The CREATE Framework: Learning Environments to Develop Creativity

Bay Area Discovery Museum

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Pulling from the academic fields of education, psychology, and neuroscience, the Bay Area Discovery Museum has developed the CREATE framework. This unique pedagogical framework describes how educators can build children's creative problem-solving skills through intentional experiences. Across a range of learning experiences, from designing exhibits, to classroom set-up, to curriculum development, these ideas can serve as guiding and foundational principles for all those experiences. For each element of the CREATE framework, an exemplar from the Bay Area Discovery Museum showcases how to enact it for children in the first decade of their life and their families. This document also includes research backing the elements of the framework and the major concepts within each framework.

CREATE

The acronym CREATE illustrates key elements of learning environments that support the development of creativity for children in their first decade.

Child-Directed

Child-directed learning environments allow children to take charge of their own learning by exploring topics or engaging in activities that are personally meaningful to them. Choice boosts **intrinsic motivation** in children, which in turn boosts creativity (Lepper, Green, & Nisbett, 1973).

Once they have made a decision about a topic or medium to investigate, children stick with their project because they have a personal connection to this choice. Choice helps children learn and create for self-fulfillment, rather than extrinsic rewards such as prizes or recognition.

When intrinsically motivated, children often enter a **state of flow** in which they are fully immersed in their learning or doing, becoming laser-focused on the activity at hand. Children in flow lose track of time, don't experience distractions, and are engaged in learning for the sake of learning. Creative performance is also heightened in flow (Rathunde & Csikszentmihalyi, 2005).

Child-directed does not mean adults disengage. In fact, adults play an important role in child-directed learning by asking provocative questions or making suggestions, setting up developmentally appropriate learning environments, or by selecting specific materials or toys for children to use. **Guided play**—a combination of adult-initiation and child-direction—provides a balance between structure and freedom that promotes exploration and learning in children (Fisher et al., 2013).

Adults can support children in learning self-direction by encouraging **planning and reflection** about the choices they make. By asking children to create a list of steps or a sketch of an idea, we are laying the architecture for long-term executive function skills (e.g., self-control, cognitive flexibility, and focus of attention).

Intrinsic Motivation

State of Flow

Guided Play

Planning & Reflection

When designing learning environments to inspire creative problem-solving, consider:

- Do children have choices in their activities, materials, process, and/or product?
- Are extrinsic rewards (e.g. points, grades, stars) used sparingly, if at all?
- Is there flexibility in the timing of the activity or lesson so that children who become immersed are able to stay in "flow"? Are there extension activities to engage children who finish more quickly?
- What are the learning goals of the activity? How do the space, materials, and/or your facilitation support children to meet these goals?
- How are children encouraged to intentionally plan and reflect?

Activity ideas:

Wind Chimes

Children explore the science of sound as they use natural and recycled materials to make their own wind chime! After they choose a stick or small branch as the base, invite children to use various materials such as wooden beads, shells, dried colorful pasta, bells, washers, and other materials to construct their own wind chimes. Yarn, pipe cleaners and wire will hold these pieces together. Allow children to experiment with different methods of fastening and combining. Try giving a design challenge such as *create a wind chime with pitches that are only in a low, deep register.*

Implementation tips:

Prepare facilitators to ask children open-ended questions like: What do you notice? What might happen if…? Why do you think that is happening? You can also print out prompts like these and have them available at each station so that caregivers can ask children the same questions. Remind caregivers that children are not required to follow steps in any particular order or use a set amount of any of the supplies–they are free to experiment.

At the Bay Area Discovery Museum:

It may seem challenging to integrate elements of choice into programs or exhibits that need to be prepped in advance, with no certainty about the age, skill level, or personal interests of the children that will show up. But building in choice is possible even in the context of these constraints. The key is to be prepared with open-ended materials and prompts that will invite each child to explore at their own level and pace, interpreting the activity in the way that fits their interests and abilities.

You'll know the program is child-directed if...

children exercise control over many aspects of the program and they lose track of time, engaging with a new activity for an extended period of time.

