Creativity Trend Report

Volume 2: Spring 2017

a Bay Area Discovery Museum publication



Letter from the editor

In our second edition of the Creativity Trend Report, we are excited to share recent and innovative research with practical applications for designing experiences and products promoting learning and creative problem solving for children. First, we discuss research on children's ability to interpret novel information (e.g., foreign language words) as real or pretend in educational television programming. That is, how do children interpret factual content when presented in a fantasy context? Our second topic focuses on learning in museums, specifically the role that adults can play in scaffolding a child's experience in an informal learning environment to promote rich and authentic learning. Lastly, we discuss work on the powerful combination of explanation and exploration in promoting problem solving and children's understanding of cause and effect. To highlight the real world applications of this research, we share our recent collaboration with Fisher-Price on their new preschool toy, the Think & Learn Code-a-pillar™, which provides children with opportunities to explain their thinking and engage in exploratory play.

A search for trending topics in a number of peerreviewed journals revealed emotion to be one of the most commonly found keywords in research related to creativity. For many years, researchers and educators have been emphasizing the important role of social and emotional skills for learning. Relatedly, research on creativity has revealed a strong link between emotions and creative potential. We are fortunate to have Professor Sandra Russ, a leading scholar on creativity, share her seminal research and insights on the relationship between emotion both positive and negative—pretend play, and the development of creativity.

We hope that our new publication helps to satisfy your craving for linking research and practice, ultimately leading to designing experiences and products that spark children's curiosity and nurture their creative spirit.

Helen Hadan

Helen Hadani, Ph.D. Head of Research, Bay Area Discovery Museum

Emotion in pretend play and creativity

Sandra W. Russ

Emotion expressed in pretend play serves important functions in child development. However, the ability to make-up and act out emotions in stories is a neglected area in research and program development. We know that imagination in pretend play is associated with creative thinking. For example, children who can use fantasy and imagination in play are better able to engage in divergent thinking—the ability to generate many ideas¹. Such divergent thinking can predict creativity in adults². For children, pretend play provides an opportunity to practice this kind of flexible thinking. For example, blocks may become many different objects; with imagination, children can take a block to outer space!

If you watch children at play, emotion is often involved in the story. Dolls are having *fun* at a pretend playground or are *happily* eating at a picnic. A monster is chasing a puppet, who is *scared*. A pretend parent is *angrily* scolding a child for not doing their homework. Play is filled with pretend emotions and emotional themes. What is the purpose of this emotional expression?

Fein³ beautifully described the role of feelings (referred to as "affect" by researchers) in pretend play and creativity, noting that emotion and imagination are expressed together and integral to creativity. In their seminal book *The House of Make-believe*, Singer and Singer⁴ stressed the connection between cognition and affect in children's play. Also, child therapists have used play in therapy to help children express emotions, reduce anxiety, and become more comfortable with their emotions. I developed a measure of pretend play the Affect in Play Scale—that assesses the amount and variety of feelings in a five minute sample of individual play. My colleagues and I, as well as other researchers, have done many studies using this measure with different populations of children in different settings. We have found that the feelings expressed in play are important in creative thinking for both preschool children and elementary school children. Importantly, the feelings children show in their pretend play have been linked to divergent thinking, teacher ratings of children's make-believe, and creativity in stories independent of verbal intelligence. A child's enjoyment of the play activity is also related to creativity.

What about negative emotion in play? Should we be concerned if the puppets are having a wrestling match or if one puppet is beating-up another? It depends on the child. For most typically developing children, the negative emotion is expressed within a story that makes sense and has imaginative components. The wrestling match ends with a winner or the scolding parent putting the child in time-out. In other words, the child is learning to regulate the negative emotions. An important finding by Fehr and Russ⁵ indicated that negative affect during the play of preschool children was associated with more prosocial (helping) behavior and less aggressive behavior in the classroom. That is, children who expressed more aggressive affect in their play stories were rated as being more prosocial by their teachers. Again, this makes developmental sense because these children feel comfortable expressing negative affect and practicing the modulation of it in pretend play. In other words, children are using their creative expression to learn important skills about coping with negative feelings. It is also important to remember that children are usually having fun when they play out the negative emotions; the anger or sadness is "pretend" anger or sadness.

