Creativity Trend Report

a Center for Childhood Creativity publication

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Welcome from the editor

Welcome to the first edition of the *Creativity Trend Report*. We are excited to share this new biannual research report that synthesizes and distills high-caliber research from some of the most prominent scholars in the fields of creativity and developmental science. At the Center for Childhood Creativity, we have a passion for research with important implications for how to create meaningful learning opportunities that nurture children's creativity, curiosity, self-confidence, and resilience.

In the past three decades, advances in empirical research have resulted in an increasingly rich understanding of how children learn through exploring and experimenting with the world around them. Those findings, however, often take years to disseminate to mainstream media, and even longer to influence how children's products are being designed. To this end, we were motivated to better align children's product and content development with emergent research by collecting and summarizing innovative, recently published research for children's product and media designers, education leaders, and curriculum developers—all who have limited time and access to sift through the volumes of research published in academic journals.

The research topics featured in this report were selected by determining the most commonly used keywords (e.g., "divergent thinking") in leading peer-reviewed journals from the years 2014-2016 in the fields of creativity and developmental psychology. With the guidance of our academic advisors, this list of keywords was distilled to identify a subset of trending topics that have strong empirical evidence and applicability. In this first report, we discuss promoting early math skills, the importance of divergent thinking in the creative process, and how to nurture helping behaviors in children. Although these topics may seem unrelated on the surface, what ties them together is recognizing that high-quality, interactive experiences with adults and peers—such as playing with toys, building with blocks, and helping others—set the foundation for lifelong creativity and learning.

We look forward to sharing our enthusiasm for innovative and influential research with you and hope that you discover something new (or rediscover something "old") in the following pages that sparks your passion for enriching the lives of children and families.

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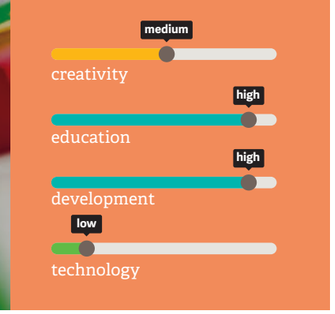
Beyond counting:

Building a strong foundation for math skills in early childhood



* Find explanation of slider bars on the next page.

Every parent and teacher would like to know the secret to being successful at math. That is, how can we develop strong math skills in all children, regardless of gender or socioeconomic status? Unfortunately, many children (and adults) lack confidence in their math abilities and the phrase "I'm not a math person" is all too common in schools and at home. Jo Boaler, Ph.D., a Stanford mathematics education professor and author of the book *Mathematical Mindsets*, argues against this myth and gives hope to individuals who are mathematically fearful or challenged[1]. Professor Boaler shares neuroscience research showing that with the right mindset and learning opportunities, anyone and everyone can be good at math.

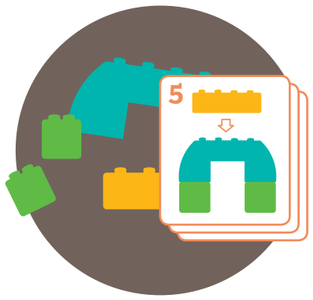
So what can be done to set a path for confidence and competence in math skills starting in early childhood? Recent research points to two strategies for building a strong foundation for math skills in young children: (1) providing a "spatial education" for preschoolers; and (2) encouraging children to count on their fingers.

Research on the relation between *spatial skills*, or the ability to mentally manipulate shapes and objects in the environment, and math skills emphasizes the importance of spatial thinking for school readiness and success in STEM fields—science, technology, engineering, and math[2]. Unfortunately, spatial skills are not often part of math curriculum and this may lead people to believe that these abilities are not teachable.

Block talk: Spatial language during block play

Fererra, Hirsh-Pasek, Newcombe, Golinkoff, and Lam (2011)

1. In the free play condition, parents and children played with blocks without any guidance.



2. In the guided play condition, children and parents were given numbered photographs that depicted steps to build a structure.

3. In the third condition—play with preassembled structures—children and parents were given a completed and glued-together model.

Key finding: Parents in the guided play condition produced significantly higher proportions of spatial talk than those in the other two conditions.

Implication: Play context impacts the amount of spatial vocabulary that children are exposed to, which in turn can benefit their spatial skills.

Research on age-appropriate and engaging materials for young children, however, argues against this view and offers convincing evidence that playing with blocks, puzzles, and shapes can provide a spatial education to young children[2].

