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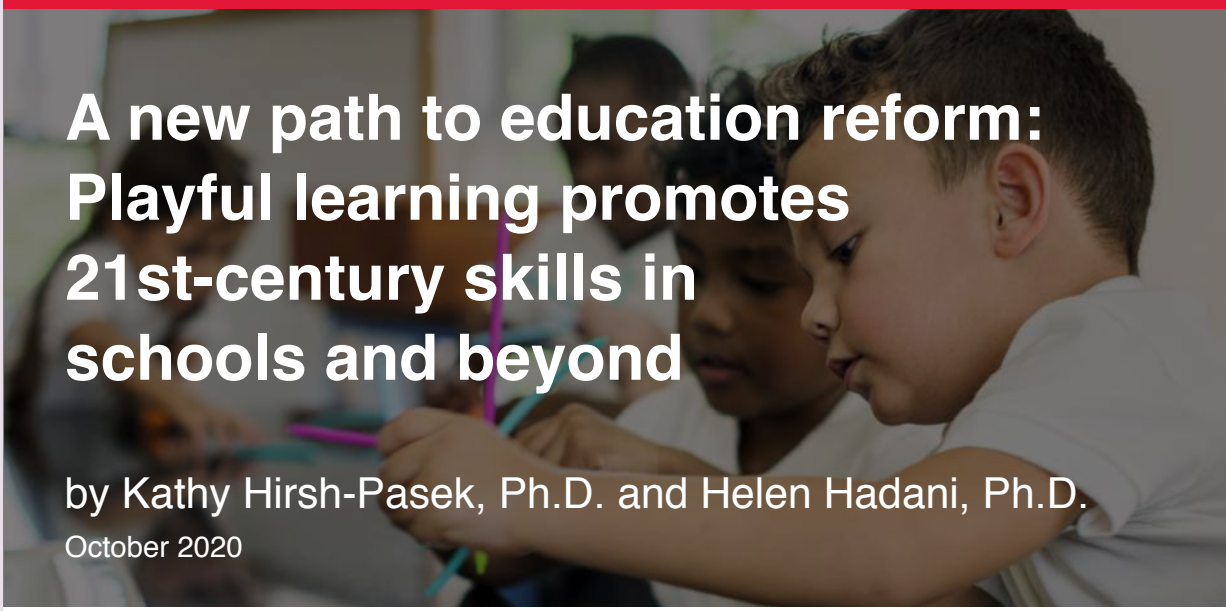

A new path to education reform: Playful learning promotes 21st-century skills in schools and beyond

by Kathy Hirsh-Pasek, Ph.D. and Helen Hadani, Ph.D.

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Executive Summary

The American education system is not preparing all children to thrive. Amidst a national movement to dismantle systemic racism, our schools risk propagating educational inequity by design. Only the most affluent students receive the highest quality education that emphasizes student agency and engagement through collaboration and inquiry.[1] Many schools across the United States remain trapped in an outdated "horse and buggy" model of education, particularly when instructing students from under-resourced communities. These schools frequently operate according to a "factory model" that emerged in the early 20th century to mold students for the industrial economy. Under this system, students are considered the "products" of the system with standardized assessments serving as "quality control" measures to encourage effective instruction.[2]

Over the past several decades, we have attempted to repair the educational "buggy" through substantial reforms.[3] These include passage of *No Child Left Behind* in 2002[4] and the development of the *Common Core State Standards* beginning in 2009.[5] However, attempting to transform the industrial era "horse and buggy" model of education by incrementally adding new wheels and an upgraded engine is insufficient. Creating a revolutionary "Tesla" model of education is necessary for better attainment of 21st-century skills. Here, we offer an evidence-based approach to education inspired by research from the science of learning addressing *how* children learn and *what* children need to learn to be successful in the 21st century. Critically, the implementation of this framework must be flexible and culturally-relevant, while maintaining core principles that foster educational equity for all students.

Problems with maintaining the status quo

A robust base of evidence justifies our call for an overhaul of America's schools.[6-9] This is the prime moment in history to take these calls seriously. Data from the *National Assessment of Educational Progress* (NAEP) do not reflect consistent growth for all students across the United States. National average reading scores show limited growth over the past several decades[8] and NAEP math results show gradual improvement over the same time span, but this growth does not apply to all students.[8]

