Creative Summer Learning Experiences

A Practical Guide for Libraries

Created for the California Library Association and the California State Library by the Bay Area Discovery Museum.

Bay Area Discovery Museum

INSTITUTE of Museum and Library SERVICES

California State Library

CALIFORNIA LIBRARY ASSOCIATION

Bay Area Discovery Museum

In the summer of 2016, the Bay Area Discovery Museum partnered with the Summer at Your Library Project of the California Library Association, and the California State Library, to learn more about summer reading programming across the state.

Bay Area Discovery Museum (BADM) staff conducted site visits, observing programs and interviewing library staff and patrons at five representative branches across the state. We found that while summer reading programs vary in both their content and execution, many fundamental elements of promoting learning and creativity in young children are already being incorporated into summer programming and beyond! What follows is a set of research-backed approaches for enhancing California summer reading programs by promoting creative learning. Pulling from the academic fields of education, psychology, and neuroscience, BADM has developed the CREATE framework. This unique pedagogical framework describes how educators can build children's creative problem-solving through intentional experiences.

For each element of the CREATE framework we've included exemplars from branches throughout the state that showcase the inspiring ways libraries are serving children ages 12 and under and their families.

Though it can be difficult to implement facilitation-heavy programs in the library context, adult facilitation - exploring alongside and thoughtfully guiding children - is what helps young learners most. And while this resource provides program examples and best practices to support library staff, many of the tips are relevant for volunteers, community partners, and caregivers who may take on the facilitator role, asking children provocative questions, probing them to explore further, and guiding their play and discovery.

We hope this guide will inspire you to see your program development as an ever-evolving process. The ideas presented here can be applied to any programming theme – literacy, STEM, the arts, etc. – and at any time of year.

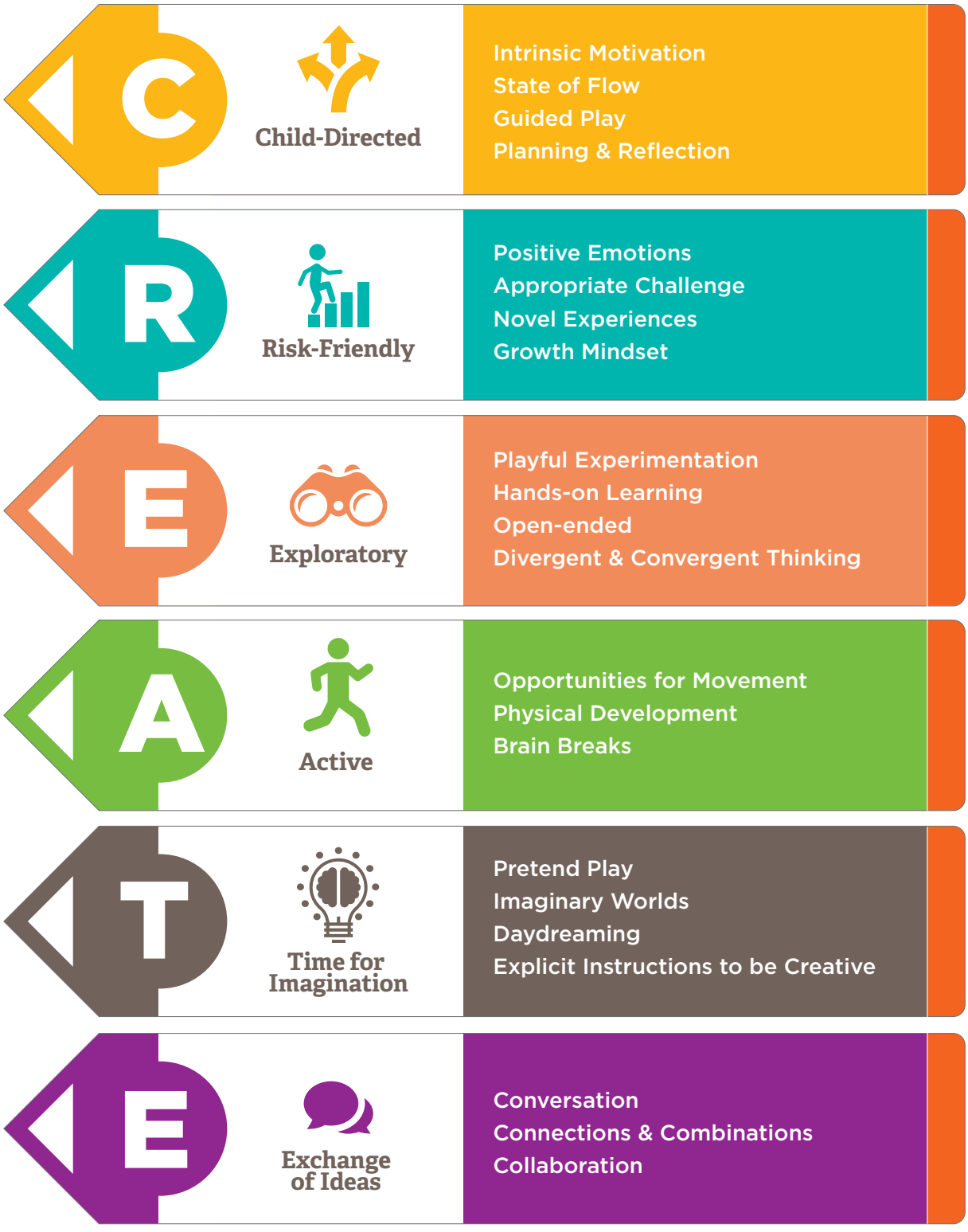
We encourage you to try applying one facet of the framework at a time and take notice of its effectiveness. And most importantly – have fun! Your enthusiasm, willingness to take risks, ability to ask questions and eagerness to explore alongside the children and families will be contagious.

