbal behavior in young infants, participating in serve-and-return exchanges, or sharing the joy and witnessing the blossoming of the passions in each of their children.

Play not only provides opportunities for fostering children's curiosity,[14] self-regulation skills,[46] language development, and imagination but also promotes the dyadic reciprocal interactions between children and parents, which is a crucial element of healthy relationships.[114] Through the buffering capacity of caregivers, play can serve as an antidote to toxic stress, allowing the physiologic stress response to return to baseline.[77] Adult success in later life can be related to the experience of childhood play that cultivated creativity, problem solving, teamwork, flexibility, and innovations.[18,52,115]

Successful scaffolding (new skills built on previous skills facilitated by a supportive social environment) can be contrasted with interactions in which adults direct children's play. It has been shown that if a caregiver instructs a child in how a toy works, the child is less likely to discover other attributes of the toy in contrast to a child being left to explore the toy without direct input.[38,116–118] Adults who facilitate a child's play without being intrusive can encourage the child's independent exploration and learning.

IMPLICATIONS FOR PRESCHOOL EDUCATION

Scaffolding play activities facilitated by adults enable children to work in groups: to share, negotiate, develop decision-making and problem-solving skills, and discover their own interests. Children learn to resolve conflicts and develop self-advocacy skills and their own sense of agency. The false dichotomy between play versus formal learning is now being challenged by educational reformers who acknowledge the value of playful learning or guided play, which captures the strengths of both approaches and may be essential to improving executive functioning.[18,19,34,119] Hirsh-Pasek et al[34] report a similar finding: children have been shown to discover causal mechanisms more quickly when they drive their learning as opposed to when adults display solutions for them.

Executive functioning skills are foundational for school readiness and academic success, mandating a frame shift with regard to early education. The goal today is to support interventions that cultivate a range of skills, such as executive functioning, in all children so that the children enter preschool and kindergarten curious and knowing how to learn. Kindergarten should provide children with an opportunity for playful collaboration and tinkering,[14] a different approach from the model that promotes more exclusive

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didactic learning at the expense of playful learning. The emerging alternative model is to prevent toxic stress and build resilience by developing executive functioning skills. Ideally, we want to protect the brain to enable it to learn new skills, and we want to focus on learning those skills that will be used to buffer the brain from any future adversity.[18] The Center on the Developing Child at Harvard University offers an online resource on play and executive functioning with specific activities suggested for parents and children (http://developingchild.harvard.edu/wp-content/uploads/2015/05/Enhancing-and-Practicing-Executive-Function-Skills-with-Children-from-Infancy-to-Adolescence-1.pdf).[120]

Specific curricula have now been developed and tested in preschools to help children develop executive functioning skills. Many innovative programs are using either the Reggio Emilia philosophy or curricula such as Tools of the Mind (developed in California)[121] or Promoting Alternative Thinking Strategies–Preschool and/or Kindergarten.[122] Caregivers need to provide the appropriate amount of input and guidance for children to develop optimal problem-solving skills through guided play and scaffolding. Optimal learning can be depicted by a bell-shaped curve, which illustrates the optimal zone of arousal and stress for complex learning.[123]

Scaffolding is extensively used to support skills such as buddy reading, in which children take turns being lips and ears and learn to read and listen to each other as an example of guided play. A growing body of research shows that this curriculum not only improves executive functioning skills but also shows improvement in brain functioning on functional MRI.[6,124–126]

Focusing on cultivating executive functioning and other skills through playful learning in these early years is an alternative and innovative way of thinking about early childhood education. Instead of focusing solely on academic skills, such as reciting the alphabet, early literacy, using flash cards, engaging with computer toys, and teaching to tests (which has been overemphasized to promote improved test results), cultivating the joy of learning through play is likely to better encourage long-term academic success. Collaboration, negotiation, conflict resolution, self-advocacy, decision-making, a sense of agency, creativity, leadership, and increased physical activity are just some of the skills and benefits children gain through play.

MODERN CHALLENGES

For many families, there are risks in the current focus only on achievement, after-school enrichment programs, increased homework, concerns about test performance, and college acceptance. The stressful effects of this approach often result in the later development of anxiety and depression and a lack of creativity. Parental guilt has led to competition over who can schedule more "enrichment opportunities" for their children. As a result, there is little time left in the day for children's free play, for parental reading to children, or for family meal times. Many schools have cut recess, physical education, art, and music to focus on preparing children for tests. Unsafe local neighborhoods and playgrounds have led to nature deficit disorder for many children.[127] A national survey of 8950 preschool children and parents found that only 51% of children went outside to walk or play once per day with either parent.[128] In part, this may reflect the local environment: 94% of parents have expressed safety concerns about outdoor play, and access may be limited. Only 20% of homes are located within a half-mile of a park.[129,130] Cultural changes have also jeopardized the opportunities children have to play. From 1981 to 1997, children's playtime decreased by 25%. Children 3 to 11 years of age have lost 12 hours per week of free time. Because of increased academic pressure, 30% of US kindergarten children no longer have recess.[42,129] An innovative program begun in Philadelphia is using cities (on everyday walks and in everyday neighborhoods) as opportunities for creating learning landscapes that provide opportunities for parents and children to spark conversation and playful learning.[131,132] For example, Ridge et al[132] have placed conversational prompts throughout supermarkets and laundromats to promote language and lights at bus stops to project designs on the ground, enabling children to play a game of hopscotch that is specifically designed to foster impulse control. By promoting the learning of social and emotional skills, the development of emotional intelligence, and the enjoyment of active learning, protected time for free play and guided play can be used to help children improve their social skills, literacy, and school readiness. Children can then enter school with a stronger foundation for attentional disposition based on the skills and attitudes that are critical for academic success and the long-term enjoyment of learning and love of school.