Schools were also greatly impacted by *No Child Left Behind* (2002),[4] a federal law that established an educational environment centered almost exclusively on students' reading and math assessment scores with punitive measures in place to hold schools accountable for student performance.[3, 6, 9-10] In this context, curricula narrowed substantially.[11-12] School became less satisfying and more stressful for teachers,[13-14] and ultimately less engaging for students.[15] All the while, the desired gains in students' reading and math skills failed to emerge.[7, 9] While some blame this on the great diversity within the United States, analyses indicate a *positive* relation between a country's percentage of immigrant students and the academic performance of their immigrant and non-immigrant students on the Programme for International Student Assessment (PISA).[16] Under the *Every Student Succeeds Act*, which replaced *No Child Left Behind* in 2015, student reading and math assessment performance remains a priority and low-performing schools may be subject to state interventions.[17]

In fact, the current educational system places the United States at a disadvantage internationally. The 2018 PISA was administered by the Organization for Economic Cooperation and Development (OECD) to 600,000 15-year-old students in 79 countries.[18] It found that students in the United States performed above the OECD average in reading, but below the OECD average in math, ranking 13th and 37th, respectively, compared to our students' international peers. For comparison, Canada ranked 6th in reading with the United Kingdom standing at 14th. In math, Canada and the United Kingdom ranked 12th and 18th, respectively.[19-20] Unfortunately, these are two data points in a pattern of poor performance, since the PISA reading and math scores for the United States have remained virtually unchanged since the early 2000s.[19]

The PISA is designed to evaluate not only what children learn, but how effectively students apply their knowledge[20] across eight, increasingly demanding proficiency levels in reading and six levels in math.[18] It does not simply require students to recite facts they memorized in school.[20] Therefore, while we acknowledge that assessments are helpful tools to hold schools accountable for student growth, we suggest that American students' lagging performance on the PISA is attributable to an educational system—and accompanying assessments—that are narrowly focused on content outcomes, rather than on the ability to critically think through a problem and to apply new knowledge systemically. Although we may have taught students to memorize information, they have not gained the critical skills to generalize and retain what they learn.

What are the skills students will need for success in the 21st century?

These data and advances in the science of learning indicate that a narrow, exclusively content-focused view of education is insufficient, raising a critical question: What can replace it to provide all students with quality education in the 21st century? Leaders of some of the largest technology companies in the United States highlight the importance of critical thinking, communication, collaboration, creativity, and leadership.[21-22] An IBM survey of more than 1,500 chief executive officers from 60 countries identified creativity as the most important leadership attribute.[23] As quoted in a 2020 report by Michelle Davis of *Education Week*, Michele Freed, general manager of education experiences at Microsoft, noted, "To be successful students

must ... be able to deal with complex and ambiguous problems and, most importantly, collaborate with each other to succeed."[21] The value of these skills extends beyond business. They are viewed as essential in a wide array of fields.[24-25] Students who develop these skills will not only be desirable employees, regardless of their specific career goals, but they are more likely to be protected from automation and outsourcing.

If we teach using a *breadth of skills* approach, we adapt how we teach to the ways that human brains learn. In short, our global, "factory-based" models of education were fashioned as "sage on the stage," or "empty vessel," approaches in which teachers are purveyors of knowledge that is poured into the empty heads of eager students.[26-28] This contrasts with the more Socratic "guide at the side" models in which children are active participants in their own learning.[29] Internationally, this approach contributed to Finland's educational success. There, high-stakes standardized tests were exchanged for a pedagogical approach that emphasizes collaboration and frequent opportunities for students to be engaged learners and to make their own decisions in the classroom—ideas that ironically originated in the United States, but were widely implemented in Finland.[30] In fact, a growing number of countries, including Chile, Sweden, and Singapore, are following in Finland's footsteps and dropping high stakes testing in favor of more equitable models that focus on the role of play and whole-child education.[31] Finland also emphasizes educational and broader societal equity, as well as teacher education that attracts highly motivated teacher candidates with evidence-based training. These features act in concert with the pedagogical methods described here to foster Finland's remarkable educational prowess.[30]

A call for playful learning and a breadth of skills approach to education

It is time for a scalable, evidence-based education reform that puts student engagement, educator expertise, and equity at the center. Specifically, we recommend adopting a method for keeping students engaged in the classroom, reflecting the latest evidence on how children learn best. Through this approach, students and teachers will see that learning can be active, engaging, meaningful, socially interactive, iterative, and joyful.[32-33] Playful learning advances these goals and will facilitate instruction using a breadth of skills approach that we call the 6 Cs: collaboration, communication, content, critical thinking, creative innovation, and confidence, all of which are evidence-based, malleable, and, to some degree, measurable.[34] While play is often associated with the early years, we advocate for the critical role of playful learning in all stages and grades. This method does not require educators to adopt a specific curriculum, but rather respects their expertise in the classroom by offering educational principles that can be widely applied.