We would like to thank the following librarians for sharing their ideas about summer reading and for helping us to shape this resource:

Allison Alvarez, *Los Angeles Public Library*
Debbie Centi, *Folsom Public Library*
Anna Hartman, *San Diego County Library*
Rita Law, *Los Angeles Public Library*
Anne Lennon, *Oakland Public Library*
Shakti Maisen, *Los Angeles Public Library*
Diane Olivio-Posner, *Los Angeles Public Library*
Dora Suarez, *Los Angeles Public Library*
Kimberlee Wheeler, *Butte County Library*

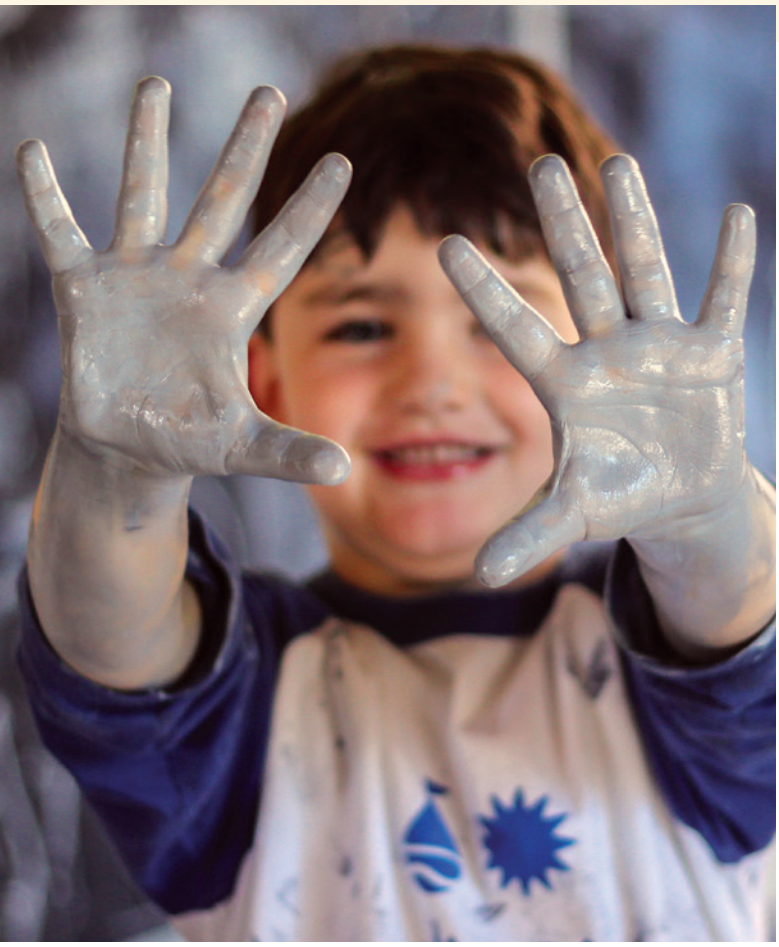
CREATE

The acronym CREATE illustrates key elements of learning environments that support the development of creativity for children aged 2-10.



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).



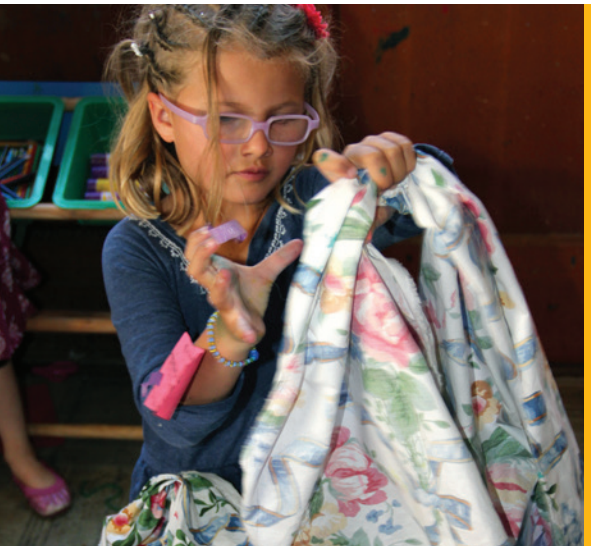
Intrinsic Motivation
State of Flow
Guided Play
Planning & Reflection

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).



