Learning through play: a review of the evidence

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The **LEGO** Foundation

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Executive summary

The aim of the LEGO Foundation is to build a future where learning through play empowers children to become creative, engaged, lifelong learners. This ambition is more critical than ever. The world of today and tomorrow is one of challenges but also of tremendous opportunity. An increasingly interconnected and dynamic reality means children will face continuous re-skilling and a need for lifelong learning as they grow. Many children also face hardship in the shape of stress, poverty and conflict. They need positive experiences and coping skills to counterbalance negative factors in their lives, and support their confidence and opportunity for making a difference. We firmly believe that promoting children's drive to learn, their ability to imagine alternatives, and to connect with their surroundings in positive ways, is absolutely essential.

This white paper summarises current evidence on the role and importance of children's learning through play. We first consider what it takes to thrive in a 21st century context, before defining learning in a broad sense: both as a deep understanding of content and as learning-to-learn skills that build on children's natural affinity to learn and engage with their world from birth. We then draw on the science of effective learning, rigorous play research and neuroscience to explore the potential of playful experiences for promoting deeper learning and a breadth of skills. We outline what evidence is known, what gaps exist, and propose future directions for research. The three boxes below summarise these insights under three headlines: what we know, what we think and what needs to be done.

Through active engagement with ideas and knowledge, and also with the world at large, we see children as better prepared to deal with tomorrow's reality - a reality of their own making. From this perspective, learning through play is crucial for positive, healthy development, regardless of a child's situation.

What we know

Learning through play happens through joyful, actively engaging, meaningful, iterative, and socially interactive experiences.

Our goal is to develop creative, engaged, lifelong learners who thrive in a 21st century world

What we think

Learning through play supports overall healthy development, acquisition of both content (e.g., math) and learning-to-learn skills (e.g., executive funtion)

The benefits and role of learning through play differ across contexts and cultures

What needs to be done

Learning through play research across cultures

Well-controlled studies examining play's role for higher-level skills

Greater understanding of how play and its benefits change over time and context

Insights from neuroscience on play in real-life contexts

School

Community
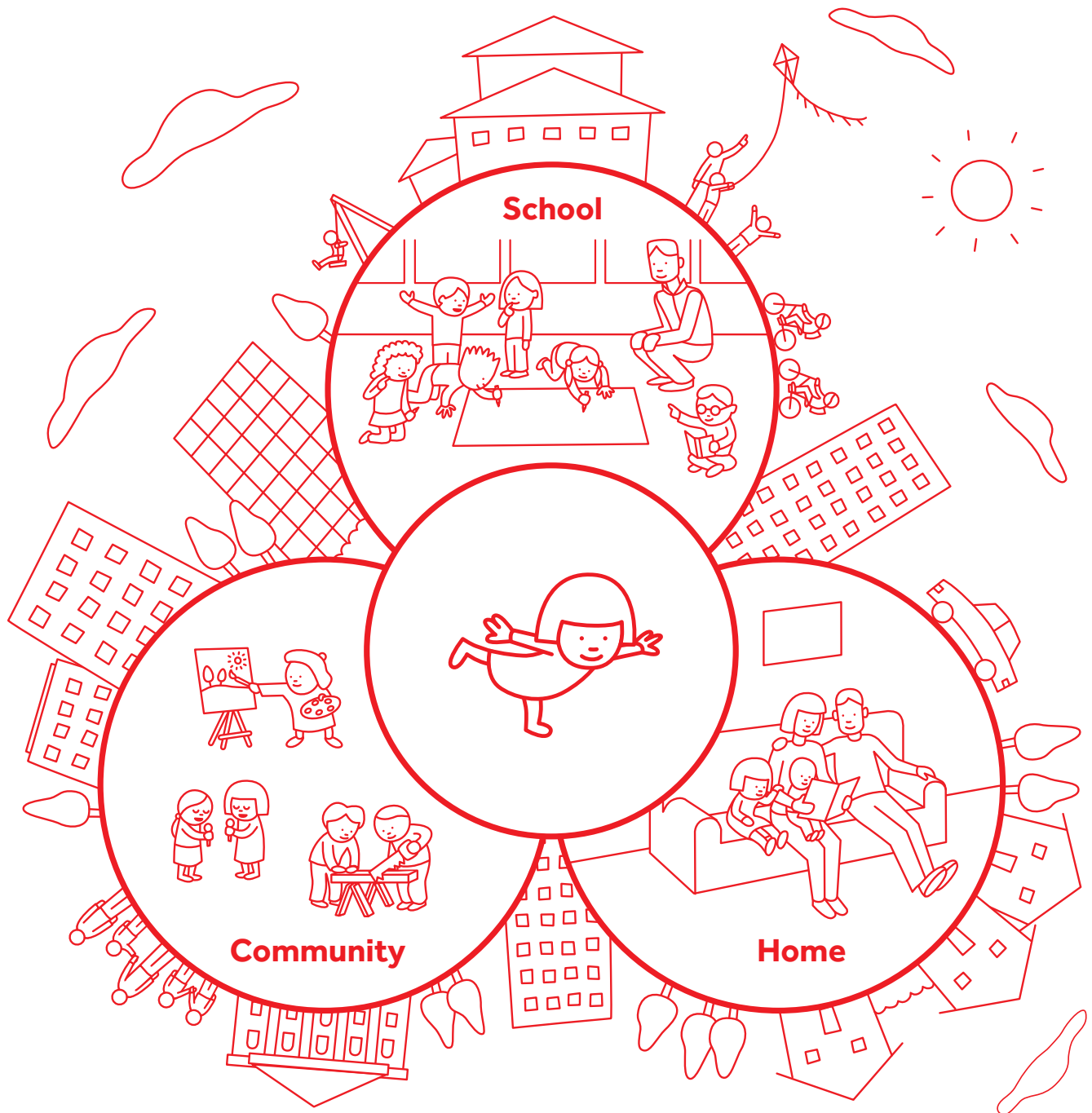
Home

" **Learning through play is about continuity; bringing together children's spheres of life - home, school and the wider world, and doing so over time.**

Susan MacKay,
Director of Teaching and Learning
at Portland Children's Museum

Thriving in the 21st century: challenges and opportunities

Today's children (tomorrow's adults) grow up facing rapid change, global challenges, and connectivity, all of which affect their prospects of life and work.

The LEGO Foundation aims to build a future where learning through play empowers children to become creative, engaged and lifelong learners. UNESCO uses the term global citizenship to highlight this need for empowering children to take active roles in the face of global challenges and to become contributors towards a world characterised by greater peace, tolerance and inclusion (UNESCO, 2015). Their call to action also reminds us of a difficult reality; all over the world, children face hardship. Neglect, loss, poverty and conflict are just some of the situations where they are at risk. They need protective experiences and coping skills to counterbalance negative factors in their lives (NSCDC, 2015). In this white paper, we focus on three specific potentials for learning through play: during children's development in the first years of life, through entering school age and laying the foundation for lifelong learning.

Play in early development

Neuroscience presents us with strong evidence for the profound influence of early experiences. In order to build healthy brain connections from the outset, young children need responsive and rich social interactions with caregivers, combined with sufficient nutrients and an environment free of toxins (CDC at Harvard University, 2016). Playful experiences offer a unique context for these supportive and rich learning experiences in early childhood (see also the forthcoming white paper titled Learning through Play in the First 1000 Days by J. Robinson, in progress).