Developing students' 6 Cs skills through playful learning promotes educational equity. It is a low-cost approach that ensures that all students can receive the skills and educational experiences necessary to become critical thinkers and engaged problem-solvers, eager to use the skills they learn to pursue their goals. At the same time, the flexibility of playful learning and the 6 Cs provides a way to accommodate a broad array of student interests, cultural experiences, and knowledge between students' homes, communities, and schools—a critical component in meaningful education.[35-36] This approach fundamentally alters the traditional view of educational success of "Did our child do well on the test?" to a definition that celebrates "happy, healthy, thinking, caring, and social children who become collaborative, creative, competent, and responsible citizens tomorrow."[34] We expect that our recommendations will help all students remain engaged in the classroom and support their development of critical skills that are necessary for success in the 21st century, regardless of the path they choose and the cultural context in which they live.

How children learn: Playful learning principles

Playful learning is an umbrella term that includes both free play and guided play.[33] These play types lay along a spectrum that ranges from free play to direct instruction (see Figure 1, and all subsequent figures and tables, in the appendix).[33] Free play is characterized by the child both setting up and engaging in their own play without a clear learning goal (e.g., making a pillow fort). At the other extreme is direct instruction, in which the adult exercises control, both initiating and directing the lesson throughout toward a learning goal. In guided play—at the middle of the play spectrum—an adult initiates or designs an activity that is centered around a learning goal. However, children maintain control over their learning within the context that the adult provides (e.g., a well-curated, science-based children's museum exhibit). Playful learning can be implemented through a number of pedagogical practices including theme-based learning and project-based learning, where children construct knowledge by exploring a real-world problem that is often driven by student interest in inquiry.

Six key characteristics are inherent in playful learning contexts. Research demonstrates that children learn best when they can be active and engaged in learning that is meaningful, socially interactive, iterative, and joyful.[32-33]

- **Active ("minds on"):** Both anecdotal and experimental evidence support the benefits of active learning—where children are focused and engaged in the learning process through questioning and reflection—over passive learning where students listen and memorize information.[37] In a widely-cited study with preschoolers, Bonawitz and colleagues found that young children who were primed for active learning were more likely to engage in exploratory play and discover hidden functions of a new toy compared to peers who passively watched an adult play with the novel toy.[38] Additional support for active learning comes from studies showing that children can build spatial skills[39-40] and learn properties of shapes[41] and new words[42-43] better when they are actively involved in the learning process versus passive receivers of information.[37] Students particularly benefit from active learning when the teacher does not provide high-quality instruction.[44]

- **Engagement:** One of the biggest challenges in learning environments is for children to filter out distractions and focus their attention on the task at hand. Engagement is critical for learning, especially in the toddler and preschool years when children's focus and attention increases significantly.[45] Young children may be easily distracted by seemingly inconsequential elements of the environment, as shown by Fisher and colleagues, who found that kindergarteners who completed science lessons in a highly decorated classroom learned less science content than when they were in a more sparsely decorated classroom.[46] However, the method of instruction matters when capitalizing on the fact that we learn from others.[47] Elementary school students show greater on-task behavior, reflecting their engagement, during small-group activities than whole-class instruction.[48] The benefits of small-group instruction even extend to students' learning outcomes from elementary school through the college level.[49]

- **Meaningful:** When children can connect their own experiences and interests to new information, this makes their learning more relevant to their own lives and richer. For example, there is a difference between introducing children to fractions with flash cards versus asking them to divide a pizza or apple pie evenly so that everyone in their family gets an equal piece. Research in children's museums suggests that adults can help children make learning meaningful by highlighting connections between new concepts and personally relevant and familiar information.[50] For instance, Callanan and colleagues (2017) explored the role of family science talk on children's conceptual

engagement in a museum exhibit and found a positive association between elaborative questions asked by parents (e.g., "Where do you think the top of the mouth is?") and children's use of language indicating they were conceptually engaged with the subject matter (e.g., "It looks like an elephant.").[51]

- **Socially interactive:** Beginning in infancy, we seek out interactions with others.[52] This desire for social interaction is fundamental to education. Dewey pioneered experiential learning with emphasis on the approach as a social process[53] and Vygotsky further declared that optimal learning occurs when students are collaborating with their peers, teachers, and others in their environment.[54] With respect to play, research finds that cooperative play with peers supports many aspects of children's development, including areas of cognitive, social, emotional, and linguistic growth.[55-56] In a study examining cooperative problem solving among peer dyads, Ramani (2012) found that preschoolers in a child-driven, playful setting built more complex structures and engaged in more positive communication (e.g., suggestions, narrations, and agreements) than children in a more structured adult-driven setting.[57] While Ramani's findings demonstrated that playing with peers supports learning, scaffolding and guidance from an adult is often helpful in navigating complex and dynamic peer interactions.[58] However, adults should be mindful of the limitations of direct instruction in an educational setting. In a study with preschoolers, those who received an uninterrupted, explicit demonstration of a single function on a toy with multiple capabilities spent less time than their peers exploring the toy's other functions, so they did not learn as much as they could from the experience.[38]