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

- How can you communicate to families —through the layout of space and materials, display of prompts, or asking of questions—that children are "in the driver's seat" of the activity?
- How can your projects build children's internal desire to learn, read, and make? When you use extrinsic rewards like prizes or stickers, how can you frame this to reinforce that what really matters is the joy of learning?
- Do the activities have multiple parts and possible extensions to engage children who complete things more quickly and allow others to get into a "flow" and remain engaged for longer?
- In maker and engineering activities, in particular, how can you encourage children to make plans before diving in and to reflect on what they have created?

In the library:

It may seem challenging to integrate elements of choice into library programs 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 most interests them individually. Anne Lennon of Oakland Public Library explains, "We're getting rid of the traditional "step-by-step" crafts that are supposed to turn out the same. Our programming has to work for the whole spectrum of patrons that might show up. We still have project ideas in mind, but we're inviting children to use the materials however they want. This may seem unstructured, but it helps ensure that the project is meaningful for each child, and is exciting when the children each leave the library with unique creations."

Activity ideas:

Food Science Fair, from the Edendale Branch of Los Angeles Public Library.

This program offers eight separate stations of mini-science experiments using food – from creating a colloid by mixing cornstarch and water to exploring how red cabbage changes color in different acids and bases. Teen volunteers facilitate each station, helping children engage with the experiments and think through the scientific process. Children can float from station to station, spending time immersed in experiments of their choosing.

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 these prompts and have them available at each station so that caregivers can ask children the same questions. Remind caregivers that children are not required to visit every station; let them follow their interests.

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

the adults acted as co-learners and the children lost track of time, engaging with a new activity for an extended period. Allison Alvarez of the Edendale Branch shared, "One of the success stories from this program was the teen volunteer who manned the colloid station. He really connected with one child who was fascinated by how the cornstarch/water combination felt, and they spent a long time observing and playing with the colloid. I think they both experienced a "state of flow" in engaging with this experiment!"

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.

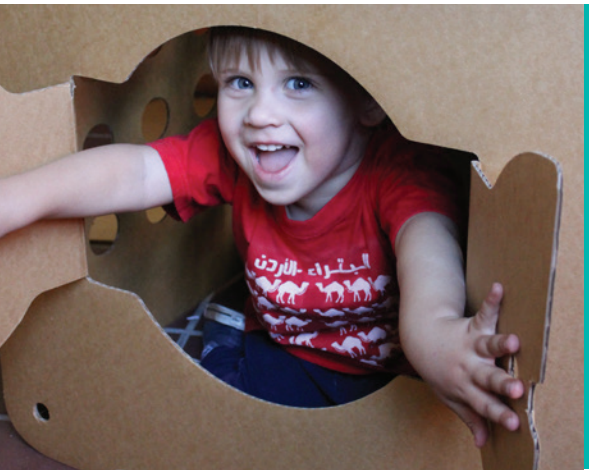
Positive Emotions
Appropriate Challenge
Novel Experiences
Growth Mindset

Positive emotions—such as satisfaction, joy, belonging, and wonder—help the brain to relax and focus and enhance openness, flexibility, and memory. Adults should be aware of individual children's emotional state, support them as needed, and build a culture of positive encouragement (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.



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

- How does your library, space, signage, or programming communicate to children and families that taking risks, trying new things, and even failing is encouraged?
- In what ways are you creating a safe and supportive space for children and families to ask questions and try new things?
- What parts of your program or activity might challenge children? How do you plan to support children when they are struggling with the challenge so they can find success on their own? How can you model this for families?
- Do you have language or signage prepared that communicates the idea that mastery comes from hard work and effort?

In the library:

Libraries have a historic reputation of being places that house information and expertise. Even children may associate libraries with finding the "right" answer more than trying something new and challenging or seeing the world from a different perspective. But when children feel comfortable and safe in the library, and learn that taking risks in summer reading programs can be fun and worthwhile, they will start to think of it as a risk-friendly place. Allison Alvarez describes her perspective: "I see so many kids afraid to make a mistake or fail even though we know failure is a part of learning. Many kids (and their parents!) are very focused on producing something at library programs, while my colleagues and I are more interested in patrons having a learning experience and trying something new."

Activity idea:

Open Studio: Build, from Oakland Public Library.