ROLE OF MEDIA IN CHILDREN'S PLAY

Media (eg, television, video games, and smartphone and tablet applications) use often encourages passivity and the consumption of others' creativity rather than active learning and socially interactive play. Most importantly, immersion in electronic media takes away time from real play,

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either outdoors or indoors. Real learning happens better in person-to-person exchanges rather than machine-to-person interactions. Most parents are eager to do the right thing for their children. However, advertisers and the media can mislead parents about how to best support and encourage their children's growth and development as well as creativity. Parent surveys have revealed that many parents see media and technology as the best way to help their children learn.[133] However, researchers contradict this. Researchers have compared preschoolers playing with blocks independently with preschoolers watching Baby Einstein tapes and have shown that the children playing with blocks independently developed better language and cognitive skills than their peers watching videos.[34,134] Although active engagement with age-appropriate media, especially if supported by cowatching or coplay with peers or parents, may have some benefits,[135] real-time social interactions remain superior to digital media for home learning.[136]

It is important for parents to understand that media use often does not support their goals of encouraging curiosity and learning for their children.[137–141] Despite research that reveals an association between television watching and a sedentary lifestyle and greater risks of obesity, the typical preschooler watches 4.5 hours of television per day, which displaces conversation with parents and the practice of joint attention (focus by the parent and child on a common object) as well as physical activity. For economically challenged families, competing pressures make it harder for parents to find the time to play with children. Encouraging outdoor exercise may be more difficult for such families given unsafe playgrounds. Easy access to electronic media can be difficult for parents to compete with.

In the 2015 symposium,[137] the AAP clarified recommendations acknowledging the ubiquity and transformation of media from primarily television to other modalities, including video chatting. In 2016, the AAP published 2 new policies on digital media affecting young children, school-aged children, and adolescents. These policies included recommendations for parents, pediatricians, and researchers to promote healthy media use.[139,140] The AAP has also launched a Family Media Use Plan to help parents and families create healthy guidelines for their children's media use so as to avoid displacing activities such as active play, and guidelines can also be found on the HealthyChildren.org and Common Sense Media (commonsensemedia.org) Web sites.

BARRIERS TO PLAY

There are barriers to encouraging play. Our culture is preoccupied with marketing products to young children.[142] Parents of young children who cannot afford expensive toys may feel left out.[143] Parents who can afford expensive toys and electronic devices may think that allowing their children unfettered access to these objects is healthy and promotes learning. The reality is that children's creativity and play is enhanced by many inexpensive toys (eg, wooden spoons, blocks, balls, puzzles, crayons, boxes, and simple available household objects) and by parents who engage with their children by reading, watching, playing alongside their children, and talking with and listening to their children. It is parents' and caregivers' presence and attention that enrich children, not elaborate electronic gadgets. One-on-one play is a time-tested way of being fully present. Low-income families may have less time to play with their children while working long hours to provide for their families, but a warm caregiver or extended family as well as a dynamic community program can help support parents' efforts.[144] The importance of playtime with children cannot be overemphasized to parents as well as schools and community organizations. Many children do not have safe places to play.[145] Neighborhood threats, such as violence, guns, drugs, and traffic, pose safety concerns in many neighborhoods, particularly low-income areas. Children in low-income, urban neighborhoods also may have less access to quality public spaces and recreational facilities in their communities.[145] Parents who feel that their neighborhoods are unsafe may also not permit their children to play outdoors or independently.

Public health professionals are increasingly partnering with other sectors, such as parks and recreation, public safety, and community development, to advocate for safe play environments in all communities. This includes efforts to reduce community violence, improve physical neighborhood infrastructure, and support planning and design decisions that foster safe, clean, and accessible public spaces.

ROLE OF PEDIATRICIANS

Pediatricians can advocate for the importance of all forms of play as well as for the role of play in the development of executive functioning, emotional intelligence, and social skills (Table 1). Pediatricians have a critical role to play in protecting the integrity of childhood by advocating for all children to have the opportunity to express their innate curiosity in the world and their great capacity for imagination. For children with special needs, it is especially important to create safe opportunities for play. A children's museum may offer

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TABLE 1 Recommendations From Pediatricians to Parents

Use play to help meet milestones. From birth, infants use play to explore the world around them as well as to learn and develop important life skills.
0–6 mo
Show your infant interesting objects, such as a brightly colored mobile or toy.
Talk to your infant often to familiarize him or her with your voice, and respond when he or she coos and babbles.
Place your infant in different positions so he or she can see the world from different angles.
Let your infant bring safe objects to his or her mouth to explore and experience new textures.
Vary facial expressions and gestures so that your infant can imitate them. Imitate your infant's sounds and engage in a back-and-forth conversation using your infant's sounds as a prompt.
7–12 mo
Use a mirror to show faces to your infant.
Provide your infant with a safe environment to crawl and explore.
Place your infant in a variety of positions, such as on his or her tummy, side, etc.
Give your infant opportunities to learn that his or her actions have effects (for example, when he or she drops a toy and it falls to the ground). Put a few toys within the reach of your infant so he or she can take toys out and play with them.
Play peek-a-boo.
1–3 y
Allow your child to spend time with objects and toys that he or she enjoys.
Give your child pens, markers, or crayons and paper to practice scribbling.
Encourage your child to interact with peers.
Help your child explore his or her body through different movements (for example, walking, jumping, and standing on 1 leg).
Provide opportunities to create make-believe situations with objects (for example, pretending to drink out of an empty cup or offering toys that enable pretend play).
Respond when your child speaks, answer questions, and provide verbal encouragement.
Provide blocks, plastic containers, wooden spoons, and puzzles.
Read regularly to and with your child. Encourage pretend play based on these stories.
Sing songs and play rhythms so that your child can learn and join in the fun.
4–6 y
Provide opportunities for your child to sing and dance.
Tell stories to your child and ask questions about what he or she remembers.
Give your child time and space to act out imaginary scenes, roles, and activities.
Allow your child to move between make-believe games and reality (for example, playing house and helping you with chores).
Schedule time for your child to interact with friends to practice socializing and building friendships.
Encourage your child to try a variety of movements in a safe environment (for example, hopping, swinging, climbing, and doing somersaults).