- **Iterative:** An ever-growing body of literature demonstrates that children generate, test, and revise hypotheses while interacting with their environment based on data.[59] In other words, learning is an iterative process. Research indicates that even infants have expectations about properties of objects and are motivated to learn when those expectations are violated. In one study, infants who watched an unexpected event (e.g., a ball rolling and magically passing through a wall) were more likely to learn about a hidden property of an object (e.g., the ball makes a sound) than infants who watched a "normal" event. Relatedly, research with preschoolers indicates that children will explore objects and causal relationships more when they observe events that violate their expectations.[60-61] While all play can be iterative, guided play in particular can be viewed as "constrained tinkering" where adults help to narrow children's range of hypothesis testing, and the play and flexible context encourages children to test and revise their theories about how things work.[33] This permits valuable learning through exploration.[62]

- **Joyful:** Joy and positive emotions are inherent elements of play. Research by Isen and colleagues demonstrates that positive affect can boost creativity and make people's thinking more flexible and integrative.[63-64] A recent model even links student participation in activities that bring them joy (e.g., sports, dance, and music) to gains in executive function skills and academic outcomes.[65] Developmental researchers have investigated the important but elusive role of positive and negative emotions in children's pretend play and creativity, and concluded that emotion and imagination go hand in hand, and are integral to the development of creativity.[66-67] Relatedly, the Affect in Play Scale—which examines the amount, variety, and intensity of feelings children express during play as well as children's organization and imagination exemplified in play—(created by Russ and colleagues) has been used in a range of studies to show that the feelings children express in their pretend play are linked to divergent thinking (i.e., generating

many different solutions to a problem) and creativity in stories.[68-69]

Successful models of playful learning

These principles of playful learning provide guidelines for how the approach may be implemented. Critically, playful learning should be tailored by educators to align with their students' interests and experiences, as well as the specific academic standards they are expected to meet. There is no single "right way" to implement playful learning. There are models that illustrate how some schools have implemented playful learning in some form across grade levels and communities. We use these models to illustrate how our approach can be used in practice, even though the examples we present are not specifically founded on these principles.

Radnor Middle School in suburban Philadelphia is a pioneer in this area. Since 1987, their *Watershed* program has engaged 7th-grade students in collaborative, interdisciplinary language arts, social studies, and science projects related to the local watershed[70] with similar programs later established for sixth and eighth graders.[71] These educational innovations are not limited to more affluent suburban communities, such as Radnor Township, [72] or older students. At the East Side High School in Newark, New Jersey, many students contend with the challenges of poverty. Yet they pursue their own interests in collaboration with peers in their school's "Future Lab," which is stocked with resources from a sewing machine to a 3-D printer.[73] At Keet Gooshi Heen Elementary School in Sitka, Alaska, a second-grade teacher frequently uses the popular computer game *Minecraft* to engage her younger students in creative, collaborative, and interdisciplinary playful learning, such as organizing a virtual mining expedition to the Alaskan Klondike.[73] In preschool classrooms around the world, students develop their mathematical language when they can practice those terms in the meaningful setting of a birthday party.[74-76] This scaffolding with playful learning materials also promotes preschool students' literacy skills.[77] Preschool teachers can structure students' play beyond providing materials and offer guidance towards learning goals,[78-79] as long as student agency is preserved.

Beyond these case studies, the EdLeader21 Network includes over two hundred schools and school districts. Members advocate for including the "4 Cs" of critical thinking, collaboration, communication, and creativity in the classroom.[80] A few states now support a play-based approach to early childhood education, including New Hampshire[81] and Maryland. [82] The identification of these model schools, one education network, and two states indicates that our proposal of engaged, playful learning is not the norm in American education; yet it is possible to implement across communities and grade levels with guidance from the teachers and administrators who have experience with the approach and see its value in the classroom on a daily basis.

Fortunately, many educators seem ready to consider playful learning as a model of active, motivated learning in school and out. As a recent survey from the education newspaper *Education Week* reported, 51% of the 586 educators who responded called curriculum reforms to prepare students for "the jobs of the future" a "top priority." Only two of the educators surveyed indicated that their districts were not addressing this critical objective.[83] Our playful learning approach is responsive to this concern, since the set of skills that it promotes fosters life-long learning across fields.