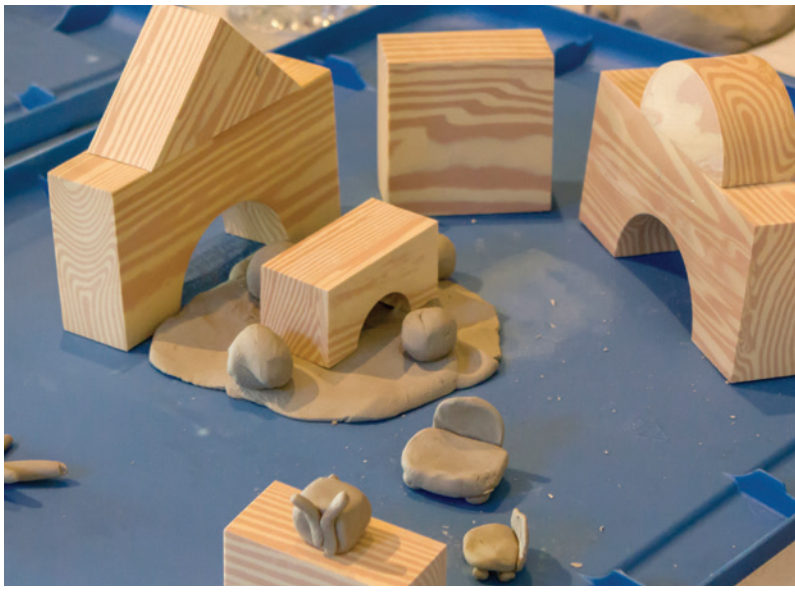
This program challenges children to engineer the structure of their dreams, using diverse building materials including recycled objects (e.g., cereal boxes, cardboard) and toys (e.g., KEVA planks, LEGOs, K'NEX). Library staff intentionally sit on the floor alongside children, helping them figure out what they want to build. Some children ask, "What do I do with these blocks?" Then, staff provide a challenge like: How tall can you stack those? Can you create a structure that looks like your favorite food? Can you work with a partner to design something that can support the weight of this book? Challenges should be posed with the specific child in mind; difficult enough to involve hard work and the possibility of failure, but within the realm of their capabilities so that children will persist through the struggle.

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.

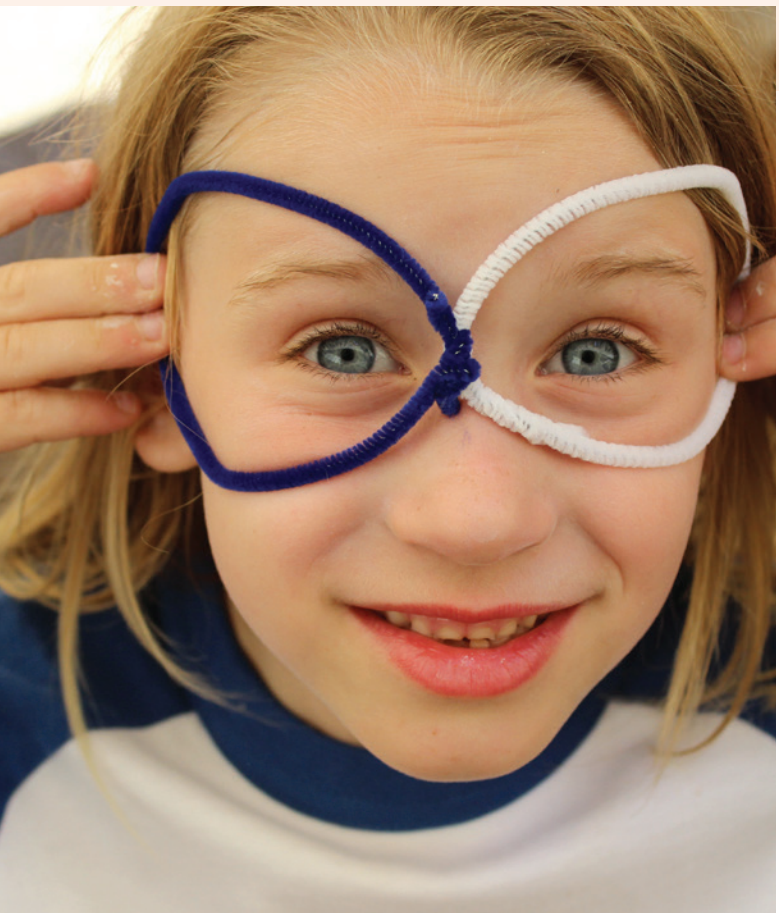
You'll know the program is risk-friendly if...

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.



Playful Experimentation
Hands-on Learning
Open-ended
Divergent & Convergent Thinking

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.

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

- Where in your library do children have a chance to learn about the world through play? How might you strengthen the exploratory play that children do by including novel materials, tools, or experiences?
- Are there opportunities for children to explore with all of their senses? How might you incorporate more discovery through hearing, feeling, and even smelling?
- What programs provide children an opportunity to learn science, engineering, or making? How can the library support families to continue hands-on learning experiences in their homes?
- What are a handful of open-ended questions you might use in your activity to boost children's curiosity?
- Are there opportunities for children to brainstorm and choose solutions?

In the library:

Summer is the season for hands-on experimentation in the library. Support children to authentically dive into interesting subjects and engage in multisensory experiences. Venture outside, or consider partnering with another community organization. Anne Lennon of Oakland Public Library reminds us, "It's important to remember that the library isn't just about books; having these engaging programs during summer helps patrons understand that the library is really a place to learn and explore new topics."

Activity idea:

Ice Exploration, from Oakland Public Library.