Adapted from pathways.org (https://pathways.org/wp-content/uploads/2019/07/PlayBrochure_English_LEGAL_FOR-PRINT_2022.pdf).

special mornings when it is open only to children with special needs. Extra staffing enables these children and their siblings to play in a safe environment because they may not be able to participate during crowded routine hours.

The AAP recommends that pediatricians:

1. Encourage parents to observe and respond to the nonverbal behavior of infants during their first few months of life (eg, responding to their children's emerging social smile) to help them better understand this unique form of communication. For example, encouraging parents to recognize their children's emerging social smile and to respond with a smile of their own is a form of play that also teaches the infants a critical social–emotional skill: "You can get my attention and a smile from me anytime you want just by smiling yourself." By encouraging parents to observe the behavior of their children, pediatricians create opportunities to engage parents in discussions that are nonjudgmental and free from criticism (because they are grounded in the parents' own observations and interpretations of how to promote early learning);
2. Advocate for the protection of children's unstructured playtime because of its numerous benefits, including the development of foundational motor skills that may have lifelong benefits for the prevention of obesity, hypertension, and type 2 diabetes;
3. Advocate with preschool educators to do the following: focus on playful rather than didactic learning by letting children take the lead and follow their own curiosity; put a premium on building social–emotional and executive functioning skills throughout the school year; and protect time for recess and physical activity;
4. Emphasize the importance of playful learning in preschool curricula for fostering stronger caregiver–infant relationships and promoting executive functioning skills. Communicating this message to policy makers, legislators, and educational administrators as well as the broader public is equally important; and
5. Just as pediatricians support Reach Out and Read, encourage playful learning for parents and infants by writing a "prescription for play" at every well-child visit in the first 2 years of life.

A recent randomized controlled trial of the Video Interaction Project (an enhancement of Reach Out and Read) has demonstrated that the promotion of reading and play during pediatric visits leads to enhancements in social–emotional development.[112] In today's world, many parents do not appreciate the importance of free play or guided play with their children and have come to think of worksheets and other highly structured activities as play.[146] Although many parents feel

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that they do not have time to play with their children, pediatricians can help parents understand that playful learning moments are everywhere, and even daily chores alongside parents can be turned into playful opportunities, especially if the children are actively interacting with parents and imitating chores. Young children typically seek more attention from parents.[46] Active play stimulates children's curiosity and helps them develop the physical and social skills needed for school and later life.[32]

CONCLUSIONS

- Cultural shifts, including less parent engagement because of parents working full-time, fewer safe places to play, and more digital distractions, have limited the opportunities for children to play. These factors may negatively affect school readiness, children's healthy adjustment, and the development of important executive functioning skills;

- Play is intrinsically motivated and leads to active engagement and joyful discovery. Although free play and recess need to remain integral aspects of a child's day, the essential components of play can also be learned and adopted by parents, teachers, and other caregivers to promote healthy child development and enhance learning;

- The optimal educational model for learning is for the teacher to engage the student in activities that promote skills within that child's zone of proximal development, which is best accomplished through dialogue and guidance, not via drills and passive rote learning. There is a current debate, particularly about preschool curricula, between an emphasis on content and attempts to build skills by introducing seat work earlier versus seeking to encourage active engagement in learning through play. With our understanding of early brain development, we suggest that learning is better fueled by facilitating the child's intrinsic motivation through play rather than extrinsic motivations, such as test scores;

- An alternative model for learning is for teachers to develop a safe, stable, and nurturing relationship with the child to decrease stress, increase motivation, and ensure receptivity to activities that promote skills within each child's zone of proximal development. The emphasis in this preventive and developmental model is to promote resilience in the presence of adversity by enhancing executive functioning skills with free play and guided play;

- Play provides ample opportunities for adults to scaffold the foundational motor, social–emotional, language, executive functioning, math, and self-regulation skills needed to be successful in an increasingly complex and collaborative world. Play helps to build the skills required for our changing world; and

- Play provides a singular opportunity to build the executive functioning that underlies adaptive behaviors at home; improve language and math skills in school; build the safe, stable, and nurturing relationships that buffer against toxic stress; and build social–emotional resilience.