What children learn: The 6 C's approach to education

Active, engaged, meaningful, socially interactive, iterative, and joyful activities are the central tenets of playful learning. If play embodies how we learn, it leaves open the question of what we need to learn to thrive in a 21st-century, global world. The addition of a learning goal produces guided play. With this pedagogical framework constructed, students can readily also learn the 6

Cs, a suite of skills intended to engage students in learning and prepare them for success in the 21st century, regardless of their chosen field. These include collaboration, communication, content, critical thinking, creative innovation, and confidence. The 6 Cs are all rooted in the science of learning and build on each other. For example, without collaboration, students will struggle to become strong communicators, since they have not yet learned how to be sensitive and respond appropriately to others (Figure 2).[34] This integration of the 6 Cs is analogous to how we read, a process that also relies on the 6 Cs. We tend to think of reading—a content area—as a singular skill. Yet research suggests that learning to read leverages children's communication skills, using the components of oral language and a rich vocabulary,[84] as well as their critical thinking; [85] not everything in print is true.

Within each skill, a student's progress can be categorized within four distinct levels (Figure 2 & Table 1 in the appendix). The 6 Cs are also measurable using different methods from education and developmental psychology.[34] On a related point, students can follow different paths to develop their 6 Cs skills. Even the "C" of content does not mandate the use of a specific curriculum manual. Instead, the 6 Cs represent a largely skill-based model that educators can—and should—adapt to fit their curricula and standards and, critically, the interests and backgrounds of their students. The 6 Cs continue to grow and build on each other over time and with experience. They are part of a dynamic learning system. For example, a student may be a skilled communicator, but need practice with critical thinking. Students may also need support transferring their 6 Cs skills across scenarios, as with a student who demonstrates strong written communication skills in English class but does not clearly communicate with his teammates on the soccer field.[34]

With this framing, it remains important to identify each of the 6 Cs, in turn, as presented by Golinkoff and Hirsh-Pasek (2016):[34]

- **Collaboration**: Considered the most fundamental 6 Cs skill, collaboration reflects how social engagement is central to human nature. It encompasses everything we do to get along with others and control our impulses. Through collaboration, we build communities and promote diverse cultures.[86] Recent neuroscience research even shows how collaborative play yields unique patterns of synchronized brain activity between infants and adults.[87] These initial collaborations further support the development of young children's self-regulation skills.[88] Children advance their understanding of collaboration throughout the elementary school years,[89] which supports academic achievement.[90] Golinkoff and Hirsh-Pasek (2016) describe how our collaborative skills progress across four levels from "On My Own" to "Building It Together" (Table 1).[34]

- **Communication:** Communication is essential in everything we do—from talking to parents and teachers to interacting with our supervisors and partners. It includes speaking, writing, reading, and listening.[86] In early childhood, language skills develop through back-and-forth conversations between children and their parents.[91] When children begin kindergarten, their language skills at that time are the strongest predictor of their academic performance in language, reading, and math, as well as their social skills.[92] Within communication, Golinkoff and Hirsh-Pasek (2016) call the first level of the skill "Raw Emotion." We then gradually progress toward the fourth level, when we can "tell a joint story." This framework applies equally well to written communication. In that context, "Level 1" writing is extremely unclear and egocentric. By contrast, a "Level 4" article or course paper is clearly organized around an established argument and sufficient evidence is provided for the reader to understand the writer's claims (Table 1).[34]

- **Content:** We broadly define content to include

reading, writing, math, science, social studies, and the arts. Content builds on the scaffold of collaboration, and particularly communication, across the disciplines, including math,[39, 93-94] literacy,[94-95] science, and social studies.[96] Beyond these conventional subjects, we recognize the importance of skills that allow us to advance our own knowledge. These "learning to learn" or executive function skills, such as attention[97] and working memory,[98-99] support students' academic achievement. As with collaboration and communication, Golinkoff and Hirsh-Pasek (2016) suggest that our content knowledge advances across four levels from situation-specific early learning, involving the acquisition of discrete pieces of information to the development of deep expertise with room for reflection on one's own knowledge (Table 1).[34]

- **Critical Thinking:** Strong critical thinkers successfully navigate through the vast sea of information in our world to obtain accurate content knowledge.[86] As students gain exposure to academic content both inside and outside of the classroom, they must leverage critical thinking to evaluate the quality of the information they receive and ideally take those skills with them beyond the classroom walls.[100] Yet students particularly struggle with this task when evaluating online sources, an essential skill in the 21st century.[101] However, critical thinking[100] and the related skill of reasoning[102] can be taught. Here, the first level of critical thinking is characterized by the skill's absence as we engage in "seeing is believing" and blindly accept information we receive. Through the second and third levels, we respectively move from recognizing multiple points of view, but seeing information in absolute terms of truth or falsehood, to acknowledging those opinions, yet assuming them to be equally accurate. Gradually, we advance to the fourth level, at which we recognize the existence of a problem and gather and evaluate evidence to solve it (Table 1).[34]