This program, which is based on an activity available on ***Creativity Catapult, (http://creativitycatapult.org)*** 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:

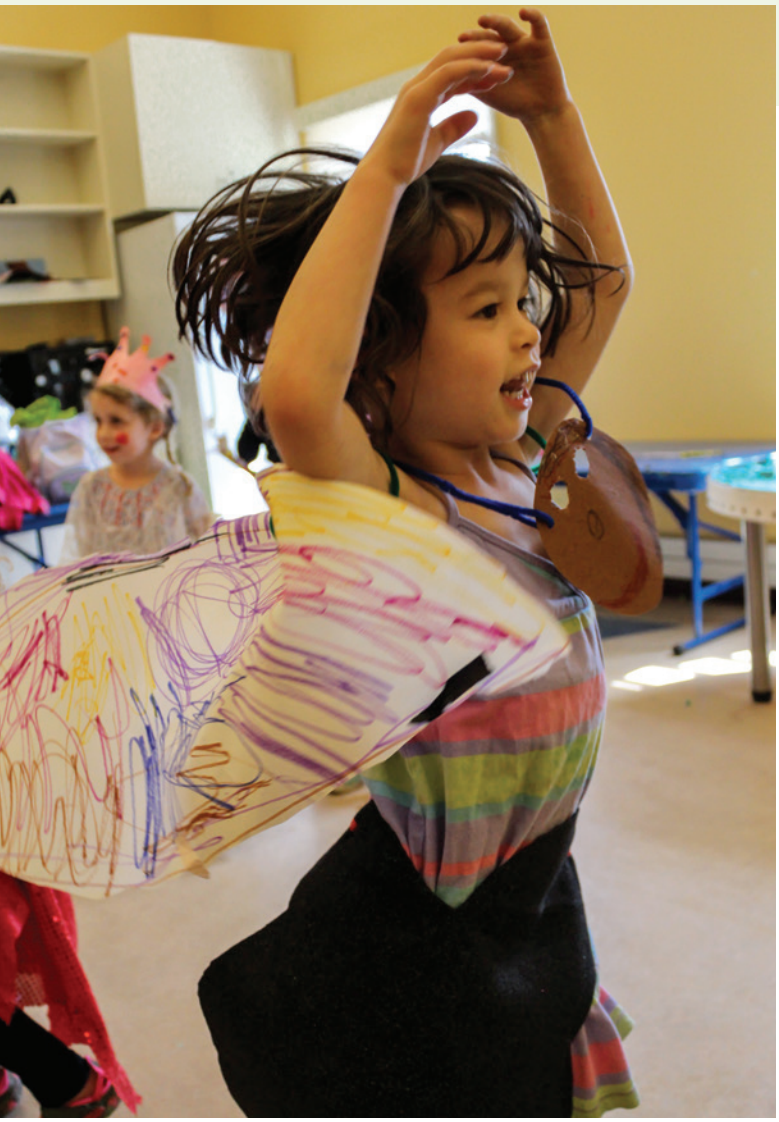
Engage children with questions throughout their excavation process: How do you think the penny got in there? Which tool would take the longest to get the twig out of the ice? Is the warm water or the cool water more effective? How do you know? Ice Exploration works particularly well with natural materials, 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!

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

children share sensory observations during the program, try multiple tools or attempt multiple 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
Physical Development
Brain Breaks

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

- Is there a space in the library or in the program for children to be physically active?
- During programs, how long are children expected to sit quietly? How might short wiggle breaks be incorporated for younger audiences? (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.)
- Are there opportunities for children to develop both gross motor skills (e.g. big body movements, coordination, balance) and fine motor skills (e.g. grip, finger control, hand/eye coordination) through your programming?

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

children are up and moving! Returning children will ask for the activities, games, or equipment they like most, and will be excited to teach their favorites to any first-time participants.

In the library:

Libraries are shaking up summer reading, offering programs for children that incorporate dance, yoga, and physical games. Diane Olivo-Posner of Los Angeles Public Library describes, "Librarians shouldn't forget that libraries can be 'active' places. More and more, our branches are sneaking physical activity into all kinds of programming. We're even incorporating quick brain breaks (everybody do 10 jumping jacks!) into programs so that children can stay focused and energized."

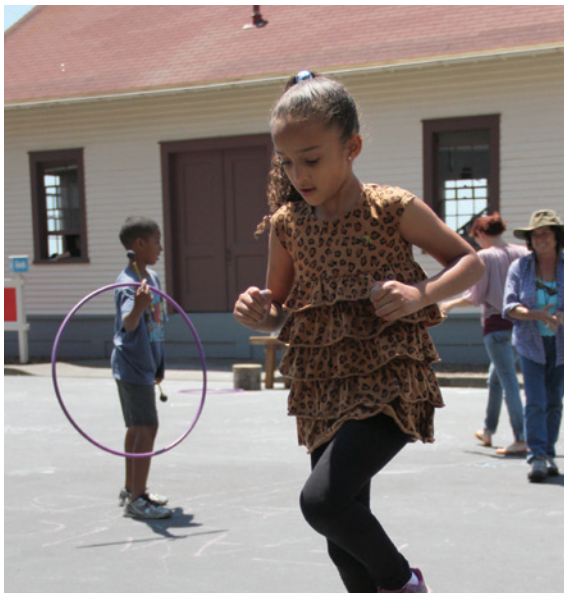
Activity idea:

Rocking Recess, from San Diego County Library.