Risk-Friendly

Learning and creativity require risk-taking, and children who are in a good place emotionally will be more confident and open to embracing new experiences and trying out new ideas. Positive emotions—such as satisfaction, joy, belonging, and wonder—help the brain to relax and focus and enhance openness, flexibility, and memory. By being **emotionally attuned** to children's state of mind and needs, adults can build a culture of encouragement and acceptance that increases both learning and creativity (Russ, 1993).

Children also need **appropriate challenge** to learn and grow. If something is too easy or too hard, children will not stay engaged. Considering a child's current level of knowledge and ability—and considering what specific support might help the child be successful—adults can design creative learning experiences that give the right amount of challenge (Hammond et al., 2012).

Novel experiences, including frequent opportunities to experience something new or see things from another person's perspective, help children develop their creativity skills. Children who are open to new things will feel more comfortable trying out a novel approach to a problem; they will generate more ideas and resist the urge to settle on easy, tried-and-true solutions. This openness allows for more creative problem-solving, as original ideas often come from incorporating new perspectives.

To build persistence and openness to new experiences, praise should focus on process and adults should reinforce a **growth mindset**: when children believe they can improve or get smarter, they focus on effort and resilience (Dweck, 2006). By normalizing failure, adults can help children understand that trying new things and making mistakes is just part of the learning process; initial failure leads to improvement and growth.

Emotionally Attuned

Appropriate Challenge

Novel Experiences

Growth Mindset

When designing learning environments to inspire creative problem-solving, consider:

- How will you create emotional safety for children?
- How will you assess where children are developmentally so that you can challenge them appropriately? How will you differentiate your activities or facilitation to reach all kids?
- Where are there opportunities for children to try new things?
- Where do you anticipate children experiencing "failure" or difficulty in the activity? What strategies will you use to support them to persist?
- How will you message that effort and hard work lead to learning and growth?

Activity idea:

Inside Out Creations

Transform old electronics into new creations! Find an old, unusable electronic device that is no longer needed and is safe to take apart. Wear safety goggles and use tools to carefully take apart the device. Lay all of the pieces out on a flat surface, and brainstorm a list of creations that could be made using the pieces. Select one of the creation ideas on the list and bring it to life, using arts and crafts supplies to add the finishing touches on the new creation.

Implementation tips:

As caring adults, when we see children struggling with something, it is difficult not to intervene. Practice walking around with your hands in your pockets so that you use your words to encourage children instead of jumping in to solve the problem for them. Celebrate the challenges with phrases like, "We do our best and keep on going!" and "When I think 'I can't…' I add the word yet." Make sure to talk about what was hard and what you can learn from it.

At the Bay Area Discovery Museum:

Museums have traditionally been viewed as places to view collections and passively receive information rather than actively participate in a learning experience. Yet it is when we are active participants in novel experiences that learning takes place, and it is when we are stretched beyond our comfort zone that our skills and abilities are able to grow. By creating emotionally safe spaces and embracing challenges as opportunities for learning, we can set up environments in which children are supported to grow through appropriate risk-taking.

You'll know the program is risk-friendly if...

children have to revise their original ideas or start their designs over, and if they say "I've never done this before!" or "I tried something new today!"

Exploratory

Children are naturally wired to explore the world around them and to build their understanding about the world through play (Singer, Golinkoff, & Hirsh-Pasek, 2006). As they grow older, this **playful experimentation** can evolve into tinkering and taking objects apart to discover more about how things work and to come up with new ideas. **Hands-on learning** leads to deeper engagement with materials and subject matter. When children learn by doing, they build strong understanding of concepts and connect learning to their everyday lives (Cook et al., 2011). This immersive, authentic learning style is related to intrinsic motivation because it is both fun and personally relevant.

Exploratory learning is **open-ended**. That is, there is no one "right" thing that children will learn or do. Instead in an exploratory learning environment, adults prompt complex thinking and inquiry by incorporating challenges and questions with multiple possible approaches and answers.

Exploratory learning allows for **divergent thinking** (i.e., the creative process of generating many ideas before settling on a solution) followed by **convergent thinking** (an analytical process of selecting the most appropriate idea for the challenge at hand). By encouraging children to brainstorm possible ideas or approaches, adults teach that real-world problems rarely have one correct answer.