- **Creative Innovation:** This "C" represents a synthesis of content and critical thinking. It is this combination of skills—and the exploration that results[38]—that will enable creative students to use what they know to make something new,[86] developing innovative solutions to the challenges they face now and in the future. Play directly supports that innovation in language and art.[103] However, creative innovation goes well beyond the arts; as Florida (2010) argues, creativity can—and should—be seen as an asset in any job.[104] Here again, we see the benefits of play. As we develop our creative skills, we advance from the tinkering of "experimentation" to pursuing a creative "vision" in response to a potentially complex problem (Table 1)—one that carries over from project to project.[34]

- **Confidence:** While new walkers persist repeatedly after falling, many students lack the confidence to continue working at their academic pursuits. They are not comfortable taking safe risks[86] in the classroom. We need to recognize the importance of confidence for academic learning. Students who exhibit confidence will try new things and take reasonable risks. They will demonstrate persistence and adaptability, even when they experience failure. Confidence is closely related to "grit," which is defined as "perseverance and passion for long-term goals,"[105] and "growth mindset"—the belief that one can improve their abilities because they are not fixed in time at a particular level.[106-107] Individuals who exhibit the first level of confidence "barrel on" without critically evaluating their abilities or comparing themselves with others, a characteristic of young children.[108] This is potentially advantageous, since pushing ahead teaches us about the world. However, this approach has serious limitations, as when inabilities are not recognized during early childhood, resulting in serious injury. Over time, we reach the fourth level of confidence, at which we "dare to fail" and take calculated risks. In the

event of failure, we learn from our mistakes. Individuals at this level typically exhibit high levels of grit and growth mindset (Table 1).[34]

The 6 Cs collectively offer a comprehensive framework of vital skills that can be naturally developed through playful learning. The "Cs" scaffold each other, building on the foundation of collaboration and communication moving toward the development of greater confidence in the classroom, workplace, or other areas of daily life.[34] Thus, they offer a cradle-to-career approach.

Bringing together the how and what of learning

Thus far, we have addressed the "how of learning" with respect to the playful learning principles, and the "what of learning" reflected in the 6 Cs, using broad terms. Several examples allow us to move from the theoretical to the implementation of the learning model. However, these examples are but suggestions, and not meant as mandates. Educators are highly encouraged to apply their own educational expertise and knowledge of their students and curricula to develop activities, as long as the core features of playful learning and the 6 Cs remain present. Critically, it is this adaptability of our playful learning and 6 Cs model that enables it to promote educational equity. Our approach can be modified to fit any group of students' interests, skills, or ambitions, which led one school superintendent at a workshop we conducted in Michigan to call playful learning and the 6 Cs the "least discriminatory" approach to learning he had seen.

While adaptable implementation is a central feature of the framework created by combining playful learning and the 6 Cs, the key elements we identified should be preserved in some way. The presence of playful learning principles and the 6 Cs in the classroom can be confirmed using a checklist (Figure 3) that enables the optimization of learning in any context, whether at the classroom, school, or district level. It may even be applied to informal educational environments, such as museums and community spaces.[109-111] One need only ask of any curriculum or classroom activity, how do the kids learn—was it active, engaged, meaningful, socially interactive, iterative, and joyful, and what was the learning goal of the activity? Was it collaborative, creative, etc.? Together, these two grids offer a profile that can be used to evaluate teacher attitudes around an activity, to examine whether it enables or hinders the aspects of the how and what of learning, and the final outcomes. It is likely that, in any project or activity, we will embrace more than one principle of each of the grids. The checklist is meant for planning and self-evaluation, rather than high-stakes evaluations of teachers, administrators, or other key stakeholders in schools or broader communities where playful learning and the 6 Cs are implemented. Examples illustrate these points.

Evidence for a playful learning approach without explicit implementation of the 6 Cs

Tools of the Mind (Tools)—a preschool and kindergarten curriculum developed by child development experts to promote executive function skills (e.g., exercising self-control and paying attention)[112-113]— demonstrates the principles we have described through an array of teacher-facilitated, hands-on activities. Common activities *Tools* classrooms use to achieve their goals include meaningful and social pretend play, memory and attention aides (e.g., a picture of an ear to remind children to listen), and play plans in which children write or draw the activities they envision for their day.[113-114]