For more information, see Kearney et al's *Using Joyful Activity To Build Resiliency in Children in Response to Toxic Stress*.[147]

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ABBREVIATIONS

AAP: American Academy of Pediatrics
BDNF: brain-derived neurotrophic factor
PFC: prefrontal cortex

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REFERENCES

1. Ginsburg KR; American Academy of Pediatrics Committee on Communications; American Academy of Pediatrics Committee on Psychosocial Aspects of Child and Family Health. The importance of play in promoting healthy child development and maintaining strong parent-child bonds. *Pediatrics*. 2007;119(1):182–191
2. Milteer RM, Ginsburg KR; Council on Communications and Media; Committee on Psychosocial Aspects of Child and Family Health. The importance of play in promoting healthy child development and maintaining strong parent-child bond: focus on children in poverty. *Pediatrics*. 2012;129(1). Available at: www.pediatrics.org/cgi/content/full/129/1/e204
3. Walker SP, Chang SM, Vera-Hernández M, Grantham-McGregor S. Early childhood stimulation benefits adult competence and reduces violent behavior. *Pediatrics*. 2011;127(5):849–857
4. Weisberg DS, Hirsh-Pasek K, Golinkoff RM, Kittredge AK, Klahr D. Guided play: principles and practices. *Curr Dir Psychol Sci*. 2016;25(3):177–182
5. Zelazo PD, Blair CB, Willoughby MT. *Executive Function: Implications for Education (NCER 2017-2000)*. Washington, DC: National Center for Education Research, Institute of Education Sciences; 2017. Available at: https://ies.ed.gov/ncer/pubs/20172000/pdf/20172000.pdf. Accessed October 24, 2017
6. Diamond A, Barnett WS, Thomas J, Munro S. Preschool program improves cognitive control. *Science*. 2007;318(5855):1387–1388
7. Watts TW, Duncan GJ, Clements DH, Sarama J. What is the long-run impact of learning mathematics during preschool? *Child Dev*. 2018;89(2):539–555
8. Meisels SJ, Atkins-Burnett S. The Head start national reporting system: a critique. *Young Child*. 2004;59:64–66
9. High PC; American Academy of Pediatrics, Committee on Early Childhood, Adoption, and Dependent Care and Council on School Health. School readiness. *Pediatrics*. 2008;121(4). Available at: www.pediatrics.org/cgi/content/full/121/4/e1008. Reaffirmed September 2013
10. Henderson TZ, Atencio DJ. Integration of play, learning, and experience: what museums afford young visitors. *Early Child Educ J*. 2007;35(3):245–251
11. Panksepp J. *Affective Neuroscience: The Foundations of Human and Animal Emotions*. 1st ed. New York, NY: Oxford University Press; 1998
12. United Nations Human Rights Office of the Commissioner. Convention on the Rights of the Child. 1989. Available at: www.ohchr.org/EN/ProfessionalInterest/Pages/CRC.aspx. Accessed October 24, 2017
13. Kinchin J, O'Connor A. *Century of the Child: Growing by Design 1900-2000*. New York, NY: Museum of Modern Art; 2012. Available at: https://www.moma.org/interactives/exhibitions/2012/centuryofthechild/. Accessed October 24, 2017
14. Resnick M. *Lifelong Kindergarten: Cultivate Creativity Through Projects, Passion, Peers, and Play*. Cambridge, MA: MIT Press; 2017
15. Gopnik A. What babies know. *New York Times*. 2016;(July 31):4
16. Gopnik A. *The Garden and the Carpenter*. New York, NY: Farrar Straus and Giroux; 2016
17. Gopnik A, Meltzoff AN, Kuhl PK. *The Scientist in the Crib*. 1st ed. New York, NY: William Morrow and Co; 1999
18. Golinkoff R, Hirsh-Pasek K. *Becoming Brilliant: What Science Tells us About Raising Successful Children*. Washington, DC: APA Press; 2016
19. Hirsh-Pasek K, Zosh JM, Golinkoff RM, Gray JH, Robb MB, Kaufman J. Putting education in "educational" apps: lessons from the science of learning. *Psychol Sci Public Interest*. 2015;16(1):3–34
20. Bruner JS, Jolly A, Sylva K, eds. *Play: Its Role in Development and Evolution*. 1st ed. New York, NY: Basic Books; 1976
21. Toub TS, Rajan V, Golinkoff R, Hirsh-Pasek K. Playful learning: a solution to the play versus learning dichotomy. In: Berch D, Geary D, eds. *Evolutionary Perspectives on Education and Child Development*. New York, NY: Springer; 2016:117–145
22. Mather JA, Anderson RC. Exploration, play and habituation in octopuses *(Octopus dofleini)*. *J Comp Psychol*. 1999;113(3):333–338
23. Wang S, Aamodt S. *Welcome to Your Child's Brain: How the Mind Grows From Conception to College*. New York, NY: Bloomsbury USA; 2011
24. Wenner M. The serious need for play. *Sci Am Mind*. 2009;20(1):22–29
25. Burghardt GM. *The Genesis of Animal Play: Testing the Limits*, 1st ed. Cambridge, MA: MIT Press; 2005
26. Goodall J. *In the Shadow of Man*. Boston, MA: Houghton Mifflin; 2010

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27. Dewar G. The cognitive benefits of play: effects on the learning brain. Available at: www.parentingscience.com/benefits-of-play.html. Accessed October 24, 2017

28. Vygotsky LS. Play and its role in the mental development of the child. In: Bruner J, Jolly A, Sylva K, eds. *Play*. New York, NY: Basic Books; 1976:609–618

29. Berk L, Meyers AB. *Infants and Children: Prenatal Through Middle Childhood*. 8th ed. New York, NY: Plenum; 2015

30. Pellis SM, Pellis VC, Bell HC. The function of play in the development of the social brain. *Am J Play*. 2010;2:278–296

31. Moore JL, Waltman K. Pressure to increase test scores in reaction to NCLB: an investigation of related factors. In: *Meeting of the American Educational Research and Evaluation Association*; September 2007; Chicago, IL

32. Hirsh-Pasek K, Golinkoff RM, Berk L, Singer DG. *A Mandate for Playful Learning in Preschool*. New York, NY: Oxford University Press; 2009