Playful Experimentation

Hands-on Learning

Open-ended

Divergent & Convergent Thinking

When designing learning environments to inspire creative problem-solving, consider:

- How might you harness children's natural desire to play in order to support them to learn how things work and to make sense of the world around them?
- Where do children have an opportunity to use multiple senses in order to deepen their thinking and understanding?
- Where do children have an opportunity to learn by doing?
- What open-ended questions might you ask?
- Are children asked to brainstorm possible ideas and select solutions?

Activity idea:

Ice Exploration

This program involves preparing blocks of ice with different objects frozen inside. Children are provided with an array of tools, including toothbrushes, tweezers, eyedroppers, warm and cold water, and salt, to excavate the frozen objects. Facilitators are on hand to encourage close observation and persistence, and to suggest excavation techniques.

Implementation tips:

Engage children with questions throughout their excavation process: *How do you think the penny got in there? Which tool would take the longest to get the twig out of the ice? Is the warm water or the cool water more effective? How do you know?* Ice Exploration works particularly well with natural materials, including plants, rocks, or even insects, but you can also try small household objects or toys. If this program goes well, it'll get messy - don't forget the towels!

At the Bay Area Discovery Museum:

Every day is a great day for hands-on experimentation in the museum. Support children to authentically dive into interesting subjects and engage in multisensory experiences. Listen for the questions children ask on their own, and the experiments they set up through their own self-guided play. Provide time for "messing about" and getting to know new tools and materials.

You'll know the program is risk-friendly if...

children share sensory observations during the program, try multiple tools or attempt multiple excavation methods, and express excitement about the process and a desire to keep exploring.

Active

Physical movement and exercise not only strengthen our bodies, but also enhance learning and boost creativity. Research shows that regular **brain breaks** and **opportunities for movement** are helpful for memory retention and for boosting creative insight. Growing number of studies suggest that physical activity may enhance creativity (e.g., divergent and convergent thinking) in adults. Physical activity should not be relegated to recess, but should be incorporated throughout learning environments (Oppezzo & Schwartz, 2014).

Many manifestations of creativity require children to develop skills related to **physical development** (e.g., fine motor skills necessary to hold a pencil to write a story; gross motor skills necessary to perform a dance). Both fine and gross motor skills play a critical role in how children explore and learn about their environment. Research supports important links between motor skills, school adjustment, and academic achievement (Grissmer et al., 2010).

Opportunities for Movement

Brain Breaks

Physical Development

When designing learning environments to inspire creative problem-solving, consider:

- How physically active will children be during this experience? If less physically active, how might you incorporate frequent breaks? (A good rule of thumb is to make sure that children are not sitting longer than three minutes per year of their age; hence, a five year old should have a chance for physical movement after 15 minutes.)
- What gross motor skills are developed through this experience (e.g. big body movements, coordination, balance)? What fine motor skills are developed through this experience (e.g. grip, finger control, hand/eye coordination)?

Activity idea:

Big Body Triangles

As one aspect of a preschool workshop focusing on triangles, students are invited to use their whole bodies to make various types of triangles. Balance pods at the points are connected by tape for students to walk around the perimeter or hop from pod to pod. Mirrors and prompts invite children to use their elbows, heads, or toes to draw triangles, or to position their body in a yoga pose to create a triangle.

Implementation tips:

Try to get the caregivers involved, too! Introducing movement activity ideas that families can do together at home can help families build more movement into their daily lives, and can provide children with a different outlet for expressing themselves.

At the Bay Area Discovery Museum:

Developing motor skills, both small body (fine motor) and big body (gross motor) is a key part of early childhood development. Children need to move their bodies constantly and they learn best when they are actively engaged! Even through adulthood, research shows that movement enhances creativity. This knowledge challenges educators to incorporate active movement as a key part of learning experiences and not just a non-essential option.

You'll know the program is active if...

children are up and moving!

Time for Imagination

Pretend play has many benefits: it allows children to generate and enact original ideas; to practice self-regulation and perspective taking skills; and to get along with others. Research supports an important link between early childhood imagination and later creativity (Russ, 2003).The quality of children's pretend play predicts divergent thinking (i.e., generating creative ideas by exploring many possible solutions) and original thinking over time. Though pretend play tends to be associated with very young children, it should be supported in children of all ages.

Children may also express their imagination through the invention of imaginary friends or, for older children, the development of full **imaginary worlds**, which can be described in elaborate detail through stories, pictures, and maps (Root-Bernstein, 2014).