A number of research studies have investigated the impact of *Tools* on executive function and academic skills including reading, writing, vocabulary, and mathematics.[113-117] Most recently, Diamond and colleagues (2019) found that kindergarten students who completed *Tools* demonstrated greater gains in their reading and writing skills than their peers who experienced typical instruction. This pattern of growth also applied to students' self-control and attention skills. Among teachers, those who used *Tools*

reported greater levels of professional satisfaction than their colleagues who continued typical instruction. Rather than being exhausted by the end of the school year, *Tools* teachers remained excited and looked forward to the next year. For both students and teachers, joyful learning increased as a result of the *Tools* curriculum.[113] Of note, an evaluation of *Tools* conducted with pre-kindergarten students in Tennessee and North Carolina found null results versus comparison conditions—the likely result of less than ideal implementation of a complex and dynamic curriculum.[118] *Tools* represents a comprehensive playful learning approach. Students are active and engaged in highly meaningful and socially interactive learning activities, including pretend play. These activities promote iterative learning while interacting with peers. Through all of these activities, *Tools* makes learning joyful. Although *Tools* does not explicitly provide 6 Cs-oriented instruction, its emphasis on pretend play and social interaction should promote those skills, especially collaboration and communication in support of content knowledge. Some activities may also boost critical thinking, creative innovation, and confidence (Figure 4).[113-114]

How the 6 Cs can be incorporated

Thematic learning as a broader method of applying playful learning and the 6 Cs in the classroom

Thematic instruction, or theme-based learning, is one well-established method that can foster an engaged, playful learning environment and support students' 6 Cs skills in the classroom.[119-121] In this interdisciplinary pedagogical approach, educators guide their students through a series of lessons and activities related to a broad, overarching theme (e.g., "mapping" or "Costa Rican rainforests").[120-121] While some themes may originate in certain subject areas, interdisciplinary connections should be abundant.[119, 121] For example, when studying Costa Rican rainforests, students can work together to identify them on a map and then incorporate science and literacy by reporting on the many plant and animal species that reside there, critically thinking about the ecological consequences of deforestation. Students may even bring their interdisciplinary learning outside of the classroom by collaborating on creative efforts to preserve the rainforest with friends and family.[120] To provide a more recent example, one school district we are collaborating with to implement the 6 Cs chose the theme of farms and the farmer's market. Themes like this one are not only interdisciplinary, but relevant to the students' lives, which makes the learning more meaningful.[121] The theme-based approach allows teachers to deliver their core curriculum as mandated while adding our playful learning principles as the "how" of learning and the 6 Cs as the "what" of learning to the approach—creating a pedagogically broader classroom.

Based on this conceptual framework, it is important to address a few practical points about the implementation of thematic instruction. Themes must be sufficiently broad to support interdisciplinary connections and deep critical thinking (e.g., the community or exploration). It is important to avoid classifying narrow topics as themes (e.g., bears), which generate superficial connections and limited critical thinking.[121] Since thematic instruction is a deeply student-focused pedagogical approach, a wide array of students benefit from it.[122-126] For example, students from under-resourced communities rely on thematic learning's interdisciplinary connections and personally relevant instruction to boost their vocabulary skills.[125] Students with special needs[123] and those who are English language learners can also benefit from thematic learning,[122, 126] again demonstrating how educational equity is a pillar of our approach.

Building on this summary of thematic learning, it is essential to demonstrate how educators might employ it to implement playful learning and the 6 Cs, using our checklist (Figure 3) as a helpful resource. Returning to the classroom that pursued the rainforest theme, at one point, students learned about the different elevation

levels found throughout the rainforest and made predictions about the climate at those levels.[120] This was an active, engaging, and socially interactive activity, during which students could refine their predictions through an iterative process. At the same time, the lesson supported students' content knowledge, as well as their collaboration, communication, and critical thinking skills. As another activity, the students participated in a campaign to recycle cans and preserve a section of the Costa Rican rainforest in partnership with a non-profit organization. Based on parent feedback, this activity was particularly engaging and meaningful for the students. It further encouraged students to practice their communication and collaboration skills with friends and family. To demonstrate application of our checklist (Figure 3) in this example, we will focus on an activity Rosenbusch (1994) described in detail: Students constructed models of Morpho butterflies that live in the Costa Rican rainforest. Although the teacher still provided materials and instructions, the students were active and engaged in a socially interactive and joyful project. Here, the impact of the project on the students' content knowledge was clear, since "After participating in the activity, children had no difficulty identifying and describing the characteristics of the Morpho butterfly."[120] During the lesson, there were likely many opportunities for students to collaborate and communicate with each other and engage in creative problem-solving using the materials provided (Figure 5).[120]

Using technology to introduce teachers to lessons that combine playful learning and the 6 Cs