This program, put on in partnership with Health and Human Services Agency, introduces patrons to a variety of movement activities, like knee tag (children try to tag a partner's knees while trying to keep their own knees untagged) or mirror (facing each other, one child mirrors the actions and movements of another; then the roles switch) and equipment, including jump ropes, hula hoops and parachutes. While the program works best when facilitators are present to introduce group games and encourage movement, some branches have offered the equipment in unfacilitated spaces and have noticed children engaging with it and releasing stress and excess energy in a productive way.

Implementation tips:

Remember to include some activities that don't require equipment, and some that can easily be reproduced in a smaller space. 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.



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).

Pretend Play
Imaginary Worlds
Daydreaming
Explicit Instructions to be Creative

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).

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

- How is your library space or programming encouraging pretend play for children through the elementary years? How is the importance of pretend play communicated to families?
- Where and how are children asked explicitly to use their imaginations and/or to come up with original ideas?
- How does the library create a space for children to day-dream?
- How are children encouraged to look at others' creations as sources of inspiration?

In the library:

Summer reading and imagination go hand in hand, as books naturally transport readers to imaginary worlds. Libraries are taking advantage of this connection by providing summer reading programs that celebrate make believe, sometimes encouraging children to come together to dress-up as or act out their favorite characters and stories. Libraries are considering more sophisticated ways to incorporate group imagination for children who may think they are too old to play pretend. Shakti Maisen of Los Angeles Public Library shares, "Encouraging pretend play and collaboration can be challenging with older children who are self-conscious about singing, dancing, and playing in a group, such as during a storytime program. Many say that they prefer to play on the computer alone rather than participate in a live program with peers. Once they join in they usually enjoy themselves, but it can be challenging to find the 'hook' to draw them into programs that involve imagination and self-expression."

Activity idea:

Stop-Motion Animation, from Los Angeles Public Library.

This activity is part of LAPL's popular Full STEAM Ahead kits, available to several branches. In this program, patrons can learn about stop-motion animation and use an app to create their own short film starring a clay character of their invention. They will enjoy the opportunity to tell a story in a new, out-of-the-box format. Creating original stories, characters, and artwork are great ways for even shy children, who may not be comfortable performing in front of a group, to flex their imaginative muscles.

Implementation tips:

In addition to clay figures, children can use what they find in their pockets, or around the library to create their stop-motion films. Part of embracing time for imagination is embracing the fact that there are no "rules"; originality is key.

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

children brainstorm many different ideas and come up with something completely original: a new creature, invented language, or an entire imaginary world. Of course, those who are deeply engaged will also stay a while!

EXCHANGE OF IDEAS

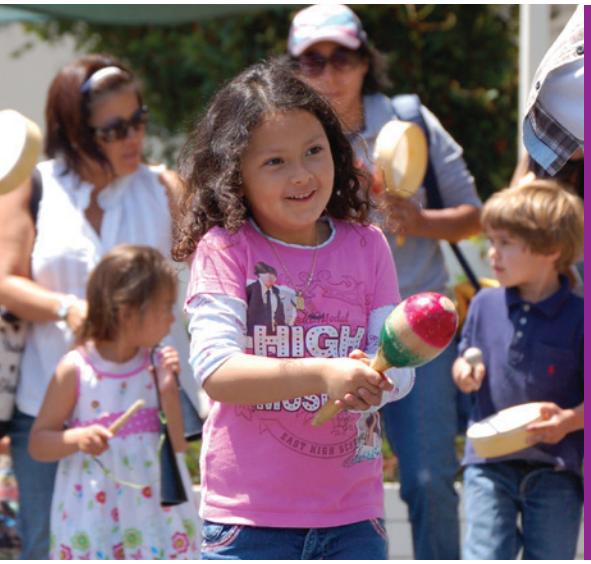
It is important for adults to model interactivity by initiating and sustaining back and forth conversations with children, so that children understand that their ideas matter (Hirsh-Pasek et al., 2015).

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
Connections & Combinations
Collaboration



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

- How are parents and caregivers encouraged to engage in rich dialogue with their children? Are there also opportunities for children to share ideas with each other?
- What words or key concepts might you use to interact with children naturally through conversation during an activity?
- In what ways can children and families who do not speak English as their first language share ideas and build community with others in the library?
- How can children be encouraged to collaborate creatively by building off of other's ideas or by making something collectively?
- Where are their opportunities to build children's interdisciplinary understanding by incorporating projects that link, for instance, art and engineering or literacy and science?

In the library:

Transform your understanding of creative collaboration. For children, collaboration involves recognizing that other people have ideas, too. And when solving a problem in a group, sometimes it makes sense to go with a peer's idea, or to combine ideas. California libraries attract diverse families, who may practice different traditions or speak different languages. This diversity sparks beneficial opportunities for exchange of ideas, and libraries are poised to facilitate this exchange, though they recognize the challenge. Shakti Maisen of Los Angeles Public Library describes, "The collaboration model can be challenging to implement. At a recent training, we librarians were talking about how to present programs that encourage kids and teens to teach each other, work together, and be open to 'failure' in order to learn new things from one another."

Activity idea:

Recycled Remix, from the Arroyo Seco Branch of Los Angeles Public Library.