Time spent **daydreaming**, sometimes called mind wandering, is not time wasted: daydreaming can be helpful for children when they are working on difficult problems. Research has shown that incubation, or taking time out to not focus on the task at hand, can help people get out of ruts and to make unusual connections that lead to creative solutions.

As children progress through the school years, they may begin to experience peer pressure to fit in and not stand out. These conventional tendencies may make it difficult for older children to be original in their ideas. Providing **explicit instructions to be creative** is helpful for everyone but particularly for children at this developmental stage. Inviting children to "be creative" prompts imagination and originality and inspires them to develop more novel or unique ideas (Runco, 1986).

Pretend Play

Imaginary Worlds

Daydreaming

Explicit Instructions to be Creative

When designing learning environments to inspire creative problem-solving consider:

- Where and when do children (through the elementary years) have opportunities and encouragement for rich pretend play?
- How can activities explicitly invite imagination, including thinking about places or things that do not currently exist?
- How can we create space for daydreaming while also supporting children to be "on task"?
- How can we invite children to look to others for inspiration but also feel challenged to come up with unique, out of the box ideas?

Activity idea:

Lights, Camera, Action! Camp

Over the course of a week, 4-6 year old campers become stars of the silver screen as they work together to create a short film. They consider character development, screenwriting, costume design, and sound effects as they collaborate on their performance. The week culminates with a film screening for families and friends.

Implementation tips:

Follow the children's interests and imagination in coming up with the story- let them lead everything from character development to the script itself. Facilitators can help to push children's thinking by asking questions: *What will happen when the monster meets the little boy? How does the monster talk?* Part of embracing time for imagination is embracing the fact that there are no "rules"; originality is key. Support children's perspective-taking as they try to consider what their character might be thinking, wearing, saying, and feeling.

At the Bay Area Discovery Museum:

Museums often introduce new topics or intriguing artifacts to children and their families. Pretend play, even into the elementary years, is one way to make sense of this novel information and to incorporate it into their own worldview. It is important to create spaces and programs that encourage pretend play, especially since we know that a large and growing body of research links children's pretend play with a host of positive outcomes such as social skills and executive function skills.

You'll know the program features time for imagination if...

children brainstorm many different ideas and come up with something completely original: a new costume, an invented language, or an entire imaginary world.

Exchange of Ideas

It is important for adults to model interactivity by initiating and sustaining back and forth **conversations** with children, so that children understand that their ideas matter (Hirsh-Pasek et al., 2015). These thoughtful conversations help children learn how to communicate their thinking to other adults and to peers, which is necessary for expressing creative ideas.

Collaboration is about more than cooperating in a group setting. Children should be encouraged to be accepting of others' ideas and build off of the ideas of others. The most creative ideas often come from creative collaboration, but this type of group work needs to be modeled and supported by adults (Fawcett & Garton, 2005).

Making **connections and combinations**, between different disciplines, topic areas, and ideas, is a vital creative practice. Help children to see links between ideas and to understand that academic disciplines don't live separately, but can come together to solve authentic problems. Teach them to use a creative tactic called synthesis: the process of combining multiple existing ideas in new ways to form a new solution (e.g., computers + cars = driverless cars).

Conversation

Collaboration

Connections & Combinations

When designing learning environments to inspire creative problem-solving consider:

- What strategies will you use to engage children in meaningful, back and forth conversations with you and/or with each other?
- What vocabulary or complex concepts will you work to incorporate into your conversations?
- How might you assess if children understand?
- How will you encourage children to work together in a way that is socially constructive, creates space for a range of perspectives, and creates potential collective creativity?
- How might you ask children to use knowledge and ways of thinking in interdisciplinary ways (e.g. asking children to precisely measure distance [math] as part of a design challenge [engineering] or asking children to anticipate what might happen next in a narrative [arts] to build the skill of prediction [science]?
- Are there opportunities to ask children to combine ideas (from each other or from the world around them) to generate new solutions

Activity idea:

Designing for Disaster

Children are presented with recycled and craft materials like popsicle sticks, straws, cardboard, and pipe cleaners, and are challenged to design and build a structure that will withstand the “earthquake” simulated by a shake table.