33. Tomasco S. IBM 2010 Global CEO Study: creativity selected as most crucial factor for future success. Available at: https://www.03.ibm.com/press/us/en/pressrelease/31670.wss. Accessed April 27, 2018

34. Hirsh-Pasek K, Golinkoff RM, Eyer D. *Einstein Never Used Flashcards: How Our Children Really Learn—and Why They Need to Play More and Memorize Less*. Pleasant Valley, NY: Rosedale; 2003

35. Logan SW, Robinson LE, Wilson AE, Lucas WA. Getting the fundamentals of movement: a meta-analysis of the effectiveness of motor skill interventions in children. *Child Care Health Dev*. 2012;38(3):305–315

36. Pellegrini AD, Smith PK. Physical activity play: the nature and function of a neglected aspect of playing. *Child Dev*. 1998;69(3):577–598

37. Lubans DR, Morgan PJ, Cliff DP, Barnett LM, Okely AD. Fundamental movement skills in children and adolescents: review of associated health benefits. *Sports Med*. 2010;40(12):1019–1035

38. Gopnik A. How babies think. *Sci Am*. 2010;303(1):76–81

39. Ansari A, Pettit K, Gershoff E. Combating obesity in head start: outdoor play and change in children's body mass index. *J Dev Behav Pediatr*. 2015;36(8):605–612

40. Pellis SM, Pellis VC. Play fighting of rats in comparative perspective: a schema for neurobehavioral analyses. *Neurosci Biobehav Rev*. 1998;23(1):87–101

41. Barry E. In British playgrounds, bringing in risk to build resilience. *New York Times*. March 10, 2018. Available at: https://www.nytimes.com/2018/03/10/world/europe/britain-playgrounds-risk.html. Accessed April 27, 2018

42. Murray R, Ramstetter C; Council on School Health; American Academy of Pediatrics. The crucial role of recess in school. *Pediatrics*. 2013;131(1):183–188

43. Pelligrini AD, Holmes RM. The role of recess in primary school. In: Singer D, Golinkoff R, Hirsh-Pasek K, eds. *Play = Learning: How Play Motivates and Enhances Children's Cognitive and Socio-Emotional Growth*. New York, NY: Oxford University Press; 2006

44. Fisher KR, Hirsh-Pasek K, Golinkoff RM, Gryfe SG. Conceptual split? Parents and experts perceptions of play in the 21st century. *J Appl Dev Psychol*. 2008;29:305–316

45. Hassinger-Das B, Toub TS, Zosh JM, Michnick J, Golinkoff R, Hirsh-Pasek K. More than just fun: a place for games in joyful learning. *J Study Educ Dev*. 2017;40(2):191–218

46. Galinsky E. *Mind in the Making*. 1st ed. New York, NY: Harper Collins; 2010

47. McClelland MM, Tominey SL. *Stop, Act, Think: Integrating Self-Regulation in the Early Childhood Classroom*. London, United Kingdom: Taylor & Francis; 2016

48. Weisberg DS, Hirsh-Pasek K, Golinkoff RM. Guided play: where curricular goals meet a playful pedagogy. *Mind Brain Educ*. 2013;7(2):104–112

49. Yogman MW, Lester BM, Hoffman J. Behavioral and cardiac rhythmicity during mother-father-stranger infant social interaction. *Pediatr Res*. 1983;17(11):872–876

50. Stern D. *The Interpersonal World of the Infant: A View From Psychoanalysis and Developmental Psychology*. New York, NY: Basic Books; 1980

51. Yogman MW. Games fathers and mothers play with their infants. *Infant Ment Health J*. 1981;2(4):241–248

52. Feldman R, Magori-Cohen R, Galili G, Singer M, Louzoun Y. Mother and infant coordinate heart rhythms through episodes of interaction synchrony. *Infant Behav Dev*. 2011;34(4):569–577

53. Campos JJ, Klinnert MD, Sorce JF, Emde RN, Svejda M. Emotions as behavior regulators: social referencing in infancy. In: Plutchik R, Kellerman H, eds. *Emotion: Theory, Research, and Experience*. Vol 2. New York, NY: Academic Press; 1983:57–86

54. Sorce JF, Emde RN, Campos JJ, Klinnert MD. Maternal emotional signaling: its effect on the visual cliff behavior of 1-year-olds. *Dev Psychol*. 1985;21(1):195–200

55. Mahler M, Pine F, Bergman A. *The Psychological Birth of the Human Infant*. 1st ed. New York, NY: Basic Books; 1998

56. Bodrova E, Germeroth C, Leong DJ. Play and self-regulation: lessons from Vygotsky. *Am J Play*. 2013;6(1):111–123

57. Walker CM, Gopnik A. Pretense and possibility–a theoretical proposal about the effects of pretend play on development: comment on Lillard et al. (2013). *Psychol Bull*. 2013;139(1):40–44

58. Burgdorf J, Panksepp J. The neurobiology of positive emotions. *Neurosci Biobehav Rev*. 2006;30(2):173–187

59. Burgdorf J, Panksepp J, Moskal JR. Frequency-modulated 50 kHz ultrasonic vocalizations: a tool for uncovering the molecular substrates of positive affect. *Neurosci Biobehav Rev*. 2011;35(9):1831–1836

60. Panksepp J. Neuroevolutionary sources of laughter and social joy: modeling primal human laughter in laboratory rats. *Behav Brain Res*. 2007;182(2):231–244

61. Ishiyama S, Brecht M. Neural correlates of ticklishness in the rat somatosensory cortex. *Science*. 2016;354(6313):757–760