A number of training studies with kindergarteners and first graders indicate that tasks such as block building can improve children's spatial skills. In these studies, children were given the opportunity to build with blocks or other construction toys (e.g., Wikki Stix) and asked to copy model designs. Researchers have found that these spatial assembly tasks improved children's spatial and math skills[3,4]. In line with this, work in neuroscience has shown that similar areas of the brain are active when individuals engage in spatial and math processing[5].

Additional research with preschoolers has emphasized the important role that parents play in providing a spatial education for young children[6]. In work by Fererra et al. (2011), researchers observed parents and their children playing with blocks for 10 minutes in three situations: (1) a free play situation with instructions to build anything, (2) a guided play situation in which the parent helped the child build a particular structure using instructions, or (3) a preassembled play situation in which children and parents were given an already assembled structure to play with. Parents in the guided play situation used more spatial terms than parents in the other two conditions. Furthermore, children in the guided play condition produced more spatial talk than those that engaged in free play with their parents. Taken together, these findings suggest that the play context impacts the amount of spatial vocabulary that children are exposed to and produce, which in turn can benefit their spatial skills.

A related area of research highlights the critical role of gesture in helping children grasp the meaning of spatial terms[7]. For example, we frequently spread our arms out wide when describing something as "big." Gesture also plays an important role in children's early number and math skills. Children often learn to count on their fingers and point to objects when counting a set. Many children, however, abandon using their fingers to count in early grade school, or before, because finger use is portrayed in a negative light and called "babyish."

In a recent article in *The Atlantic*, Jo Boaler and Lang Chen (2016)[8] presented evidence from psychology and neuroscience that suggests parents and teachers should be encouraging children to use their fingers to count. For example, first graders with better finger representation tended to score higher on number comparison and estimation tasks in the second grade. Children's finger representation, or *finger gnosia*, is assessed by having one of their fingers touched by another person (while their fingers are under a table or covered) and asking them which finger was touched.

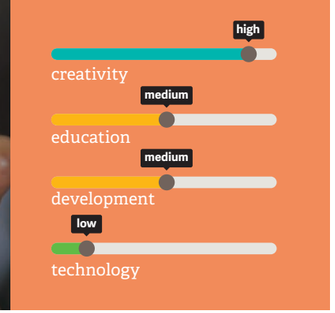
The good news is that finger representation can be improved with training and this often leads to increases in math achievement[9]. Surprisingly, researchers found that first graders' finger representation was a better predictor of future math achievement than their scores on measures of cognitive processing. This interesting link could explain why musicians, pianists in particular, often have strong math skills compared to people who do not play a musical instrument (parents, remember this when your child wants to quit piano!).

Developing strong math skills needs to start early. Math skills in early education predict academic achievement in multiple subject areas including later math and literacy[10]. Research tells us that promoting spatial skills through block play and encouraging children to use their fingers to count will help young children build strong mathematical knowledge by making math visual, giving it meaning beyond the abstract concepts of numbers and symbols, and suggesting simple-to-execute educational interventions.

* These ratings provide a guideline for the content captured in each topic summary. For example, education is "high" in the math topic summary because the research summarized has direct applications for educational (both formal and informal) settings. In addition, technology is "low" because the specific research discussed in the topic summary itself is not related to technology (although math and technology are closely linked in a broader sense).

A path towards divergent thinking:

Providing options without assigning them



Creativity often involves exploring many possible solutions to a problem or finding different uses for ordinary objects. How can we leverage what we know about creative thinking to develop fun and meaningful play experiences as opposed to favoring more short-lived entertainment? *Divergent thinking*, or the open-ended generation of ideas towards increasingly creative solutions, often leads to young children (and for *some* of us as we grow older) finding an activity worthwhile in and of itself[11]. If toys are to be creative and evoke creativity in a young audience, providing numerous options for children to choose from isn't necessary. When given proper constraints, children will discover and generate many of their own options. An inherent quality of divergent thinking is that in order to evoke it in children (and adults), we don't need to provide the answers—they will.

One doesn't need expertise or a degree in fields like aesthetics or cognitive psychology to understand that creativity is a complex process with unpredictable outcomes. A functional understanding of creative thinking involves two separate, but intertwined processes: generating ideas and choosing which idea is the best. Put simply, creativity involves both divergent *and* convergent thinking (see graphic below for a visualization of these types of thinking). How we define creativity should shed some light on the importance of each cognitive process. The "standard definition of creativity" proposes that in order to be creative, an idea must be both original *and* useful[12]. If you overlay this definition onto the two processes, generating a lot of ideas increases the likelihood for original ones, while choosing the best idea is often determined by what we deem to be most useful.