This literature has several important and practical implications for helping children engage in pretend play both in the classroom and at home. Adults can help children incorporate feelings into their play by using play prompts that include emotion. For example, play out a story about a boy going to a birthday party and having fun. Also, adults can encourage group play. In fact, a recent study with elementary school girls found that children's imagination and affect expression during play increased after participating in small group play sessions facilitated by an adult, compared to a control group⁶. Moreover, children's divergent thinking scores increased for the below average players (e.g., those with low scores on the Affect in Play Scale) after participating in the group play sessions. Finally, our work with children has shown that adult play facilitators support children to think creatively during play through modeling (e.g., "How about we pretend this Lego is a baby bottle!") and their enjoyment and praise of the child's play. Importantly, these are easy interventions that can make a big difference in helping children develop play skills. What's more, playing with children is fun!

Sandra W. Russ, Ph.D., a clinical child psychologist, is a Distinguished University Professor of Psychology at Case Western Reserve University and holds the Louis D. Beaumont University Professor chair. Her research program has focused on relationships among pretend play, creativity, and adaptive functioning in children, and she developed the Affect in Play Scale, a widely-used pretend play assessment for children. She is the author of several books including Affect and Creativity: The Role of Affect and Play in the Creativity Process and Pretend Play in Childhood: Foundations of Adult Creativity. Professor Russ' recent honors include being appointed as a Distinguished University Professor at Case Western Reserve University and receiving the Arnheim Award for Outstanding Achievement in Psychology and the Arts from Division 10 of the American Psychological Association.



From fantasy to reality:

Promoting cognitive flexibility in early childhood

One of the most well-investigated aspects of child development is how young people actively seek out new experiences. Throughout early childhood our learning is driven by changing preferences for novelty at times children seek out familiar experiences, while at other times, they are more drawn in by new experiences. While our reactions to novelty tend to vary as we age, a pervasive preference for novelty—or what personality psychologists call *Openness to Experience*⁷—is a trait linked to creativity⁸. The early benefits of novel experiences for learning have been highlighted by recent research⁹ indicating that infants gather information about improbable events when their expectations about the world are violated (e.g., when a ball rolling downhill appears to pass through a wall in its way). Similarly, the strong presence of fantasy in children's thinking during early development allows them to creatively interpret new information, and learn to embrace unfamiliar experiences, such as hearing non-native or new words.

The comparison of realistic and fantastical contexts has become a topic of increasing interest, especially as many children are now interacting with various forms of digital media. Because children are becoming more familiar with digitally rendered characters and scenes—

Children making sense of novelty and nonsense







 parents ask girls about cartoon time...
year-old focused on what talking backpack said; dismissed Spanish as "unfamiliar"



3. 5-year-old dismissed backpack as silly, but focused on unfamiliar, foreign language

take-away: When interpreting novel information in a fantasy context, younger children may dismiss factual content as "just pretend," while older children consider unfamiliar facts as real.

where anything seems possible—such fantastical scenarios are becomingly increasingly normalized. How then do children distinguish between fantasy and reality, and how do their reality judgments affect their interpretation of novel information?

To address this question, Marie-Louise Mares and Gayathri Sivakumar¹⁰ examined three- to five-year-olds' perceptions of what was real and what was pretend, and the implications of these reality judgments for learning while watching popular, educational television programs, including Dora the Explorer and Ni Hao, Kai Lan. The researchers' findings revealed that the older preschoolers in the sample, the five-year-olds, were more likely to dismiss fantastical scenarios as unreal than the threeyear-olds, and that these younger children were more likely to dismiss words from foreign languages as fantasy (see comic strip on previous page). That is, younger children were more likely to say that talking backpacks were real, but that Chinese and Spanish words were "just pretend." Whereas the unfamiliarity of the foreign words caused the younger children to dismiss them as fantasy, the wildly fantastical context of a world where backpacks could speak was deemed possible, suggesting that digital media-not unlike its cartoon predecessors-continues to normalize fantasy worlds.