Implementation tips:

Invite grown-ups–including caregivers, and community partners – to join the fun. It can be helpful to explicitly tell adults that they are welcome and encouraged to play alongside their child. Inviting large-scale building often leads naturally to collaboration!

At the Bay Area Discovery Museum:

Transform your understanding of creative collaboration. For children, collaboration involves recognizing that other people have ideas, too, and that when solving a problem in a group, sometimes it makes sense to go with a peer’s idea, or to combine ideas. Museums attract diverse families, who may practice different traditions or speak different languages. This diversity sparks beneficial opportunities for exchange of ideas, and museums are poised to facilitate this exchange, though they recognize the challenge.

You’ll know the program features exchange of ideas if...

children are working, talking and sharing ideas with each other and adults. Learning goals incorporate multiple content areas, like engineering and math.

Related and Notable Studies

This section gives a brief overview of some of the notable studies that are related to the concepts described in the CREATE framework. We hope these studies will help you in "making the case" for creative learning environments in your educational settings.

Child-Directed

Adults play an important role in child-directed learning by asking provocative questions or making suggestions, setting up developmentally appropriate learning environments, or by selecting specific materials or toys for children to use. Guided play—a combination of adult-initiation and child-direction—provides a balance between structure and freedom that promotes exploration and learning in children.

Recent work suggests that rewards which exercise children's imaginations and capitalize on their innate curiosity can help preserve intrinsic motivation and increase persistence. In one study, Alvarez and Booth (2014) varied the rewards they promised preschoolers for repeatedly completing an intentionally tedious task. Remarkably, the group who completed the task the greatest number of times was not the one who received stickers after each completion, but the group who got to learn causally rich information about a strange new object or animal each time. Thus, while external rewards generally may degrade intrinsic motivation (Lepper, Greene, & Nisbett, 1973), rewards that engage children's minds propel them to immerse themselves in even uninteresting tasks.

This total immersion is often referred to as "flow." Research since Csikszentmihalyi's introduction of the term in 1990 enables us to better understand the circumstances that encourage flow, which has been linked to long-term engagement in a subject and academic performance (Shernoof & Hoogstra, 2001). While much of the work has been conducted with high school students, the principles of environments that foster flow apply regardless of age. Adults can encourage flow by encouraging children's autonomy, providing opportunities for children to choose what they want to focus on, and respecting those choices (Black & Deci, 2000). Flexible schedules allow states of flow to be achieved in long, uninterrupted periods (Rathunde & Csikszentmihalyi, 2005). Adults can also help children increase their interest and sense of direction—two fundamental components of flow—by encouraging children to relate an activity to their own lives, and by helping them to set clear goals for the activity.

Another way in which adults and children can work together to promote learning is through guided play. Studies with young children have compared learning outcomes for groups of children taught something in a traditional, didactic fashion to children "taught" something in a collaborative, playful context. Guided play has been shown to result in richer, more extensive learning—in some cases, also retained for longer—for learning targets as varied as a new word for a novel object (Zosh, Brinster, & Halberda, 2013) to geometric properties of shapes like triangles (Fisher et al., 2013). In one study, children were taught new vocabulary words in a story read by an instructor, then allowed to play with toys related to the story and new words. Children who played with the instructor, either participating in re-enactments of scenes or in dialogues about the book, learned the new words better than children who played with the toys while the instructor merely observed (Dickinson et al., 2013).

Risk-Friendly

Decades of research in psychology and education illuminate how adults can empower children to not only embrace new challenges, but work tenaciously to overcome them in new ways. Approaching a new problem exercises children's executive function skills, which include working memory and the ability to plan, inhibiting automatic responses, focusing attention, and thinking creatively. As with any early learning, adults can scaffold the growth of children's executive function skills by helping focus their attention on key aspects of a problem and manage their frustration when something doesn't work (e.g., Hammond et al., 2012). Even infants are experts at taking cues from adults on how risky or difficult achieving a goal will be, and will persist for longer on a task they have seen an adult achieve effortfully, rather than immediately (Leonard & Schulz, 2016). Adults can also improve children's executive function skills by modeling planning and self-monitoring, and working to create environments that are less chaotic (Hughes and Ensor, 2009).