Connecting play and education

As children grow, preparing them for the demands of school and the wider society is key. However, content only serves children as far as they can apply and build on it: a child who has not grasped the concepts of plus and minus stands little chance of understanding equations. Attaining key content and facts is important for school and life, but children also need a deep, conceptual understanding that allows them to connect concepts and skills, apply their knowledge to different situations, and spark new ideas (Winthrop & McGivney, 2016; Frey, Fisher, & Hattie, 2016). We see playful experiences as optimal for engaging in this type of deeper learning (see the section on 'Characteristics of playful experiences' in this white paper).

Play and lifelong learning

Finally, today's world is uncertain and constantly changing – from shifting career and political landscapes to increasingly digital economies and social life. New technologies mean we live and work in ways that did not exist twenty years earlier. Children need skills and mindsets allowing them to step into this uncertainty, create opportunities for themselves and their communities, and learn throughout life. Using the simple, yet compelling words by researchers Golinkoff & Hirsh-Pasek (2016), realising children's potential in the face of this uncertainty means supporting them to be "happy, healthy, thinking, caring, and social children who will become collaborative, creative, competent, and responsible citizens tomorrow".

What global citizenship, coping and thriving look like for children may differ dramatically across time, culture, and context, but the deep understanding that comes from effective learning experiences will no doubt be an important step. In playful experiences, children tap a breadth of skills at any one time. When playing together, children are not just having fun but are building skills of communication and collaboration. A game of hide-and-seek helps them to manage feelings about the unknown while also helping them to think about what other people know and see. Beyond enjoyment, playful experiences have the potential to give children the skills they will need in the future that go beyond facts. As we discuss more fully below, playful experiences appear to be a powerful mechanism that help children not only to be happy and healthy in their lives today but also develop the skills to be the creative, engaged, lifelong learners of tomorrow.

In the following sections, we present insights from diverse scientific literatures to describe the nature of children's learning and the role of play and agency in their development. This leads to five characteristics that describe the interface between play and learning: joyful, meaningful, actively engaging, iterative and socially interactive. This evidence base offers a broad, yet compelling picture of how playful experiences support children's development and learning, particularly in the early years of life. Yet, we also recognise that more work is needed to discover the mechanisms by which child play engages with learning outcomes, and what happens as children grow older. In the closing remarks of this white paper, we point to future directions and unanswered questions on learning through play.

" We don't teach uncertainty in schools. It should be the absolute bedrock of what we teach children – how we come to know and how we describe reality. In fact, we teach the exact opposite.

**Adam Rutherford, science writer,
& Rufus Hound, comedian**

Learning is broad, interconnected and dynamic

Learning is sometimes thought of in the strictly cognitive or academic sense, yet research in child development has shown us that learning is much broader and interconnected.

A holistic view on learning

Newer approaches to theory and practice have done an excellent job of extending the view of learning to include areas such as physical (e.g., fine and gross motor skills), social (e.g., empathy and theory of mind), emotional (e.g., development self-regulation and even self-conscious emotions), and creative development (e.g., divergent thinking, making and expressing). This broad view of learning is a tremendous step forward in our understanding. However, some still view these different domains as separate from each other. Such a view fails to capture the real nature of learning-to-learn and particularly the skills required in learning to learn that truly allow children to be prepared for 21st century opportunities (Golinkoff & Hirsh-Pasek, 2016). We see the shortcomings of this domain-based model in two ways.
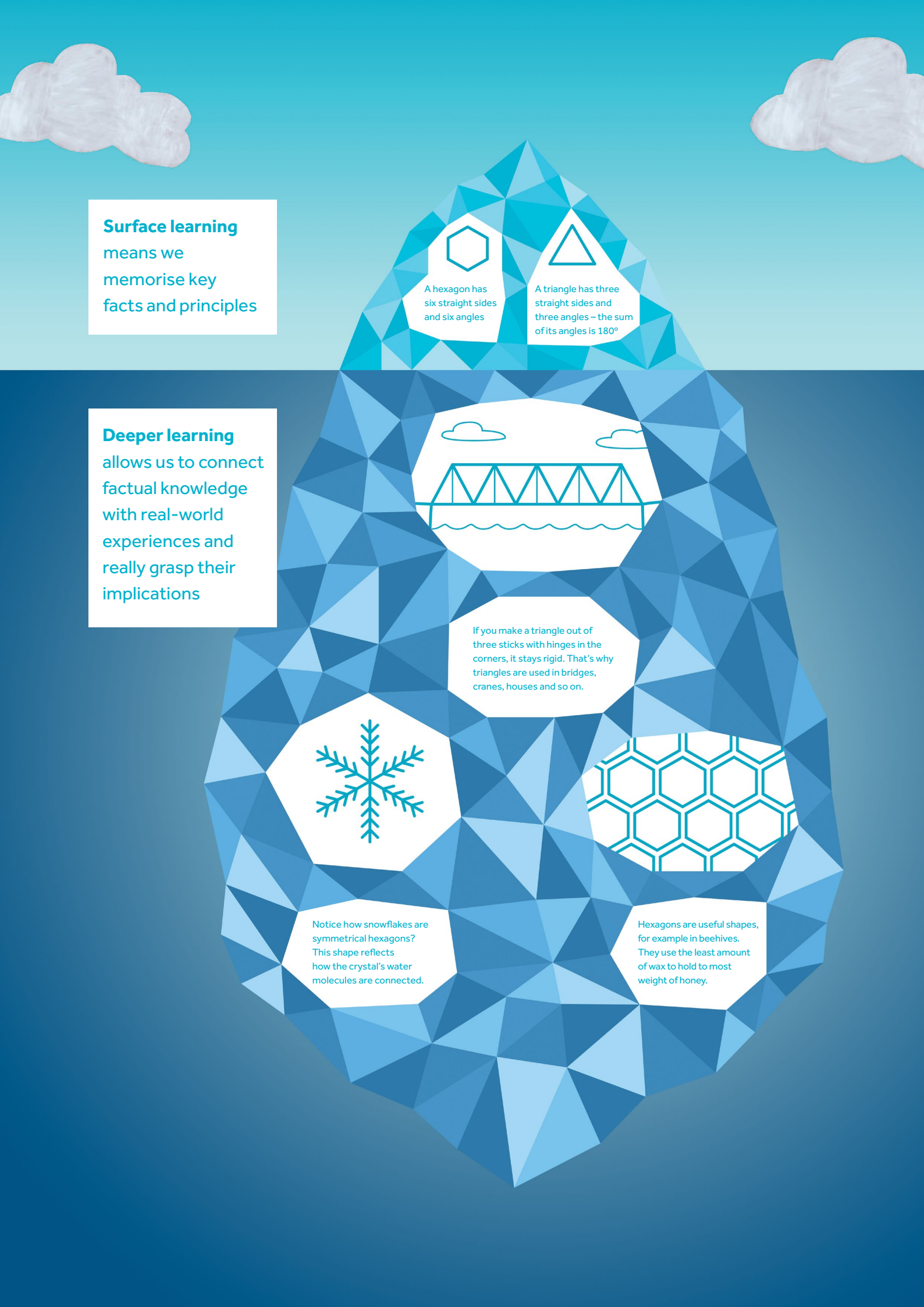
Child development is interconnected

First, research in the last few decades has repeatedly shown that the different domains of development are not silos as much as they are interconnected gears: development in one area can influence development in another. For example, physical development lays the foundation for later cognitive and social skills. A whole new world opens to a toddler who learns to walk instead of crawling. Now, he can hold a toy with ease and go in search of his caregiver, gaining access to new interactions, language and play (Karaski, Tamis-LeMonda, & Adolph, 2014).