Recent research[13] has helped validate what many creativity researchers have proposed: divergent thinking is a predictor of creative potential. As an example of a divergent thinking task, the ability to generate a lengthy list of "things that move on wheels," and how creative those responses are, says a lot about our potential. Regardless of experiences or skill sets, performance on divergent thinking tasks has predicted creativity later in life[14,15]. These findings suggest that we can identify creative potential (and giftedness[16]) in our children now, but also support them in becoming divergent and innovative thinkers later in life. Creativity can also be forecasted by children's reactions to toys. Sandra Russ and her colleagues (1999)[17] observed behaviors of children as they played with toys, finding that engagement in pretend play predicted how those children would perform on divergent thinking tasks four years later (along with predicting girls' math achievement[18]). There are many ways to encourage the development of creative thinking, and research continues to uncover the significant contributions of play.

Two ways of thinking

Divergent

generating many solutions to a problem.

Convergent

focusing on a limited number of possible solutions.

One of the true joys of parenting is watching our child(ren) engage with a toy for lengthy amounts of time. So, what is the mysterious quality that harbors attention, and prolongs play time with a particular toy? An array of literal bells and whistles may keep a child entertained. Objects, however, provide more sustainable attention by evoking a sense of "doing for the sake of doing, "or what is called *intrinsic motivation*. An object has the potential for countless creative uses when perceived with flexibility and abandon. A toy can *scaffold* (i.e., support and encourage) children's creativity, but should avoid providing too much direction. That is to say, when it comes time to actually be creative, there is no amount of monitoring that will simply make it happen. Hovering over a child often provides a sense of evaluation that hinders a child's ability to diverge from the norm with their thinking.

In a truly clever study[19], a toy with numerous hidden functions was presented to two groups of young children. One group was instructed by an adult about one of the toy's functions, while the other group experienced an adult that "accidentally" bumped the toy to reveal one thing it could do (e.g., a button that played music). The latter group spent significantly more time exploring other functions of the toy than their guided peers, who focused on the one function demonstrated by an adult. Such findings suggest the power of discovery over instructions, and undoubtedly speak to the power of play.

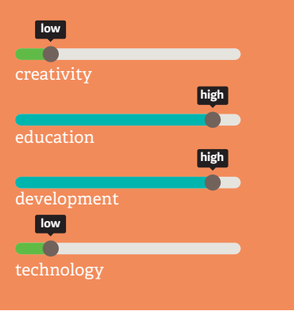
Since the launch of Sputnik in 1957, creativity and innovation have never been more important and valuable. Providing children a toy with little direction or presumption is not something we should avoid, rather, it is *a void* that we can help them become more accustomed to and appreciate.

Ways to support children's divergent thinking

- Redirect children's activities to use ordinary materials towards extraordinary ends. Divergent thinking is about exploring many views and uses of objects in ways that aren't so habitual. For examples of fun activities that were developed to enhance divergent thinking, visit the Center for Childhood Creativity's Creativity Catapult at www.creativitycatapult.org:
  - Circle Game
  - Found Portraits
  - Towel Transformations
  - Select Your Words Carefully
- Another way to become more comfortable with divergent thinking is to first identify those things that most people take for granted by always doing them the same way. For example, ask your child if he or she always puts the left sock on first? How about the route you take coming home? Work together to name as many of those auto-pilot activities as you can, and brainstorm the ways that you could mix it up and do things differently. Recognizing patterns and learning how to reinvent new ones is not only divergent, but one of the biggest steps towards innovation!
- Encourage children to brainstorm as many solutions as they can whenever a problem arises. Research on divergent thinking has uncovered that the more solutions you can come up with for a problem, the more likely you are to come up with a creative one. That problem might be about what's for dinner, and if there is more than one hungry child, the more options they come up with, the more likely they are to overlap and make the decision that much easier.

Little helping hands:

Promoting helping and sharing in young children

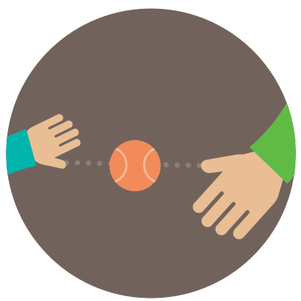


As infamously stated by Thumper in the classic Disney film Bambi, "If you can't say something nice, don't say nothing at all." This quote represents a universally agreed-upon social expectation that individuals should be kind to one another. Despite such expectations, however, people do not always act in ways that align with this ideal; just look at the (social) media.