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by guest

62. Panksepp J, Burgdorf J. "Laughing" rats and the evolutionary antecedents of human joy? *Physiol Behav*. 2003;79(3):533–547

63. Burgdorf J, Wood PL, Kroes RA, Moskal JR, Panksepp J. Neurobiology of 50-kHz ultrasonic vocalizations in rats: electrode mapping, lesion, and pharmacology studies. *Behav Brain Res*. 2007;182(2):274–283

64. Six S, Panksepp J. ADHD and play. *Scholarpedia*. 2012;7(10):30371

65. Gordon NS, Burke S, Akil H, Watson SJ, Panksepp J. Socially-induced brain 'fertilization': play promotes brain derived neurotrophic factor transcription in the amygdala and dorsolateral frontal cortex in juvenile rats. *Neurosci Lett*. 2003;341(1):17–20

66. Bell HC, Pellis SM, Kolb B. Juvenile peer play experience and the development of the orbitofrontal and medial prefrontal cortices. *Behav Brain Res*. 2010;207(1):7–13

67. Diamond MC, Krech D, Rosenzweig MR. The effects of an enriched environment on the histology of the rat cerebral cortex. *J Comp Neurol*. 1964;123:111–120

68. Huber R, Tononi G, Cirelli C. Exploratory behavior, cortical BDNF expression, and sleep homeostasis. *Sleep*. 2007;30(2):129–139

69. Burgdorf J, Kroes RA, Beinfeld MC, Panksepp J, Moskal JR. Uncovering the molecular basis of positive affect using rough-and-tumble play in rats: a role for insulin-like growth factor I. *Neuroscience*. 2010;168(3):769–777

70. Gordon NS, Kollack-Walker S, Akil H, Panksepp J. Expression of c-fos gene activation during rough and tumble play in juvenile rats. *Brain Res Bull*. 2002;57(5):651–659

71. Roth TL, Lubin FD, Funk AJ, Sweatt JD. Lasting epigenetic influence of early-life adversity on the BDNF gene. *Biol Psychiatry*. 2009;65(9):760–769

72. Pellis SM, Pellis VC, Himmler BT. How play makes for a more adaptable brain: a comparative and neural perspective. *Am J Play*. 2014;7(1):73–98

73. Einon DF, Morgan MJ, Kibbler CC. Brief periods of socialization and later behavior in the rat. *Dev Psychobiol*. 1978;11(3):213–225

74. Hol T, Van den Berg CL, Van Ree JM, Spruijt BM. Isolation during the play period in infancy decreases adult social interactions in rats. *Behav Brain Res*. 1999;100(1–2):91–97

75. Greenough WT, Black JE. Induction of brain structure by experience: substrates for cognitive development. In: Gunnar MR, Nelson CA, eds. *Developmental Behavioral Neuroscience: The Minnesota Symposia on Child Psychology*. Vol 24. Hillsdale, NJ: L Erlbaum; 1992:155–200

76. Vanderschuren LJ, Niesink RJ, Van Ree JM. The neurobiology of social play behavior in rats. *Neurosci Biobehav Rev*. 1997;21(3):309–326

77. Siviy SM. Effects of pre-pubertal social experiences on the responsiveness of juvenile rats to predator odors. *Neurosci Biobehav Rev*. 2008;32(7):1249–1258

78. Garner AS, Shonkoff JP, Siegel BS, et al; Committee on Psychosocial Aspects of Child and Family Health; Committee on Early Childhood, Adoption, and Dependent Care; Section on Developmental and Behavioral Pediatrics. Early childhood adversity, toxic stress, and the role of the pediatrician: translating developmental science into lifelong health. *Pediatrics*. 2012;129(1). Available at: www.pediatrics.org/cgi/content/full/129/1/e224

79. Gruber MJ, Gelman BD, Ranganath C. States of curiosity modulate hippocampus-dependent learning via the dopaminergic circuit. *Neuron*. 2014;84(2):486–496

80. Barnett LA. Research note: young children's resolution of distress through play. *J Child Psychol Psychiatry*. 1984;25(3):477–483

81. Hatfield BE, Williford AP. Cortisol patterns for young children displaying disruptive behavior: links to a teacher-child, relationship-focused intervention. *Prev Sci*. 2017;18(1):40–49

82. Corbett BA, Schupp CW, Simon D, Ryan N, Mendoza S. Elevated cortisol during play is associated with age and social engagement in children with autism. *Mol Autism*. 2010;1(1):13

83. Siviy SM. Play and adversity: how the playful mammalian brain withstands threats and anxieties. *Am J Play*. 2010;2(3):297–314

84. Pellis SM, Pellis VC. *The Playful Brain: Venturing to the Limits of Neuroscience*. Oxford, United Kingdom: Oneworld Publications; 2009

85. Wolfgang CH, Stannard LL, Jones I. Block play performance among preschoolers as a predictor of later school achievement in mathematics. *J Res Child Educ*. 2001;15(2):173–180

86. Lewis V, Boucher J, Lupton L, Watson S. Relationships between symbolic play, functional play, verbal and non-verbal ability in young children. *Int J Lang Commun Disord*. 2000;35(1):117–127

87. Fisher KR, Hirsh-Pasek K, Newcombe N, Golinkoff RM. Taking shape: supporting preschoolers' acquisition of geometric knowledge through guided play. *Child Dev*. 2013;84(6):1872–1878

88. Cheng YL, Mix KS. Spatial training improves children's mathematics ability. *J Cogn Dev*. 2012;15(1):2–11

89. Panksepp J. Can PLAY diminish ADHD and facilitate the construction of the social brain? *J Can Acad Child Adolesc Psychiatry*. 2007;16(2):57–66