Social competence and emotion regulation in turn underpin children's cognitive skills (McClelland, Acock & Morrison, 2006), and language helps children interact with peers in positive ways (Vallotton & Ayoub, 2011). Studies looking across the span of childhood find that infants who are more physically active and explore more at the age of 5 months show more success in school at age 14 (Bornstein, Hahn, & Suwalsky, 2013). These examples highlight that children's growth and development is beautifully complex and not easily broken down into neat divisions. Importantly, lessons from neuroscience also tell us that learning is dynamic and not easily divisible into separate and independent mental processes (e.g., Bassett et al., 2004; Dahaene, 2009; Sporns et al. 2004; Wandell, Rauschecker, & Yeatman, 2012).

Learning-to-learn skills

Second, if we think about development as fitting into neat domain-based divisions, we lose sight of the crucial learning-to-learn skills that cut across domain boundaries (Golinkoff & Hirsh-Pasek, 2016). Truly learning information and new skills requires a dynamic, deep, conceptual understanding that often relies upon all of those domains. For example, executive function - a suite of abilities that includes working memory, the ability to inhibit impulses, and switch attention between tasks or rule sets - has been shown to relate to a variety of academic skills including math and literacy. Some studies have even found that children's impulse control in preschool predicts a wide range of outcomes in adolescence and adulthood, including higher SAT scores, better health, and lower rates of substance abuse (Mischel et al., 2011).

Surface learning means we memorise key facts and principles

A hexagon has six straight sides and six angles

A triangle has three straight sides and three angles – the sum of its angles is 180°

Deeper learning allows us to connect factual knowledge with real-world experiences and really grasp their implications
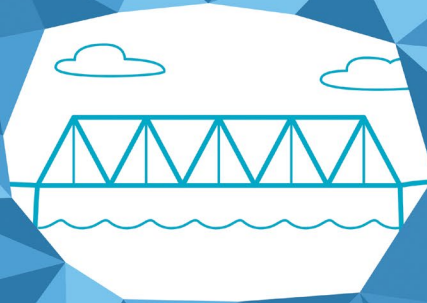
If you make a triangle out of three sticks with hinges in the corners, it stays rigid. That's why triangles are used in bridges, cranes, houses and so on.

Notice how snowflakes are symmetrical hexagons? This shape reflects how the crystal's water molecules are connected.
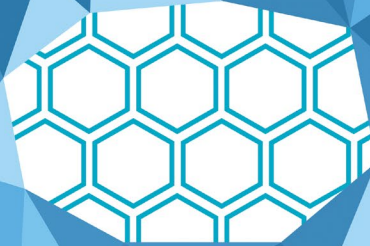
Hexagons are useful shapes, for example in beehives. They use the least amount of wax to hold to most weight of honey.

Learning-to-learn skills encompass a wide variety of abilities that help children learn information, acquire skills, and deal with new situations (e.g. Care, Kim, Anderson, & Gustafsson-Wright, 2017; Deci & Ryan, 2000; 2012; Dignath, Buettner, & Langfeldt, 2008; Harvard CDC, 2011). They include the ability for children to be motivated drivers of own experiences. This involves focus and attention to avoid distractions that pop up, the curiosity and motivation to seek out new opportunities and information, the willingness to take risks, have confidence, and have a love of learning. Additionally, children benefit from having the skills necessary to be a self-starter - namely autonomy, persistence, and goal setting - and the ability to rise to meet new challenges. This requires imagining innovative and creative solutions to problems and adapting those solutions if the first try fails.

When children develop the ability to explore their environment, be resourceful about the materials, people, and skills that they engage with, and think flexibly about different approaches to a situation, they are better equipped for whatever challenge next confronts them. Many problems will also require the ability to isolate important aspects of a situation, test out hypotheses, and reason critically and scientifically about evidence. We must also think about how best to prepare children to think in this critical, scientific way. Finally, we cannot ignore the fact that we live in a social world, and to succeed in life children must have the ability to interact and work with other people. Young children need to not only understand and regulate their own emotions but also express those emotions effectively and to understand and empathise with others. Beyond communication, the ability to effectively work with other people to accomplish goals is critical. Children and adults are more successful when they can communicate their ideas to others, collaborate to accomplish joint goals, negotiate when partners disagree, and take leadership when necessary to help move a team forward (Jones, Greenberg, & Crowley, 2015).

Importantly, these kinds of skills not only build upon themselves, but also upon one another in a dynamic cycle of development. Let's imagine two children building with blocks, and one decides to knock the other's tower down. In this situation, the tower-builder must try to control the negative emotions this action causes. In building this emotional regulation, the child

How do we build these important skills for the future?
Research suggests that playful learning experiences appear to be a particularly effective mechanism for the development of these broad, dynamic, and interconnected skills (termed "the 6 C's" by Golinkoff & Hirsh-Pasek, 2016). Imagine a group of neighbourhood children playing on a playground. These children are pretending to be part of a family, with different children taking on different roles in the family - the parents, the siblings, even the family pet! At first glance, this appears to be a simple game of pretend. But when viewed through the lens of playful learning, we see that children are actually building much more than a pretend family. As they negotiate roles, they are building the skills of communication and collaboration. As they look around for new materials to incorporate into their pretend reality, the are exhibiting creative innovation (e.g., a bicycle turned upside down becomes an ice cream truck). As the younger ones begin to question the 'rules' imposed by the older children, they are practicing their critical thinking skills. As they all begin to act out things outside of their comfort zones, they are building confidence in themselves and their ability to face new challenges. Finally, even content knowledge is being strengthened through increased exposure to language and even math as they pay the ice cream seller with their "currency" (e.g., sticks). These are the same skills that will help children to become successful adults and are reviewed in the rest of this piece.

"

Content is not learnable if communication skills are not in place, and critical thinking operates on content, not in a vacuum. In this way, the skills build on and reinforce one another.

Rebecca Winthrop & Eileen McGivney,
Center for Universal Education, Brookings Institution

is now better prepared to interact more effectively with others in similar circumstances; equally, she is building the skills that will help her to control her fear during a doctor's visit or her sadness when a parent leaves for the evening. In this way, play experiences can help children to exercise those same skills in safe contexts and extend them to more challenging situations.

By highlighting a breadth of skills, the idea is not to lose sight of content. In fact, the two are sides of the same coin. For example, critical thinking and reasoning is easier when one has knowledge of the context of a problem (see Willingham, 2006) or can think of the problem in terms of information that is personally familiar. Ingenuity often depends on knowing how something is currently done and looking for ways to make it better (DeHaan, 2009). In short, learning content is critical because the more you know, the more you are able to learn. Children can learn content

directly, for example when taught about scientific discoveries in school or reading a picture book about animals with a caregiver. In these cases, the content is presented directly to them. The point is, however:

New information is learned better when it connects to and expands what we already know.

See Willingham (2009) for a discussion and the section on meaningfulness in this paper. Learning experiences can also build up the learning-to-learn skills that allow children to find relevant content through their own efforts. It is important to cultivate both paths, and playful experiences provide a context that can support both. In the next section, we present insights from research on how children learn best - both skills and content.