The mistreatment of one another is paradoxical and intriguing because prosocial (helping) behavior is essential for maintaining social order and positive relationships, and further, moral development begins early in life[20]. Infants appear to prefer individuals who are helpful over those who are hurtful[21,22]. Moreover, young children actively help, share, and cooperate with those around them[23,24]. Taken together, this begs the question: Can something be done to encourage helping behaviors in children?

Barragan and Dweck (2014)[25] aimed to investigate this very question. The researchers conducted a series of studies with toddlers and preschoolers designed to assess whether reciprocal play with another individual may uniquely motivate helping behavior. In these studies, an adult experimenter and child spent time

Reciprocal interactions trigger helpful behaviors in children Barragan and Dweck (2014)



1. In the reciprocal play condition, the child and experimenter rolled a ball back and forth.

2. In the parallel play play condition, the child and experimenter each rolled a ball on their own while next to each other.

3. After a few minutes, the experimenter "accidentally" knocked an object to the ground and clearly desired help from the child to retrieve it.

Key finding: Toddlers who engaged in reciprocal play were three times more likely to help pick up objects as children who engaged in parallel play.

Implication: Altruistic behavior is strongly influenced by social interactions and can be elicited by simple and short reciprocal interactions.

engaged in play that was either reciprocal (e.g., passing a ball back and forth) or parallel (playing *next* to one another, but not *with* one another), and the child was then given the opportunity to be kind to the adult (retrieve an object or share stickers). Interestingly, the researchers found that children who played reciprocally with the adult were more helpful and generous than children who played in parallel next to the adult. Participating in a simple reciprocal activity sufficiently established a positive, benevolent relationship between the experimenter and child that ultimately resulted in increased altruistic behavior (for a graphic representation of this study, see the figure on the previous page).

Researchers have also found that language is related to young children's prosociality[26]. For example, Drummond and colleagues (2014)[26] investigated the role of language, specifically emotion and mental state terms (e.g., "thinks," "wants," "happy"), in promoting helping behaviors in toddlers. Parent-child pairs spent time together reading a book and playing with toys, and children were then presented with a set of helping tasks (e.g., will the child provide a blanket to an experimenter who appears cold?). The researchers explored whether there was an association between emotion and mental state talk and children's subsequent helping behavior. Drummond et al. (2014)[26] found that, indeed, children from parent-child duos who used more of this language also more frequently engaged in empathic (emotion-based, other-oriented) helping. Talk about thoughts and feelings likely bolstered children's emotion understanding, and thus, resulted in more displays of compassion.

This literature has made it evident that social influences greatly shape the development of helping behavior[27,28]. The ways individuals interact with one another, and the types of information that a child is provided, meaningfully shape how he or she may act when presented with the opportunity to help and share. Additionally, considering this work as a whole, we can take solace in the simple ways that parents and teachers can work to improve the likelihood of helping behavior among children. This is great news, because being prosocial (socially competent) in kindergarten is related to a plethora of positive outcomes (e.g., success in school/work, mental health, substance abuse) in young adulthood[29]. An investment in developing helping behaviors in young children is meaningfully associated with success later in life.

Ways to nurture prosocial behaviors in children

- Encourage children to participate in games and activities that involve collaboration, turn-taking, and reciprocal play. Research tells us that altruistic behavior is strongly influenced by social interactions, and playing games that encourage children to work together provide fun opportunities for promoting prosocial attitudes and behaviors. Great models of such activities can be found in the Center for Childhood Creativity's Creativity Catapult www.creativitycatapult.org:
  - Down, Down, Down
  - One Word Stories
  - Shadow Shadow
- After your child watches a show or reads a book, engage in conversation regarding what the character(s) were thinking and feeling (and why). Discussing mental states in relation to media content beneficially provides children with an opportunity to learn about connections between experiences, thoughts, and emotions. Children understand more about their and others' emotions when their everyday interactions are emotionally rich.
- Find opportunities for children to help with tasks and chores around the house or at school. Many children are eager to "help" fold laundry, bake cookies, or wash dishes, and although these genuine efforts to help are often not the most efficient way to complete a task, research suggests that this parent-child interaction may contribute to the development of early helping.

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