90. Christakis DA. Rethinking attention-deficit/hyperactivity disorder. *JAMA Pediatr*. 2016;170(2):109–110

91. Atkinson L, Jamieson B, Khoury J, Ludmer J, Gonzalez A. Stress physiology in infancy and early childhood: cortisol flexibility, attunement and coordination. *J Neuroendocrinol*. 2016;28(8)

92. Blair C, Granger D, Willoughby M, Kivlighan K. Maternal sensitivity is related to hypothalamic-pituitary-adrenal axis stress reactivity and regulation in response to emotion challenge in 6-month-old infants. *Ann N Y Acad Sci*. 2006;1094:263–267

93. Laurent HK, Harold GT, Leve L, Shelton KH, Van Goozen SH. Understanding the unfolding of stress regulation in infants. *Dev Psychopathol*. 2016; 28(4, pt 2):1431–1440

94. Hibel LC, Granger DA, Blair C, Finegood ED; Family Life Project Key Investigators. Maternal-child adrenocortical attunement in early childhood: continuity and change. *Dev Psychobiol*. 2015;57(1):83–95

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95. Sutherland SL, Friedman O. Just pretending can be really learning: children use pretend play as a source for acquiring generic knowledge. *Dev Psychol*. 2013;49(9):1660–1668

96. Dickinson DK, Tabors PO, eds. *Beginning Literacy With Language: Young Children Learning at Home and School*. Baltimore, MD: Paul Brookes Publishing; 2001

97. Christakis DA, Zimmerman FJ, Garrison MM. Effect of block play on language acquisition and attention in toddlers: a pilot randomized controlled trial. *Arch Pediatr Adolesc Med*. 2007;161(10):967–971

98. Dansky JL, Silverman I. Effects of play on associative fluency in preschool-aged children. *Dev Psychol*. 1973;9(1):38–43

99. Hillman CH, Pontifex MB, Castelli DM, et al. Effects of the FITkids randomized controlled trial on executive control and brain function. *Pediatrics*. 2014;134(4). Available at: www.pediatrics.org/cgi/content/full/134/4/e1063

100. Przybylski AK. Electronic gaming and psychosocial adjustment. *Pediatrics*. 2014;134(3). Available at: www.pediatrics.org/cgi/content/full/134/3/e716

101. Sosa AV. Association of the type of toy used during play with the quantity and quality of parent-infant communication. *JAMA Pediatr*. 2016;170(2):132–137

102. Zosh J, Verdine B, Filipowicz A, Golinkoff R, Hirsh-Pasek K, Newcombe N. Talking shape: parental language with electronic versus traditional shape sorters. *Int Mind Brain Educ Soc*. 2015;9(3):136–144

103. Buchsbaum D, Bridgers S, Skolnick Weisberg D, Gopnik A. The power of possibility: causal learning, counterfactual reasoning, and pretend play. *Philos Trans R Soc Long B Biol Sci*. 2012;367(1599):2202–2212

104. Carlson SM, White RE, Davis-Unger AC. Evidence for a relation between executive function and pretense representation in preschool children. *Cogn Dev*. 2014;29:1–16

105. Lillard AS, Lerner MD, Hopkins EJ, Dore RA, Smith ED, Palmquist CM. The impact of pretend play on children's development: a review of the evidence. *Psychol Bull*. 2013;139(1):1–34

106. Heckman J. Keynote address. In: Winthrop R, ed. *Soft Skills for Workforce Success: From Research to Action*. Washington, DC: Brookings Institution; 2015. Available at: www.brookings.edu/~/media/events/2015/06/17-soft-skills-workforce-success/0617_transcript_softskills.pdf. Accessed October 24, 2017

107. Pellis SM, Iwaniuk AN. Evolving a playful brain: a levels of control approach. *Int J Comp Psychol*. 2004;17:90–116

108. Korczak DJ, Madigan S, Colasanto M. Children's physical activity and depression: a meta-analysis. *Pediatrics*. 2017;139(4):e20162266

109. Goldstein J. Play in children's development, health and well-being: technology and play. In: Pellegrini DA, ed. *Oxford Handbook of the Development of Play*. New York, NY: Oxford University Press; 2011

110. Rothbaum F, Pott M, Azuma H, Miyake K, Weisz J. The development of close relationships in Japan and the United States: paths of symbiotic harmony and generative tension. *Child Dev*. 2000;71(5):1121–1142

111. Berkule SB, Cates CB, Dreyer BP, et al. Reducing maternal depressive symptoms through promotion of parenting in pediatric primary care. *Clin Pediatr (Phila)*. 2014;53(5):460–469

112. Weisleder A, Cates CB, Dreyer BP, et al. Reading is not just for language: promoting cognitive stimulation also enhances socioemotional development. In: *Pediatric Academic Societies Annual Conference*; April 30–May 4, 2016; Baltimore, MD

113. Cates CB, Weisleder A, Dreyer BP, et al. Leveraging healthcare to promote responsive parenting: impacts of the Video Interaction Project on parenting stress. *J Child Fam Stud*. 2016;25(3):827–835

114. Brazelton TB, Yogman M, Als H, Tronick E. The infant as a focus for family reciprocity. In: Lewis M, Rosenblum L, eds. *The Child and Its Family*. New York, NY: Plenum; 1980

115. Lieber R. Why planning for play deserves serious thought. *New York Times*. 2016;(January 2):B1

116. Bonawitz EB, Ferranti D, Saxe R, et al. Just do it? Investigating the gap between prediction and action in toddlers' causal inferences. *Cognition*. 2010;115(1):104–117