Children are born to learn through play

The tools for enhancing and strengthening children's learning are already available in our homes, communities, and classrooms. The answer is, in essence, as simple as child's play.

From the first moments of life

Children possess an amazing, natural potential to learn. Infants as young as a few hours old prefer to listen to the sounds of human voices over any other sound (Vouloumanos & Werker, 2007) and young infants have even been referred to as "scientists in the crib" (Gopnik, Meltzoff, & Kuhl, 1999) due to their natural curiosity and drive. Beyond more obvious areas, such as language development and motor skills, young children also have an imagination and inventiveness that helps them create new ideas and opportunities, and a strong motivation to connect and engage with others. Play harnesses and builds on this potential. From pretending to discover a new country in one's own backyard to hours spent building the world's largest train-station, there is no doubt that play and childhood go hand-in-hand. In the past few decades, research has repeatedly shown that play experiences are not merely fun, nor just a way to pass the time along the way to adulthood. Instead, play has a central role in learning and in preparing you for challenges later on in childhood and through adulthood. In the next section, we will explore the characteristics of play that lead to deeper learning - ultimately preparing children for handling unforeseen events and taking advantage of opportunities in their lives in the 21st century.
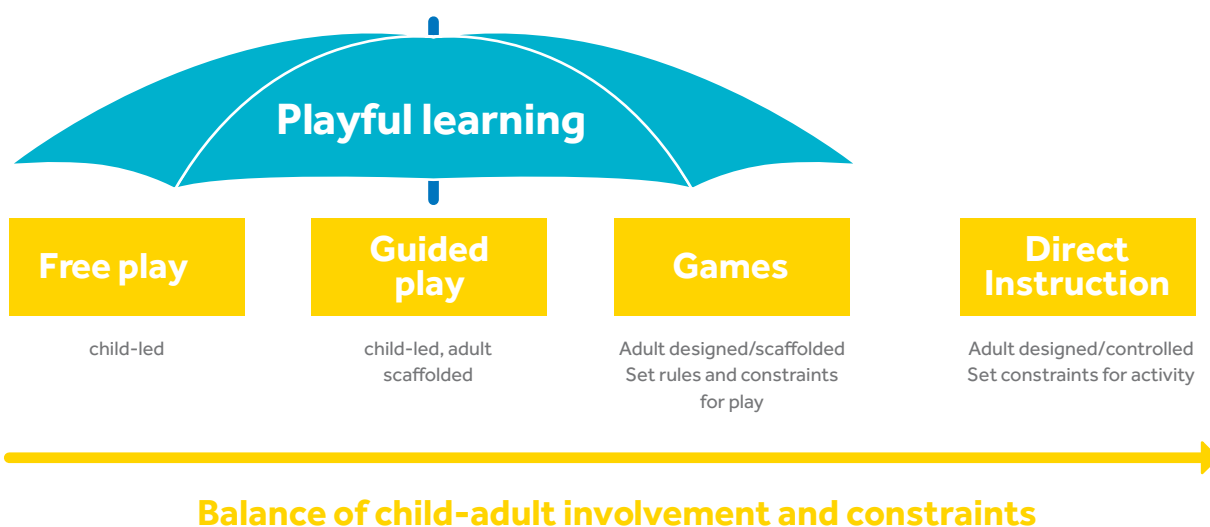
Play is natural and necessary

From vocal play in human infants to play observed in other animal species such as rats, non-human primates, and dolphins, play seems to be a natural inclination across the animal kingdom and help individuals within a species to learn, grow, and thrive (Pellegrini, Dupuis, & Smith, 2007). Extreme cases, where infants were raised in deplorable conditions (Bos, Fox, Zeanah, & Nelson, 2009) or experimental manipulations where rats and mammals were raised without play (Spinka, Newberry, & Bekoff, 2001) have shown that play is not simply a 'bonus'. Rather, play has a key role in healthy, positive development. Although natural, play must also be supported by the environment. A report from the American Academy of Pediatrics highlights the need and importance of play for promoting healthy child development, especially for those children living in poverty whose access to safe, playful experiences may be lacking (Milteer, Ginsburg, The Council on Communication and Media, & Committee on Psychosocial Aspects of Child and Family Health, 2012).

A continuum of playful learning

Generally, the literature conceptualises play as existing along a continuum. At one end, free play gives children the freedom to explore, play, and discover with minimal constraints. But play is not just something that happens in a vacuum: our environments structure play (e.g., the materials available when playing in a home, in a yard, in urban environments, in rural environments, etc.) as do the peers, adults, and other people around us. And so, at the other end of the continuum is play that is more guided or structured. The term "playful learning" is an umbrella term that is used to include free play as well as these more structured, guided play contexts (see figure below). Additionally, researchers have recently added games under this umbrella (Hassinger-Das, Toub, Zosh, Michnick, Hirsh-Pasek, & Golinkoff, 2017). Playful learning can take many forms, including physical games such as hide and seek, construction play with blocks, board games, pretending with objects, or engaging in fantastical role play (see the literature review on play types and children's development by Neale, Whitebread et al., 2017). Although there is ongoing debate in research and practice about where free play ends and more guided play begins (e.g. Pyle & Danniels, 2017), our goal in this piece is not to resolve this theoretical debate. Instead, we maintain that learning through play can happen through free play *and* when adults or aspects of the environment structure the play situation towards a particular learning goal.

Playful learning

Free play	Guided play	Games	Direct Instruction
child-led	child-led, adult scaffolded	Adult designed/scaffolded Set rules and constraints for play	Adult designed/controlled Set constraints for activity

Balance of child-adult involvement and constraints

The importance of child agency

Whether adults are supporting or not, a critical requirement for learning through play is that children must experience agency and be supported rather than directed. Anyone who has spent time with an 18-month-old knows just how much children like to take control. Whether it is putting on her own shoes or feeding herself despite lacking fine motor skills, a hallmark of toddlerhood is the idea of the self as an agent. This quest for control, initiative, and, in a way, leadership, does not end with toddlerhood however. Indeed, the challenge of balancing a child's own desires with the reality of rules, social norms, and situation has been at the heart of many psychological theories. From Freud's id, ego, and superego to Erikson's psychosocial stages of development, the idea that children have a drive for at least some degree of agency is prevalent both anecdotally and theoretically. Having agency does not equal 'anything goes' for children either at home or in education contexts. Agency in learning through play means seeing the child as capable rather than a blank slate to be filled (Daniels & Shumow, 2003).

Agency is about the balance of initiative in the child-adult relationship: are children's interests listened to? Are they consulted on decisions that concern them? Do they initiate an activity and invite adults to join them in play and decision-making? In other words, what opportunities do children have for exerting their thinking and actions in a social context where others hold the same rights? Two dimensions may be helpful to consider: how planned the learning environment is, and how much the child and adult control the evolving 'flow' of activities (Sinclair, 2004; Toub, Rajan, Golinkoff, & Hirsh-Pasek, 2016; Cheng, Reunamo, Cooper, Liu, & Vong, 2015).