This program, a collaboration with Zimmer Children's Museum, involves creating musical instruments out of recycled materials then using the instruments for storytelling, singing, and dancing. Multidisciplinary and collaborative, patrons experiment with familiar and novel materials to design their instruments, making sure to share their ideas with others, working together to improve the designs. The goal is to end up with a variety of sounds represented in the newly formed "band."

Implementation tips:

Invite grown-ups - including caregivers, adult patrons, and community partners – to join the fun. Partnerships with community organizations allow libraries to take advantage of the resources and expertise in their communities, authentically modeling "exchange of ideas" for children. This can also expand the types of programming you might offer to blend art, science, technology and more!

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

a group of children solves a problem collaboratively and turns to another child for support instead of an adult. A child may also synthesize multiple ideas or say, "This activity reminds me of ___" or "Your idea gave me the idea to ____."

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 library 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.

Bibliography

Alvarez, A. L. and Booth, A. E. (2014). Motivated by Meaning: Testing the Effect of Knowledge-Infused Rewards on Preschoolers' Persistence. Child Development, 85, 783-791.

Barker, J. E., Semenov, A. D., Michaelson, L., Provan, L. S., Snyder, H. R., Munakata, Y. (2014). Less structured time in children's daily lives predicts self-directed executive functioning. Frontiers in Psychology, 5, 1-19.

Black, A. E. and Deci, E. L. (2000). The effects of instructors' autonomy support and students' autonomous motivation on learning organic chemistry: A self-determination theory perspective. Science Education, 84: 740-756.

Bonawitz, E., Shafto, P., Gweon, H., Goodman, N. D., Spelke, E., & Schulz, L. (2011). The double-edged sword of pedagogy: Instruction limits spontaneous exploration and discovery. Cognition, 120(3), 322-330.

Carlson, S. M. (2013). Kindergarten fine motor skills and executive function: Two non-academic predictors of academic achievement (Unpublished doctoral dissertation). George Mason University, Fairfax, VA.

Carlson, S. M., White, R. E., & Davis-Unger, A. C. (2014). Evidence for a relation between executive function and pretense representation in preschool children. Cognitive Development, 29, 1-16.

Cook, C., Goodman, N. & Schultz, L. (2011). Where science starts: Spontaneous experiments in preschoolers' exploratory play. Cognition, 120(3), 341-349.

Csikszentmihalyi, Mihaly (1990). Flow: The Psychology of Optimal Experience. New York, NY: Harper and Row.

Diamond, A. (2000). Close interrelation of motor development and cognitive development and of the cerebellum and prefrontal cortex. Child Development, 71(1), 44-56.

Dickinson, D.K., Hirsh-Pasek, K., Golinkoff, R.M., Nicolopoulou, A., & Collins, M.F. (2013). The Read-Play-Learn intervention and research design. Paper presented at the biennial meeting of the Society for Research in Child Development, Seattle, WA.

Dweck, C. S. (2006). Mindset: The new psychology of success. New York: Random House Digital, Inc.

Fawcett, L. M., & Garton, A. F. (2005). The effect of peer collaboration on children's problem-solving ability. British Journal of Educational Psychology, 75(2), 157-169.

Fisher, K.R., Hirsh-Pasek, K., Newcombe, N., & Golinkoff, R.M. (2013). Taking shape: Supporting preschoolers' acquisition of geometric knowledge through guided play. Child Development, 84(6), 1872-1878.

Gabbert, B., Johnson, D. W., & Johnson, R. T. (1986). Cooperative learning, group-to-individual transfer, process gain, and the acquisition of cognitive reasoning strategies. The Journal of Psychology, 120(3), 265-278.

Gillies, R. M., & Ashman, A. F. (2000). The effects of cooperative learning on students with learning difficulties in the lower elementary school. The Journal of Special Education, 34(1), 19-27.

Gómez, F., Nussbaum, M., Weitz, J. F., Lopez, X., Mena, J., & Torres, A. (2013). Co-located single display collaborative learning for early childhood education. International Journal of Computer-Supported Collaborative Learning, 8(2), 225-244.

Greene, T. R., & Noice, H. (1988). Influence of positive affect upon creative thinking and problem solving in children. Psychological Reports. 63(3), 895-898.

Grissmer, D. W., Grimm, K. J., Aiyer, S. M., Murrah, W. M., & Steele, J. S. (2010). Fine motor skills and early comprehension of the world. Developmental Psychology, 46(5), 1008-1017.

Hammond, S. I., Müller, U., Carpendale, J. I., Bibok, M. B., & Liebermann-Finestone, D. P. (2012). The effects of parental scaffolding on preschoolers' executive function. Developmental Psychology, 48(1), 271.

Hart, B., & Risley, T. R. (1995). Meaningful differences in the everyday experience of young American children. Paul H Brookes Publishing.

Hirsh-Pasek, K., Adamson, L. B., Bakeman, R., Owen, M. T., Golinkoff, R. M., Pace, A., Yust, P.K. & Suma, K. (2015). The contribution of early communication quality to low-income children's language success. Psychological Science, 26(7), 1071-1083.

Hoff, E.V. (2005). Imaginary companions, creativity, and self-image in middle childhood. Creativity Research Journal, 17(2-3), 167-180.