Relatedly, research on word learning has uncovered that the use of fantastical themes affects how readily children embrace new terms. Deena Weisberg and colleagues¹¹ found that storybooks and playtime were effective methods for introducing new words, such that children were more likely to use new words in real-world contexts when those words were initially introduced within fantastical contexts (e.g., in a world of dragons), rather than more familiar contexts (e.g., a farm scenario). One could interpret this to mean that introduction to the novel words within a fantastical context made children more eager to try out the new words in real-world situations. Furthermore, because they impose less stringent rules on reality, imaginary contexts provide opportunities for young children to play with ideas before considering how they might not fit social norms.

Taken together, these findings illustrate how fantastical contexts help support learning in early development by providing a flexible outlet for children to play with novel information as they negotiate the differences between unfamiliar and unrealistic. Though children become increasingly capable of discriminating between real and pretend with age, exposure to fantastical worlds such as cartoons—continues to provide valuable opportunities for children to explore new vocabulary with relatively fewer restrictions.

It should come as little surprise that the creative process, too, benefits from the freedom to explore new ideas without fear of fit or failure and that *how* children attend to unfamiliar information relates to the development of creativity. More specifically, the relationship between openness to experience and creativity seems to suggest that children seeking novelty are more likely to generate new ideas—a staple of creativity itself. When educational content encourages acceptance of what is unfamiliar (i.e., a *tolerance for ambiguity*), children retain playfulness; leading to more creative and open-minded explorations¹². As this work suggests, embracing the unfamiliar, rather than dismissing it prematurely, has many short- and long-term benefits.

Another way to support cognitive flexibility and creativity is through developmentally appropriate projects and games. For examples of fun activities that were developed to enhance cognitive flexibility, visit <u>BADM.org/Activities</u>:

- Inside out creation
- One word stories
- The absolutely very worst possible idea ever
- Impromp3bles
- Fairytale flip
- Animal remix

Attention, pleasel:

Optimizing children's learning in museums

"1, 2, 3. Eyes on me!" Upon entry into any early education classroom, it is likely that one may hear teachers call out this phrase or a similar expression to regain the attention of their students. Although attention research has long explored learning in formal environments^{13,14}, it is also important to consider the benefits of directed attention in informal environments, such as museums. Importantly, recent trends in museum education have begun to shed light on how children learn in settings that are more similar to daily life than traditionally structured academic institutions¹⁵. Furthermore, due to the active (and sometimes chaotic) nature of museums, intentional adult guidance can provide a particularly important means of directing and aiding child learning.

For instance, Nora Benjamin and her colleagues¹⁶ demonstrated the importance of parent-child interactions for directing attention and maximizing learning at museums in research with 4- to 8-yearolds and their parents. First, parent-child dyads spent 15 minutes completing an activity which consisted of guidance for building structures (i.e., discussion of what makes structures strong and time to practice construction), instruction to use elaborative questions (e.g., "Why would a workman wear these goggles?," "What is this called?"), or a combination of both. Following this, the parent-child groups completed a variety of construction tasks together, such as building a structure and evaluating the strength of other structures displayed in a series of photos. It was found that parents who had been encouraged to use "Wh" questions during their initial museum activity also used more of that language in

the activities that followed. That is, they were more likely to engage with their children using elaborative questions and conversation—a type of talk known to propel learning and thinking forward. Moreover, children who received instruction regarding the best ways to construct a stable structure, and engaged in elaborative conversation with a caregiver, subsequently demonstrated the most success in creating and identifying successful building features. This work demonstrates the meaningful effect that guided questions and attention can have on children's learning of engineering concepts.