While effective models and stability are important for fostering children's ability to problem-solve, so is the occasional upset to children's routines. Inspired by the unusual biographies of many especially creative individuals, Ritter et al. (2012) directly examined the link between unusual or unexpected experiences and creative thinking. In one of their experiments, college students walked through a virtual reality environment that appeared to defy basic laws of physics. After just three minutes of the experience, those students performed better on a cognitive flexibility ("thinking outside the box") task than other students who had walked through a normal scene, or merely watched a video of the same physics-violating events. Thus, diversifying experiences that children actively, as opposed to vicariously, experience can break them out of their typical patterns of thought, and encourage them to make new connections.

Greene & Noice (1988) looked at similar measures of cognitive flexibility when they asked how positive moods might influence adolescents' ability to creatively problem-solve. Two groups of 8th-grade students varied in whether or not they experienced a deliberately positive interaction with the experimenter before completing two creative thinking tasks. The students who had experienced the positive interaction brainstormed more (and more unusual) solutions, and were more likely to discover the non-obvious trick to a physical puzzle.

Exploratory

In early education, there can be a tension between completely self-directed exploration and the explicit instruction necessary for more specific learning goals or complex topics. Research with young children speaks to the value of dissolving this dichotomy by providing opportunities where children's self-directed exploration and free choice is scaffolded by adults. While studies of children's spontaneous engagement with something like a novel toy have shown that adults' pedagogical demonstration can limit children's exploration (e.g., Bonawitz et al., 2011), further studies clarify how adults can demonstrate a task without squashing children's interest. Kittredge & Klahr (2015), for example, invited 4-7-year-olds to find toy animals hidden in a miniature forest with multiple hiding places. Children who saw an adult demonstrate how to find the animals discovered fewer animals than children who were left to explore the scene on their own. However, children who received what the researchers called "enhanced verbal demonstration" (e.g., Here's how you can find animals. *gasp* I found a lizard! But, there could be lots of other ways to find animals…) discovered just as many. This result implies that children's interest and persistence in a goal-directed task can be preserved—even when an adult demonstrates how to solve it—if the demonstrator also hints that there might be other strategies or solutions.

Long before children themselves could verbalize the strategy they use to achieve a goal, and certainly before they could design a controlled experiment to answer a question, they are conducting experiments through play. Preschoolers, for example, play more with a toy they have seen demonstrated, but don't understand, than one they have never seen before or understand already (Schulz & Bonawitz, 2007). Not only do children explore more when they don't understand

something, they seem to generate evidence in the course of their exploratory play that disambiguates how it works. In one study, preschoolers were given ambiguous evidence about which of a set of beads activated a machine, before being allowed to play freely with both. When Cook and colleagues analyzed children's play during this period, they discovered that children were in fact conducting informative experiments that elucidated the causal relationship between the beads and the machine (Cook et al., 2011).

Active

In a study with college students, Oppezzo and Schwartz (2014) had participants complete a convergent and divergent thinking task while seated, and then while walking on a treadmill. They found that walking had a large effect on divergent thinking (i.e., generating creative ideas by exploring many possible solutions), with the average increase in creative output around 60%. In another experiment, they tested participants' creative analogy generation (e.g., when given the prompt of "budding cocoon," generating the analogy of "coming out of a meditation retreat") while seated or walking, either indoors and outside. Walking outside produced the most novel and highest quality analogies, suggesting that engaging not only in physical activity, but with the outdoors, can help individuals come up with new and creative ideas.

We see from the above work that research is beginning to support the commonsense intuition that physical movement—and walking in particular—boosts creativity. More surprising, however, might be the documented relation between the development of children's motor skills and later outcomes in a wide range of important academic domains. Researchers analyzing data from large-scale longitudinal studies have found that children's kindergarten motor skills are related to their reading and math achievement in elementary (Son & Meisels, 2006; Grissmer et al., 2010) and middle school (Carlson, 2013). Other studies show links between children's motor skills and concurrent measures of school readiness, like number knowledge (Pagani & Messier, 2012). These correlations make sense in light of neurological evidence suggesting motor and cognitive development are closely interrelated (Diamond, 2000).