117. Bonawitz E, Shafto P, Gweon H, Goodman ND, Spelke E, Schulz L. The double-edged sword of pedagogy: instruction limits spontaneous exploration and discovery. *Cognition*. 2011;120(3):322–330

118. Schulz LE, Bonawitz EB. Serious fun: preschoolers engage in more exploratory play when evidence is confounded. *Dev Psychol*. 2007;43(4):1045–1050

119. Sobel DM, Sommerville JA. The importance of discovery in children's causal learning from interventions. *Front Psychol*. 2010;1:176

120. Center on the Developing Child. Enhancing and practicing executive function skills with children from infancy to adolescence. Available at: http://developingchild.harvard.edu/wp-content/uploads/2015/05/Enhancing-and-Practicing-Executive-Function-Skills-with-Children-from-Infancy-to-Adolescence-1.pdf

121. Bodrova E, Leong DJ. *Tools of the Mind: The Vygotskian Approach to Early Childhood Education*. 2nd ed. New York, NY: Merrill/Prentice Hall; 2007

122. Domitrovich CE, Cortes RC, Greenberg MT. Improving young children's social and emotional competence: a randomized trial of the preschool "PATHS" curriculum. *J Prim Prev*. 2007;28(2):67–91

123. Yerkes RM, Dodson JD. The relation of strength of stimulus to rapidity of habit-formation. *J Comp Neurol Psychol*. 1908;18(5):459–482

124. Blair C, Raver CC. Closing the achievement gap through modification of neurocognitive and neuroendocrine function: results from a cluster randomized controlled trial of an innovative approach to the education of children in kindergarten. *PLoS One*. 2014;9(11):e112393

125. Diamond A, Lee K. Interventions shown to aid executive function development

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in children 4 to 12 years old. *Science*. 2011;333(6045):959–964

126. Blair C, Granger DA, Willoughby M, et al; FLP Investigators. Salivary cortisol mediates effects of poverty and parenting on executive functions in early childhood. *Child Dev*. 2011;82(6):1970–1984
127. Louv R. *Last Child in the Woods: Saving Our Children From Nature-Deficit Disorder*. Chapel Hill, NC: Algonquin Books; 2008
128. Tandon PS, Zhou C, Christakis DA. Frequency of parent-supervised outdoor play of US preschool-aged children. *Arch Pediatr Adolesc Med*. 2012;166(8):707–712
129. Hofferth SL, Sandberg JF. Changes in American children's time, 1981-1997. *Adv Life Course Res*. 2011;6:193–229
130. Bishop R. Go out and play, but mean it: using frame analysis to explore recent news media coverage of the rediscovery of unstructured play. *Soc Sci J*. 2013;50(4):510–520
131. Hirsh-Pasek K, Golinkoff RM. Transforming cities into learning landscapes. Available at: https://ssir.org/articles/entry/transforming_cities_into_learning_landscapes. Accessed October 24, 2017
132. Ridge KE, Skolnick Weisber D, Ilgaz H, Hirsh-Pasek KA, Golnikoff RM. Supermarket speak: increasing talk among low socio-economic status families.*Mind Brain Educ*. 2015;9(3):127–135
133. Radesky JS, Eisenberg S, Kistin CJ, et al. Overstimulated consumers or next-generation learners? Parent tensions about child mobile technology use. *Ann Fam Med*. 2016;14(6):503–508
134. Anderson DR, Pempek TA. Television and very young children. *Am Behav Sci*. 2005;48(5):505–522
135. Adachi PJ, Willoughby T. The link between playing video games and positive youth outcomes. *Child Dev Perspect*. 2017;11(3):202–206
136. Radesky JS, Zuckerman B. Learning from apps in the home: parents and play. In: Kucirkova N, Falloon G, eds. *Apps, Technology, and Younger Learners: International Evidence for Teaching*. Oxford, United Kingdom: Routledge; 2017
137. American Academy of Pediatrics. Growing up digital. In: *Media Research Symposium*; October 1, 2015; Berlin, Germany
138. Lillard AS, Peterson J. The immediate impact of different types of television on young children's executive function. *Pediatrics*. 2011;128(4):644–649
139. American Academy of Pediatrics Council on Communications and Media. Policy statement: children, adolescents, and the media. *Pediatrics*. 2016;132(5):958–961
140. American Academy of Pediatrics Council on Communications and Media. Policy statement: media and young minds. *Pediatrics*. 2016;138(5):89–92
141. Rich M. Health importance of media on children. In: *American Academy of Pediatrics National Conference and Exhibition*; October 2016; San Francisco, CA
142. Hirsh-Pasek K, Golinkoff RM. The great balancing act: optimizing core curricula through playful learning. In: Zigler E, Gilliam W, Barnett S, eds. *The Preschool Education Debates*. Baltimore, MD: Brookes Publishing Co; 2011:110–116
143. Christakis E. *The Importance of Being Little*. New York, NY: Viking Press; 2016
144. Bodrova E, Leong D. *Tools of the Mind: The Vygotskian Approach to Early Childhood Education*, 2nd ed. New York, NY: Pearson; 2006
145. Child Trends. Neighborhood safety. Available at: https://www.childtrends.org/indicators/neighborhood-safety/. Accessed October 24, 2017
146. Fisher EP. The impact of play on development: a meta-analysis. *Play Cult*. 1992;5(2):159–181
147. Kearney B, Ritzenthaler H, Gray G, Yoder W. *Using Joyful Activity To Build Resiliency in Children in Response to Toxic Stress*. Brook Park, OH: Ohio Guidestone; 2017

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