These findings are paralleled by additional empirical research in museums. For instance, Erin Jant and her collaborators¹⁷ completed a study at a natural history museum in which approximately 3- to 7-year-old children and their parents were given a variety of preexhibit experiences (such as receiving exhibit-related objects and/or reading "Wh" questions) designed to affect their interactions with a subsequent exhibit. The researchers found that parent-child dyads who were initially given cue cards that displayed exhibit-relevant artifacts and suggestions for "Wh" questions engaged in more elaborative conversations with their children. Relatedly, Kevin Crowley, a professor at the University of Pittsburgh School of Education, and his colleagues¹⁸ found that elementary school-aged children who played with an interactive exhibit in the company of a parent engaged in more conversation, spent longer at the exhibit, and explored more of its uses than children who attended the exhibit with a peer or by themselves.

After surveying these works as a whole, it is reasonable to conclude that the combination of hands-on learning and adult guidance provides an optimal learning experience for children in informal learning environments. This idea that adult guidance-often referred to as "scaffolding" by developmentalists-can enhance children's learning and thinking is not a new concept. Indeed, foundational work on scaffolding and the zone of proximal development^{19,20} theorizing that learning is most effectively supported through instruction based on a child's current level of understanding first emerged in the 1970's. These earlier works-and much of the work based on scaffolding and zone of proximal development principles to followindicate that striking a delicate balance between providing assistance and maintaining a child's sense of autonomy can be a challenging, but invaluable part of the learning process (see infographic below

for details). Additionally, recent work on guided play further demonstrates the impressive benefits of assisted learning²¹.

The growing body of research on guided participation seems to indicate that utilizing an adult (or activity) to engage children in specific types of conversation and to direct their attention towards specific information, successfully promotes learning. Importantly, the reviewed research also provides insight into the ways we can construct informal and formal learning environments (for example, museum educators could encourage hands-on interaction with the exhibits and model the types of elaborative questions most likely to increase children's knowledge acquisition for caregivers) that—without removing independent exploration—will successfully guide children's attention to the most beneficial learning opportunities.

Helpful and intrusive adult actions when children struggle



Adapted from Hammond, S. I., Müller, U., Carpendale, J. I. M., Bibok, M. B., & Liebermann-Finestone, D. P. (2012) and Wood, Bruner, & Ross (1976).

Problem solving:

The power of explanation and exploration

Parents of young children spend much of their time answering an endless stream of "Why?" questions.

In fact, researchers estimate that three- to fouryear-olds ask an average of 76 information-seeking questions per hour²²! Children learn about the world through explanations from adults, but recent research highlights that the reverse—children generating explanations for how things work— also influences children's causal reasoning and problem solving. Relatedly, researchers and theorists have long believed that children learn about causal relationships through exploratory play. The synergistic relation between explanation and exploration is a current and growing focus for developmental researchers. That is, explanation serves as a tool for generating and evaluating hypotheses while exploration provides a mechanism for testing them²³. We often assume that objects that look alike have similar causal properties, but there are many exceptions to that rule. For example, many green plants look like poison ivy, but do not have the same (unfortunate) outcome. How do children learn to look beyond perceptual properties (i.e., what an object looks like) and instead appreciate an object's causal properties (i.e., the nature of how an object functions)?

Two recent studies support the idea that prompting preschoolers to explain what they observe can change how they reason about cause and effect. In the first study, Caren Walker at the University of California at San Diego and her colleagues²⁴ presented 3- to 5-yearolds with a set of blocks and a special toy that played music when some of the blocks were placed on it. After each block was placed on the toy, children were asked to either explain ("Why did/didn't this block make my toy

A powerful combination for problem solving

(Legare, 2014)



Explanation

Asking children to explain how things work deepens reasoning about cause and effect.



Exploration

When children encounter something unexpected, they engage in more exploratory play to discover how things work. play music?") or verbally report ("What happened to my toy when I put this block on it? Did it play music?") the outcome. When preschoolers were prompted to explain why some of the blocks did or did not activate the toy, they were more likely to focus on the causal (internal) properties of the blocks instead of the appearance of the blocks.