Imagine a teacher arranging creative centres in the classroom. In one corner, children cut cardboard owls from a template; in another, they choose and colour print-outs with a shape - triangles, squares, or circles; in the third corner, children work together to build a city from wooden blocks. On the surface, all children are busy doing a task with creative materials but they have different degrees of choice: from none when they are cutting out templates to at least some when choosing and colouring shapes. The greatest opportunities for flexing their 'thinking muscles' come when they are allowed to create and develop a city from their own idea to a final product. Likewise, we can picture a two-year-old with her dad, trying to solve a puzzle. In one scenario, the dad hands over the puzzle pieces, one by one, and indicates where to place each piece. In this case, he controls almost all aspects of the activity. Alternatively, he might support her to work on the puzzle herself, but occasionally make suggestions, such as rotating a piece if it doesn't fit at first or trying to look for similar colours. Researchers find that this kind of scenario, where caregivers ensure that children play an active role in solving a problem-solving task, promotes children's executive functions - that crucial suite of skills used in goal-setting and flexible thinking (Matte-Gagné, Bernier, & Lalonde, 2015; Hammond, Müller, Carpendale, Bibok, & Liebermann-Finestone, 2012).

Benefits for development

The importance of agency and self-directedness and their impact on learning for humans across the lifespan is, in fact, widely researched. From the work on self-determination theory (Ryan & Deci, 2000) and intrinsic motivation with adults (Cordova & Lepper, 1996), the literature is full of examples in which choice and a sense of agency in determining what is learned appears to be a powerful mechanism. Even before adulthood, seeing oneself as an agent has been linked with learning. Infants who are given experience with grasping objects themselves are better able to

understand the mental states (such as intention and desire) that underlie actions of others (Sommerville, Woodward, & Needham, 2005). As children begin to move through the world on their own instead of being carried or pushed in a stroller (and thus, have a higher degree of agency), we see widespread benefits to cognition. According to Campos and colleagues (2000), "...the onset of locomotor experience brings about widespread consequences, and after infancy, can be responsible for an enduring role in development by maintaining and updating existing skills." (p. 150). For example, elementary school children who are allowed choice about the features of a game are more motivated to play and learn more from it (Cordova & Lepper, 1996).

Play is an agentic learning context

Play captures many of the features that we know from research lead to deeper learning, and thus provides an optimal environment to develop the skills and knowledge that children need to thrive and succeed as adults. Children are intrinsically motivated to play, which makes it fertile ground for learning and developing new skills. During play, children can take charge, making choices about what they do and how. Play can be a highly social activity, allowing for opportunities to learn from and about others. Thus, play can provide many opportunities for learning, but not all play is learning, and not all learning is play. Next, we describe five characteristics that specifically define playful learning experiences and review evidence on how these link to children's deeper learning.

Characteristics of playful learning experiences

What does it look like when children learn through play? On the next pages, we dive into five characteristics of play with insights from research on how they promote deeper learning.

Regardless of whether a play activity falls closer to free play, guided play or games on the continuum, we say that optimal learning through play happens when the activity (1) is experienced as joyful, (2) helps children find meaning in what they are doing or learning, (3) involves active, engaged, minds-on thinking (4) involves iterative thinking (e.g., experimentation, hypothesis testing), and (5) involves social interaction (the most powerful resource available to humans - other people). The selection of these characteristics is based on the theory presented by Hirsh-Pasek, Zosh, Golinkoff, Gray, Robb, & Kaufman (2015) where they provide evidence that a deep, conceptual understanding requires that children are active (minds-on) and engaged (not distracted) with meaningful material especially in socially interactive contexts. Here, we use this conceptualisation as a foundation, combined with a playful state of mind - joy and iteration - to further explain learning through play.

The five characteristics ebb and flow as children are engaged in learning through play activities. All five characteristics are not necessary all the time, but over time children should experience moments of joy and surprise, a meaningful connection, be active and absorbed, iterate and engage with others. Joy is a necessary requirement for an experience to be playful. Indeed, the '...predominant emotions of play are interest and joy.' (Gray, 2013, p. 18). When it comes to deeper learning, active engagement is necessary as one cannot imagine children reaching a depth of understanding and ability to apply without being minds-on and actively processing information or experiences. Additionally, learning through play requires that an experience is meaningful to the child. Exposure to abstract concepts that are not connected to children's real-life experience may lead to shallow memorisation of information, but will not foster the type of deeper, flexible learning we wish to encourage (see illustration on page 9).

Together with a sense of agency, we suggest that joy, meaningfulness, and active engagement, are necessary for children to enter a state of learning through play, and the addition of any combination of the other two characteristics (iteration and social interaction) supports even deeper learning. In the following sections, we draw on existing research to describe the potential of learning through play.

Socially interactive

Iterative

Joyful

Actively engaging

Meaningful

Joyful

Joy is at the heart of play

Here, we define joy in a broad sense: as pleasure, enjoyment, motivation, thrill, and a positive emotion - whether over a short period of time or over the entire play session. In other words, joy is seen as both enjoying a task for its own sake and the momentary thrill of surprise, insight, or success after overcoming challenges. From a child enjoying a pretend play session with a peer to the thrill of building that tower just right, joy is a key facet of play. Saying that learning through play must be joyful does not mean that there can be no negative or neutral emotions at all. Sometimes frustration with a problem is necessary to feel the joy of breakthrough when it is finally solved. Further, the power of surprise or the thrill of the unexpected can bring joy to an otherwise boring or even potentially intimidating situation (e.g., just think of a child's reaction to a jack-in-the-box or when a child who is pouting because she is losing a board game lands on a piece that puts her in first place). Crucially, joy is also linked with learning in a number of ways.

In developmental research, joy is often linked with interest or motivation. Over the last few decades, researchers have made great strides in investigating motivation through concepts such as mindset (Dweck, 2006) and grit (Duckworth, 2016), and how these can improve learning. For example, everyone can intuitively remember just how hard it can be to learn or be productive when we are sad about something happening in our lives, or when that inner critic swallows all our mental energy. This is not just an impression. Research repeatedly shows that negative life experiences have implications on learning and development, just as perseverance and positive outlook improve our ability to handle stress and challenges in life (Donaldson, Dollwet, & Rao, 2015).

We can also easily remember the excitement felt and the ease of learning about something that caught our attention in a surprising way. Recent work suggests that even infants show more learning after a surprising event than after one that is expected (Stahl & Feigenson, 2015; 2017). From neuroscience, we find that emotions are integral to neural networks responsible for learning (Immordino-Yang & Damasio, 2007). Joy, for example, is associated with increased dopamine levels in the brain's reward system linked to enhanced memory, attention, mental shifting, creativity, and motivation (e.g., Cools, 2011; Dang, Donde, Madison, O'Neil, Jagust, 2012). Indeed, thinking of emotions as secondary to thinking in learning goes against recent research in the developmental and neuroscientific disciplines (Immordino-Yang & Damasio, 2007).