Hughes, C. H., & Ensor, R. A. (2009). How do families help or hinder the emergence of early executive function? New Directions for Child and Adolescent Development, 2009(123), 35-50.

Karniol, R., Galili, L., Shtilerman, D., Naim, R., Stern, K., Manjoch, H., & Silverman, R. (2011). Why superman can wait: Cognitive self-transformation in the delay of gratification paradigm. Journal of Clinical Child & Adolescent Psychology, 40(2), 307-317.

Kittredge, A. K., Klahr, D., & Fisher, A. V. (2015). The pedagogy of discovery. Paper presented at the meeting of the American Educational Research Association, Chicago, IL.

Leonard, J. A., & Schulz, L. (2016). If at first you don't succeed: The role of evidence in preschoolers' and infants' persistence. Paper presented at the meeting of the Cognitive Science Society, Philadelphia, PA.

Lepper, M. R., Greene, D., & Nisbett, R. E. (1973). Undermining children's intrinsic interest with extrinsic reward: A test of the "overjustification" hypothesis. Journal of Personality and Social Psychology, 28(1), 129-137.

Oppezzo, M., & Schwartz, D. L. (2014). Give your ideas some legs: The positive effect of walking on creative thinking. Journal of Experimental Psychology: Learning, Memory, and Cognition. 40(4), 1142-1152.

Pagani, L. S., & Messier, S. (2012). Links between motor skills and indicators of school readiness at kindergarten entry in urban disadvantaged children. Journal of Educational and Developmental Psychology, 2(1), 95.

Rathunde, K., & Csikszentmihalyi, M. (2005). Middle School Students' Motivation and Quality of Experience: A Comparison of Montessori and Traditional School Environments. American Journal of Education, 111(3), 341-371.

Ritter, S. M., Iona Damian, R., Simonton, D. K., van Baaren, R. B., Strick, M., Derks, J., & Dijksterhuis, A. (2012). Diversifying experiences enhance cognitive flexibility. Journal of Experimental Psychology, 48, 961-964.

Root-Bernstein, M. (2014). Inventing Imaginary Worlds: From Childhood Play to Adult Creativity Across the Arts and Sciences. Lanham, MD: Rowman & Littlefield Education.
Root-Bernstein, M., & Root-Bernstein, R. (2006). Imaginary worldplay in childhood and maturity and its impact on adult creativity. Creativity Research Journal, 18(4), 405-425.

Runco, M. A. (1986). Maximal performance on divergent thinking tests by gifted, talented and nongifted children. Psychology in the Schools, 23, 308-315.

Russ, S. W. (1993). Affect and creativity: The role of affect and play in the creative process. Hillsdale, NJ: Lawrence Erlbaum Associates.

Russ, S. W. (2003). Play and creativity: Developmental issues. Scandinavian Journal of Educational Research, 47(3), 291-303.

Russ, S. W., & Cooperberg, M. (2003). Longitudinal prediction of creativity, coping, and depression in pretend play. Unpublished manuscript, Case Western Reserve University, Cleveland, OH.

Russ, S. W., Robins, A. L., & Christiano, B. A. (1999). Pretend play: Longitudinal prediction of creativity and affect and fantasy in children. Creativity Research Journal, 12(2), 129-139.

Schulz, L., & Bonawitz, E.B. (2007). Serious fun: Preschoolers play more when evidence is confounded. Developmental Psychology, 43(4), 1045-1050.

Shernoff, D. J. and Hoogstra, L. (2001). Continuing motivation beyond the high school classroom. New Directions for Child and Adolescent Development, 2001, 73-88.

Singer, D. G., Golinkoff, R. M., & Hirsh-Pasek, K. (Eds.). (2006). Play= Learning: How play motivates and enhances children's cognitive and social-emotional growth. Oxford University Press.

Son, S. H. & Meisels, S. J. (2006). The relationship of young children's motor skills to later school achievement. Merrill-Palmer Quarterly, 52(4), 755-778.

Tsay, M., & Brady, M. (2010). A Case Study of Cooperative Learning and Communication Pedagogy: Does Working in Teams Make a Difference? Journal of the Scholarship of Teaching and Learning, 10(2), 78-89.

Weisberg, D. S., Ilgaz, H., Hirsh-Pasek, K., Golinkoff, R. M., Nicolopoulou, A, & Dickinson, D. K. (2015). Shovels and swords: How realistic and fantastical themes affect children's word learning. Cognitive Development, 35, 1-14.

Weisleder, A. & Fernald, A. (2013). Talking to children matters: Early language experience strengthens processing and builds vocabulary. Psychological Science, 24(11), 2143-2152.

Zosh, J.M., Brinster, M., & Halberda, J.P. (2013). Inference is better than instruction. Poster presented at the meeting of the Society for Research in Child Development. Boston, MA.

Bay Area Discovery Museum

Bay Area Discovery Museum
557 McReynolds Road
Sausalito, CA 94965
(415) 339-3900
BADM.org

Creative Summer Learning Experiences: A practical guide for libraries was supported in whole or in part by the U.S. Institute of Museum and Library Services under the provisions of the Library Services and Technology Act, administered in California by the State Librarian