In a second study, Cristine Legare and Tonia Lombrozo²⁵ introduced another group of preschoolers to a novel mechanical toy consisting of interconnected gears. Children who were prompted to explain how the toy worked performed significantly better on measures of causal learning (e.g., the shape of the gears) than children who were not explicitly encouraged to generate a causal explanation, but did not perform better on measures involving perceptual details (e.g., the color of the gears). In other words, simply asking children to explain how things work can influence how they solve problems by encouraging them to attend to the causal powers of objects.

Another powerful mechanism for problem solving is exploration. Research suggests that childrens' curiosities are motivated by gaps in information, which lead to exploration in order to fill in these gaps and satisfy curiosity²⁶. That is, children will explore more when there is something to be learned.

To further investigate the relationship between uncertainty and exploration, Tessa van Schijndel and her colleagues²⁷ examined children's patterns of exploration in a situation where they observed conflicting evidence in forming shadows. Children ages 4- to 9-years-old were introduced to a shadow machine that projected shadows of puppets varying in size according to the size and distance of the puppets from a light source. Children who were confronted with conflicting evidence performed more informative experiments during free play than those who observed evidence that confirmed their theory. More specifically, all of the children who watched a conflicting event performed an experiment in which one dimension (size or distance) was varied while the other was kept constant.

Studies with infants and preschoolers also demonstrate that children's curiosity is fueled by uncertainty and conflicting evidence. In a widely-cited study with preschoolers, Elizabeth Bonawitz at Rutgers University and her colleagues²⁸ found that children explored a novel toy more when they thought there was more to be discovered. More recently, Johns Hopkins professor Lisa Feigensen and her graduate student Aimee Stahl²⁹ found that when infants see something surprising (e.g., a ball pass through a solid wall) they focus more on that object and learn more about it by testing relevant hypotheses about the object's surprising behavior (e.g., banging the ball to test if it was solid).

Together, these findings provide practical and meaningful guidance for promoting problem solving and causal reasoning skills in young children. Asking children to explain their observations and presenting them with theory-violating evidence can evoke children's curiosity, motivate them to explore, and lead them to engage in hypothesis testing behaviors to learn about the world around them. How can toymakers put these findings into practice? Learn how a new toy for preschoolers from Fisher-Price, the Think and Learn Code-a-pillar[™], encourages children to explain what they observe and engage in exploratory play to solve problems on the following page.

Code-a-pillar: Promoting explanation and exploration through playful learning

In 2016 researchers at BADM partnered with Fisher-Price to develop a curriculum based on 21st century learning skills (creativity, critical thinking, collaboration, and communication) for their new preschool learning toy, the Think & Learn Code-apillar™. The Code-a-pillar is an interactive, programmable toy designed for children ages 3-6 years that introduces young children to coding and sequencing skills. Children can "program" a path for Code-a-pillar by connecting segments (e.g., forward, left, right) in different sequences.

By allowing children to combine segments in a variety of sequences, Code-a-pillar provides opportunities for children to explain what they observe (e.g., how Code-a-pillar moves from point A to point B) and explore many possible solutions to a problem (e.g., how to get Code-a-pillar through an obstacle course). We had the opportunity to observe teachers implement the Code-a-pillar curriculum in preschool classrooms and were impressed with young children's ability to explain why the toy followed a certain path. Or in some cases, why Code-a-pillar didn't follow the "correct" path. In addition to front, left, and right segments, children can program Code-a-pillar to "act" happy or sleepy (using sounds and lights) or repeat actions. Adding a "repeat" segment to Code-a-pillar makes the toy repeat the motion of the segment children attach to it—and a dial on this segment allows children to further program the number of times they want the action repeated. This segment, in particular, promotes exploratory play by giving children an opportunity to figure out how the repeat segment changes the path of the Code-a-pillar.

Future generations of Code-a-pillar could include a "mystery" segment to promote explanation and exploration. Through exploratory play, children can figure out how this segment affects Code-a-pillar's movements. For example, the mystery segment could have the opposite effect of the segment it is attached to (i.e., right would become left).

Through hands-on, active play, Code-a-pillar provides a developmentally appropriate and engaging way to solve problems using the powerful combination of explanation and exploration.



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This publication was made possible by the generous support of The Walt Disney Company



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