> "
>
> ## The predominant emotions of play are interest and joy.
>
> **Peter Gray,**
> play researcher
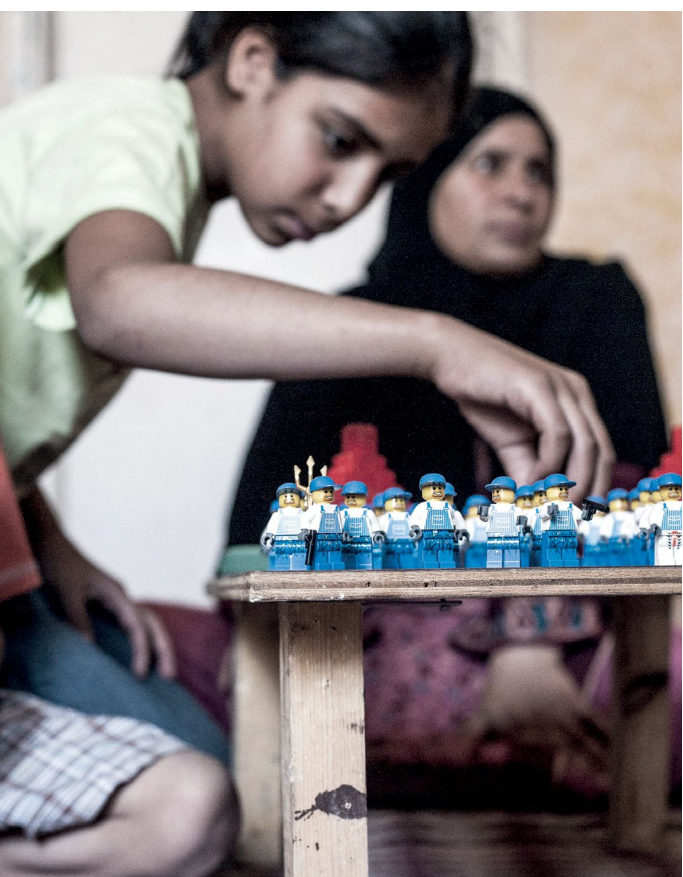
Meaningful

Making sense of experiences

Meaningful is about children finding meaning in an experience by connecting it to something they already know. In play, children often explore what they have seen and done, or noticed others do, as a way of grasping what it means. By doing so, they can express and expand their understanding.

Imagine a two-year-old who will readily say "1 2 3 4 5 6 7 8 9 10!" when asked to count to 10. His parents are happy and the child feels proud to have given the right answer. But when this same child is given five pieces of candy and asked to count how many he has, he can't come up with the answer. Although this child appears to know a "fact" - this is really just an illusion. He has no true conceptual understanding that he can use flexibly or that connects to his world. The same kind of "learning illusion" is also apparent when children can recite the alphabet song but are unable to identify the letters or the relevant sounds that go with each letter. To move past rote learning to more meaningful understanding (Ausubel, 1968), the child must learn to connect the illusory fact to something in real life. Children need to count actual objects rather than reciting the count list without context. By showing that each successive number in the list corresponds to an individual object in a set, children begin to understand the true meaning of counting.

The importance of meaning making cannot be underestimated: from Ausubel's (1968) distinction of rote versus meaningful learning, to Shuell's (1990) writing on rote learning being a precursor to "real" learning, to Chi's (2009) more recent paper outlining the importance of active construction of new understanding based on what is already known, deep learning must extend beyond facts to conceptual understanding.

When thinking about applying the importance of meaning to our conceptualisation of learning through play, a particularly strong example comes from the work of Fisher, Hirsh-Pasek, Newcombe, and Golinkoff (2013). In this work, the researchers compared children's learning when they were told a new fact directly (e.g., a triangle has three sides, some triangles have sides of equal size although others do not) to contexts in which children were given a goal to discover the 'secret of the shapes.' Children in the latter condition, who had to think about the shapes in a more meaningful context, were not only better able to identify non-standard shapes (e.g., skewed triangles) but also retained this information a week later. As such, learning through play can help children to tap into their existing knowledge and spur them to make connections, see relationships, and gain a deeper understanding of the complex world around them. Another method used to help children find meaning that seems powerful for learning is known as dialogic reading. When parents or caregivers engage in dialogic reading, they do not simply read the words on the page. Instead, they prompt children to think about what might come next or how a character might be feeling. They may ask children to relate what is happening in the story to something that is happening in their own lives. This type of meaning-making in reading is linked to greater vocabulary gains (Hargrave & Senechal, 2000). Also, making connections between familiar and unfamiliar input guides the brain in making effortful learning easier (Luu, Tucker, Stripling, 2007). Meaningful experiences help us connect new insights with our existing mental frameworks; this way of processing recruits networks in the brain associated with analogical thinking, memory, transfer, metacognition, insight, motivation and reward (e.g., Bunzeck, Doeller, Dolan, & Duzel, 2012; Gerraty, Davidow, Wimmer, Kahn, & Sohomy, 2014; Hobeika, Diard-Detoeuf, Garcin, Levy, & Volle, 2016).

Actively engaging

Learning is hands-on and minds-on

Learning through play also involves being actively engaged. When children are immersed in the act of self-directed effort, are minds-on, and persist through distraction, we see benefits to learning. Imagine a child who is intently absorbed in playing with a set of building bricks. She is actively imagining how the pieces will go together and is so immersed that she fails to hear her father call her for dinner. This mental immersion and resistance to distraction is a hallmark of both play and learning separately, but seems to be especially powerful within the context of learning through play.

Hirsh-Pasek, Zosh, et al., (2015) make the distinction that active learning requires children to be "minds on," whether or not their bodies are active. From studies finding that children learn best when they play an active role in solving a problem rather than being explicitly instructed (Zosh, Brinster, & Halberda, 2013; Matté-Gagne, Bernier, & Lalonde, 2015) to studies showing that children as young as 3 months of age are more likely to interpret others' actions as goal-directed if they had personal, active experience with something like reaching for an item themselves (Sommerville, Woodward, & Needham, 2005), it is crucial that children adopt an active and engaged mindset. Learning through play creates that mindset without falling victim to the downsides of instruction-based pedagogy.

Adults influence child curiosity

Bonawitz and colleagues discuss this double-edge sword of pedagogy (Bonawitz, Shafto, Gweon, Goodman, Spelke, & Schulz, 2011). In this study, children were allowed to play with a novel toy with a number of hidden functions. When an adult taught them how the toy works by showing a limited number of those functions (e.g., actions A and B yield results X and Y), the children tended to play with only those functions. In contrast, when an adult who claimed not to know about the toy "accidentally" revealed one of the hidden functions, children tended to explore more widely and discover more of the other hidden features of the toy on their own. The didactic context in the first condition led children to believe that the adult had taught them all there was to know about the toy and they explored no further on their own.

This finding does not suggest that we should leave children in a world with zero guidance or instruction; they can and do learn from listening to and observing others. Children in the first condition of Bonawitz and colleagues' study learned the functions that were shown to them, but when they were put in a less structured environment, they engaged in the kinds of minds-on thinking that led to more exploration of the toy. These more self-directed, discovery-based techniques can support a deeper, conceptual understanding. In fact, neuroscience finds that active and engaged involvement increases brain activation related to agency, decision-making, and flow (e.g., Kuhn, Brass, & Haggard, 2012). It enhances memory encoding and retrieval processes that support learning (e.g., Johnson, Singley, Peckham, Johnson, & Bunge, 2014). Full engagement in an activity allows the brain to exercise networks responsible for executive control skills, such as pushing out distractions, which benefit short term and lifelong learning (Diamond, 2013).

Iterative

Neither play nor learning is static

A fourth characteristic of learning through play involves the iterative nature of children's play and learning. From a toddler playing with a puzzle and trying out different strategies to a young child discovering that the angle of a slide impacts how far a marble will shoot across a room, iteration - trying out possibilities, revising hypotheses, and discovering the next question - leads to deeper learning. Because play is a scenario that provides children agency to direct their own activities and a safe space to experiment without risk, it encourages iterative and exploratory behaviour. For example, children engaged in a playful building activity with a peer built larger, more complex structures than pairs of children engaging in an adult-directed, structured activity (Ramani, 2012).