Time for Imagination

Correlational, descriptive, and longitudinal studies have documented the strong relationship between pretend play in early childhood and the creation of imaginary playmates and make-believe worlds with later creativity (Root-Bernstein, 2014; Root-Bernstein & Root-Bernstein, 2006; Russ, Robins, & Christiano, 1999). In a study with elementary-schoolers, Russ and colleagues (1999) found that quality of imagination and fantasy in early pretend play predicted divergent thinking over a four-year period, and later showed that the same relationship persisted into high school with a subset of their original group (Russ & Cooperberg, 2003). Complementary results come from another study with elementary schoolers, which found that fourth-graders with imaginary companions were more creative on two of three estimates of creativity (Hoff, 2005).

Results from studies of children's engagement in imaginative activities suggest pretend play is important for later creativity. A related and important question is how can adults create environments that encourage children to develop real-world skills through make believe scenarios and companions? Barker and colleagues looked at how relevant aspects of children's early environments relate to the development of their executive function, a consistent predictor of important academic and life outcomes. After collecting information from parents about their 6-7-year-old children's typical schedules, they found a positive relation between the amount of time children spent in unstructured activities and their self-directed executive function (Barker et al., 2014). The researchers concluded that providing children with leisure time where they can imagine their own goals and decide on their own what actions to take gives them practice with critical real-life skills. Another research team interested in the earliest development of these skills found that measures of pretense representation (a component of pretend play) and executive functioning skills are correlated as early as preschool (Carlson et al., 2014).

Not only does children's pretend and unstructured play correlate with later executive function, a recent study reveals a more direct way in which pretend play can influence executive function skills like self-regulation. Karniol and colleagues (2014) tasked children with waiting until an

experimenter returned to eat a desirable snack, or else terminating the experiment early and settling for a less desirable one. They were interested in how children's self-transformation through imagination could support self-control, and therefore varied what children were told, shown, or given before the waiting period. Merely being told to imagine themselves as Superman, a superhero with special powers that can wait really well, enabled children to wait significantly longer, regardless of whether or not they were given a prop like a cape to help them self-transform. This study suggests some cognitive tasks that are difficult for children, like delay of gratification, may be improved through interventions that engage children's ability to transform themselves and their environments through imagination. Further studies show positive effects of imaginative framing in other contexts, like on language production after a two-week word-learning intervention using fantastical, as opposed to realistic, stories (Weisberg et al., 2015).

Exchange of Ideas

Considerable research documents the profound relationship between children's early language environments and later language outcomes, with focus typically on the long-term consequences of large disparities in the number and diversity of words children hear in infancy (e.g., Hart & Risley, 1995; Weisleder & Fernald, 2013). A recent study instead emphasizes the importance of building a 'strong communicative foundation,' which moves beyond focusing on the amount of speech a child receives to focusing on the quality of the interaction an adult and child share (Hirsh-Pasek et al., 2015). The researchers coded videos of free play sessions between parents and their 24-month-old children for features like 'symbol-infused joint engagement' (e.g., signaling what to jointly focus on through gesture or words), 'routines and rituals' (e.g., coordinating their activity using a familiar play routine), and 'fluent and connected communication' (e.g., effortless turn-taking paired with the occasional companionable silence). They found that these measures, which were widely variable across parent-child pairs, were highly predictive of children's expressive language one year later—and much more so than just the number of words parents used.

The benefits of quality, cooperative interactions extend well beyond the verbal domain and early developmental time period. Several studies have tested the effect of peer collaboration in educational contexts by comparing progress on a given task by school-age children working individually, to progress made in groups or pairs. Researchers have found significant advantages of peer collaboration over individual work on a variety of measures of problem-solving and creative thinking (Fawcett & Garton, 2005; Gabbert, Johnson, & Johnson, 1986). In a study with college students, active participation in team-based learning was related to overall academic performance (Tsay & Brady, 2010). Advantages of cooperative learning contexts extend beyond academic and task performance, as well, in some cases seeming to improve social skills and oral language development (Gómez et al., 2013). Maybe most promisingly, given these results, training in the skill of collaboration itself appears to be a long-term gift that enables children to get more out of cooperative learning interactions even a year in the future (Gillies, 2000). To explain the advantage of collaboration, researchers and theorists typically point out that peers play a critical role in deepening learners' engagement with and understanding of a problem by introducing new ways of conceptualizing or approaching it, and forcing their teammates to explain their thought processes.

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