Children also use play to test out hypotheses and explore unknowns. In one study, preschool children observed a demonstration of a toy where the causal structure was unclear (two buttons were pressed simultaneously and two effects occurred) or a demonstration that made clear how the toy worked (each button was pressed separately and led to distinct effects). Children who viewed the ambiguous demonstration spent more time playing with the toy, whereas children who viewed the clear demonstration chose to play with a new toy instead (Schulz & Bonawitz, 2007; see also Cook, Goodman, & Schulz, 2011; Buchsbaum et al., 2012). Even infants show this tendency: 11-month-olds who observed an object appear to pass through a solid wall subsequently banged the object against the table to test its solidity, and others who observed an object appear to hover in mid-air dropped it repeatedly to test if it would fall (Stahl & Feigenson, 2015). Engaging in this type of iterative play not only helps children learn and understand more about the world around them, but also strengthens their critical thinking and scientific reasoning.

Pretend play itself is a form of counterfactual reasoning, where children have to keep in mind a set of premises separate from reality and reason about what those premises imply (Weisberg & Gopnik, 2013). For example, if a child is pretending that an empty cup contains tea, and then the cup tips over, they continue their game as if the table is now covered in tea (Harris & Kavanaugh, 1993). When children naturally engage in this type of reasoning during play, they are using the same set of skills that scholars and scientists use when they test theories by reasoning about what would follow if a given set of conditions were true.

With practice, iteration increasingly engages brain networks related to taking alternative perspectives, flexible thinking, and creativity (Kleibeuker, De Dreu, & Crone, 2016; Kleibeuker et al., 2017; Van Hoeck, Watson, & Barbey, 2015). In addition, perseverance associated with iterative thinking is frequently linked to reward and memory networks that underpin learning (Boorman, Behrens, & Rushworth, 2011; Nemmi, Nymberg, Helander, & Klingberg, 2016).

Socially interactive

Social interaction is key

Finally, although play and learning can happen on one's own, a powerful context for both learning and play is social interaction. Through the processes of sharing one's own mind, understanding others through direct interaction, and communicating ideas, children are not only able to enjoy being with others, but also build a deeper understanding and more powerful relationships.

In fact, infants are driven to look for, and participate in social interaction. Social partners are key resources for learning from as early as the first few hours of life. From imitating a tongue protrusion of a social partner right after birth (Meltzoff & Moore, 1983) to increased learning of new object labels when a social partner looks at and labels an object rather than just a straight, non-social presentation of the identical information (Wu, Gopnik, Richardson, & Kirkham, 2011), evidence continues to mount that social partners and social information are not just a support to learning but may actually be a key to learning. The importance of social interaction is perhaps best highlighted by the classic work of Vygotsky (1978) whose sociocultural theory is centred around the idea that learning happens through social partners.

Although some types of play are solitary in nature, most play involves others, and as such, is an important scaffold for learning of all types. Social interaction may be important for some of the more complex, learning-to-learn skills such as critical thinking. Gokhale's (1995) work demonstrated that there is a particular benefit for critical thinking skills when children work in groups versus when they work alone. Similar positive relationships are seen among children's language abilities, creativity, and social play (Holmes, Romeo, Ciraola, & Grushko, 2015).

Interactions fuel learning throughout life

Importantly, research shows that social interactions early in life set the stage for learning and development throughout the life course. Positive caregiver-child interactions help build the neural foundations for developing healthy socio-emotional regulation and protecting from learning barriers, such as stress (Center for the Developing Child at Harvard University, 2016). Early social interaction can promote plasticity in the brain to help cope with challenges later in life (Maier & Watkins, 2010; Nelson, Fox & Zeanah, 2013; Nelson, 2017). Furthermore, social interaction activates brain networks related to detecting the mental states of others, which can be critical for teaching and learning interactions (German, Niehaus, Roarty, Giesbrecht, & Miller, 2004).

Future directions and unanswered questions

In the 21st century, space for learning through play is contested across children's spheres of life: at home and in their communities, as well as in school contexts.

Many families, in particular those with lower incomes, are pressed to make ends meet: 'It's exhausting to be a parent in any circumstance, but it's much more exhausting to be a parent when you don't have the resources that other families have" (Lew-William, October 3, 2016). This leaves caregivers little energy for positive interactions with their children, despite the significant benefits of such interactions (Bono, Francesconi, Kelly & Sacker, 2014; Hurley, Yousafzai & Lopez-boo, 2016). At a policy and practice level, recent decades have seen a push for children to learn academic skills at ever younger ages. For example, US kindergartens have shifted towards more literacy and math content, direct instruction, and assessment, over creative and child-led activities (Bassok, Latham & Rorem, 2016) as well as recess in both US and Britain (Pellegrini & Bohn, 2005).

International evidence is mounting
On the other hand, the importance of learning through play and child-centred practices is gaining traction internationally, fuelled by inspiring examples such as ReachUp. This home visiting programme is based on the Jamaican Study (Gertler, Heckman, Pinto, Zanolini, Vermeersch, Walker, … & Grantham-McGregor, 2014), and showed impressive gains for children living in under-resourced contexts. In the intervention, a community health care worker visits new mothers for one hour weekly, teaching parenting skills and encouraging them to interact and play with their children. Amazingly, the participating children caught up with more advantaged peers in their cognitive development, mental health and social behaviour.

Research also begins to show how child-centred preschool lays a more solid foundation for later learning than an academic focus alone (Marcon, 2002; Campbell & colleagues, 2008; Weisberg, Hirsh-Pasek & Golinkoff, 2013). A number of educational programmes offer inspiration for future efforts. For example, the Montessori curriculum, which emphasises the importance of children actively directing their own experiences, has been shown to lead to positive results on academic as well as social and behavioural measures (Lillard, 2016). Another programme worth noting is the Abecedarian Approach (Ramey, Sparling & Ramey, 2012). This early childhood education programme targeted infants and young children from low-income families. The researchers investigated if providing children with enriched learning experiences, embedded in stable, nurturing and responsive relationships with caregivers, could buffer against the adverse effects of poverty.

In the first longitudinal study, two groups of children were compared: 57 children were enrolled in the programme, while 54 children were not. For both groups, families received basic nutrition, supportive social services, and health care during the first five years of the child's life. The main difference was attendance of the full-day preschool programme, where activities were designed to be highly engaging

and fun (Ramey, Sparling & Ramey, 2012). The authors underscore an important view of children as active learners, explorers and responders. Learning was seen as occurring throughout the day including during daily routines, physical play and exploration. Results showed that children experiencing the Abecedarian Approach improved on their academic and social competencies, achieved higher education levels, and were more likely to have full-time, higher paying jobs than the control. Still, some have raised questions about the programme's effectiveness (Spitz, 1992) and the relative cost versus benefits of implementing such a programme on a large scale (Masse & Barnett, 2002).

More research is needed

It is clear, more work has yet to be done: the reality for many children is that gaps persist between good intentions, policies and actual practices (Yoshikawa et al., 2013; Ramstetter, Murray, & Garner, 2010; Cheng, 2015; Nicholson, Bauer & Wolley, 2016). Next, we outline five particular areas of research that, to our minds, are central next steps in helping clarify our understanding of learning through play, and in overcoming gaps in policy and practice.

1. **Cross-cultural evidence**

   Almost all work cited in this review, and available via traditional research streams, is done in Western cultures. Although many would interpret the play characteristics and the impact of learning through play to be universal, the data simply does not yet exist to back up this claim. In the future, it will be important to conduct studies across cultures to determine whether learning through play yields the same benefits across contexts and cultures.

2. **Linking learning through play to diverse outcomes**

   Although many studies have investigated playful learning and its benefits for content knowledge (e.g., math, spatial information, vocabulary), much less work has been done to examine the benefits of learning through play on more dynamic, learning-to-learn skills such as executive function, communication, collaboration, and critical thinking. Many of the current studies that do investigate whether play interventions improve skills such as sociability or creativity suffer from methodological flaws that limit the conclusions that can be drawn. A recent review, for example, examines the impact of pretend play on child development and finds that the evidence is mixed and additional studies are needed before one can draw a firm conclusion on the impact of pretend play (Lillard, Lerner, Hopkins, Dore, Smith, & Palmquist, 2013). This kind of principled, objective, critical view of the data is necessary for play research in general and especially needed when examining more complex learning-to-learn constructs.

3. **Methods for testing higher level skills**

   As the skill one is testing becomes more complex, it becomes harder to investigate the impact of learning through play. For example, although researchers can easily test a child's vocabulary before and after playful learning, it is harder to test whether a child's critical thinking or innovation improves. Secondly, due to the changing and dynamic nature of both child development in general and of play in particular, it is difficult to do the kinds of principled, controlled studies that would allow researchers to determine the causal mechanisms linking play to outcomes. One cannot simply assign children to either a "no play" or "play" group and measure outcomes. Although highly problematic, these are challenges that can be solved. The job of scientists and researchers is to develop innovative ways of testing these constructs.

4. **The changing nature of play and play characteristics**

   In this white paper, we outlined five evidence-based characteristics that help children learn and that define playful learning contexts. Much work remains to be done, however, to determine how varying levels of these characteristics support different types of learning across childhood. For instance, work on the video deficit with children (e.g., Anderson & Pempek, 2005), in which younger children are unable to learn new information through passive television watching but older children can, suggests that social interaction helps younger children to learn but that it becomes less important (at least in some cases) over time. The literature review on the role of play in children's development (Whitebread, Neale et al., 2017) starts to theorise about the way different types of play espouse these characteristics in different ways. However, work remains to be done to establish how different types of play support learning across ages.

5. Neuroscientific insights

As hinted at in this piece, neuroscience is beginning to uncover the neural mechanisms of the characteristics of playful experiences and how these link to learning. Although neuroscience evidence is beginning to mount, further work is needed. This topic is covered in the literature review 'Neuroscience and learning through play: a review of the evidence' (Liu, Solis et al., 2017) and we anticipate much more insight over the next decade as the technology improves enough that testing infants and young children in more naturally occurring situations (e.g., play situations) becomes more affordable and less invasive.

Closing thoughts

The goal of this white paper has been to summarise the most recent, rigorous research on the role and importance of play for children's life and learning. We conclude that the evidence on learning through play is mounting; more than an enjoyable experience, engaging with the world in playful ways is essential for laying a foundation for learning early in life. Beyond infancy and toddlerhood, learning through play is also proving to be an effective and worthwhile pedagogical technique for teaching in the 21st century.

Still, we have much yet to discover about learning through play. For example, what is it about play that fuels learning more specifically - from the level of neurons to children's behaviour and interactions with peers and adults? How can we extend research on guided play to the more complex learning-to-learn skills, as well as other cultural contexts? Research into each of the areas will help close important gaps in our understanding of learning through play, and offer a crucial evidence base to inform the decisions of those influencing children's daily lives, learning and prospects: across homes, communities, schools, governments and wider systems.

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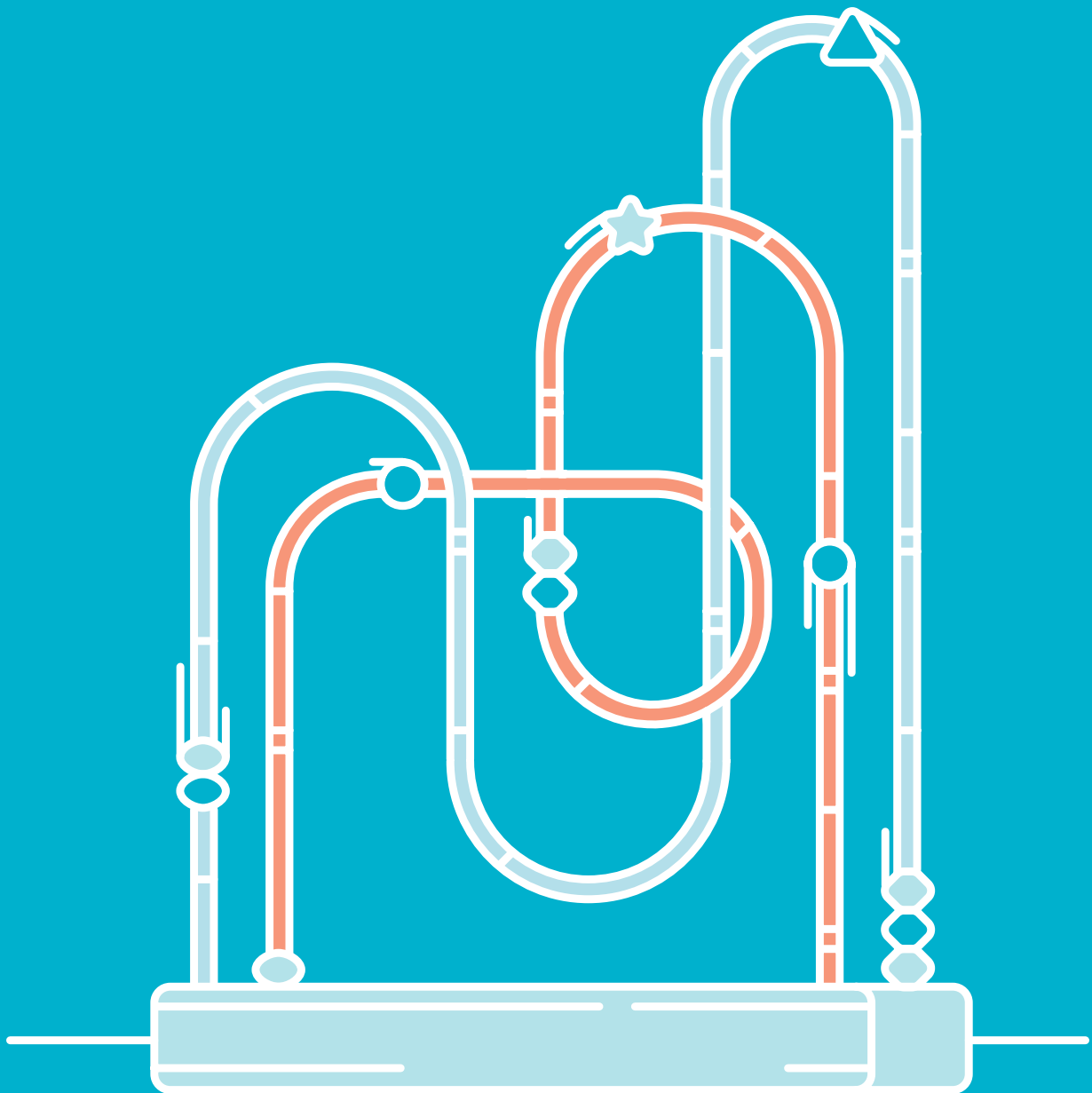
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