Project Rangeet, recently implemented in Bangladesh, introduces elementary school educators to an array of lessons that help students recognize the importance of respecting themselves, their society, and their planet.[127-128] These include "We Are All Made of the Same Stuff," an activity that addresses equality, diversity, and discrimination using play dough sculpture, the "Build It Challenge," a collaborative project that helps students empathize with people who have physical disabilities, and "Creating a Food Web," which employs art and movement as students construct a food web and then demonstrate what occurs when the food web's central tree is cut down.[129] Educators obtain lesson materials through Project Rangeet's original mobile app.[127-128] These lessons are aligned with the United Nations' Sustainable Development Goals[127-128], but Project Rangeet's curriculum also reflects our all playful learning principles and the 6 Cs (Figure 6).[129]

Montessori preschool as a model of playful learning and the 6 Cs in early childhood

Our playful learning and 6 Cs approach closely aligns with the pedagogy of Maria Montessori in support of our youngest learners. Developed in Rome over a century ago, the Montessori approach emphasizes student agency and confidence with the teacher facilitating the learning process.[130-131] Montessori preschool students complete hundreds of tasks[130] that are aligned with their interests and designed to facilitate active, engaged, meaningful, and socially interactive learning. As students focus on their engaging and meaningful activities, they become more joyful learners, and if they make mistakes, they correct their errors via an iterative process.[131] In a Montessori classroom, students leverage all our principles of playful learning to advance their 6 Cs skills of collaboration, communication, critical thinking, creative innovation, and confidence.[131-132] At the same time, Montessori students outperform their peers on assessments of academic and socio-emotional content knowledge (see Figure 7 in the appendix).[133-134]

Ongoing research

While there is little published research directly on 6 Cs in the classroom, our preliminary results from a small urban school district with a high percentage of students from under-resourced backgrounds are promising. In interviews, educators suggested that the 6 Cs helped their students become more engaged learners. At

the same time, the 6 Cs represented a valuable professional development opportunity, as educators adopted a new, joyful approach to instruction focused on student engagement. A student survey demonstrated the effectiveness of the 6 Cs' implementation with respect to critical thinking, creativity, and confidence. Students who received 6 Cs instruction even showed improved standardized test scores in math and reading compared to peers who did not receive 6 Cs instruction. These preliminary findings suggest that implementation of the 6 Cs seems effective. With these grids at a teacher's side, we can tweak educational programs so that they optimize opportunities for learning. In short, we are teaching in ways most compatible with the ways human brains learn.

A cautionary note on using playful learning and the 6 Cs in the classroom

The *Tools of the Mind* curriculum, thematic learning, Project Rangeet, and Montessori preschool are examples of programs that are not specifically designed to be 6 Cs programs, but they do illuminate ways in which we can bring the 6 Cs to life in various pedagogical frameworks. Educators should be mindful to align their instruction, even when using these models, with the principles of playful learning and the 6 Cs. For example, Rosenbusch's (1994) rainforest theme enabled students to construct models of plants and animals that live there. These were active, engaging, socially interactive, and joyful activities that at least promoted students' collaboration, communication, content, and creative innovation skills.[120] Yet the framing of these activities within the principles of playful learning and the 6 Cs is important to help elucidate the factors that make the theme effective for learning. It is critical for students to maintain some agency when creating their models. Additionally, the activity's relevance should be emphasized, such as describing how some living things may become extinct if the rainforest is not protected.

Beyond implementation of thematic learning, educators often use "learning centers" in the classroom. However, these centers depart from playful learning when teachers maintain complete control over the activities that their students complete without permitting collaboration and communication. It is also critical for the activities to be meaningful and engaging. Simply assigning students to complete different worksheets around the classroom does not align with playful learning or the 6 Cs.[135]

In response to this guidance, educators are encouraged to think about their own students and curricula, and then develop lessons that are best-suited for their classrooms. However, the principles of playful learning and the 6 Cs should guide the pedagogical decision-making process. Using the dual checklists is invaluable in this process.

Bringing playful learning and the 6 Cs into the community

Playful learning exists not only in the classroom, but outside the classroom in informal learning spaces. Playful Learning Landscapes (PLL) is an initiative that uniquely blends the science of learning, placemaking, and community cohesion—transforming public and shared spaces into fun and enriched learning hubs and "piazzas" for the development of healthy children, families, and communities. To create these spaces at bus stops, on sidewalks, in parks, and on playgrounds, we were guided by the checklists and principles embedded in how and what children learn. Data from pilot installations show that PLL promotes healthy caregiver-child interactions that are engaging, joyful, and socially interactive.[136-139] For example, Urban Thinkscape—which transformed an abandoned lot next to a bus stop in West Philadelphia into an interactive play space—includes a bench with puzzles on the back and a hopscotch game that promotes flexibility and self-control. The activities and structures in Urban Thinkscape provide opportunities for children to engage in high-quality communication with their caregivers and peers, engage in collaborative problem solving, and

take risks to build confidence. Results comparing Urban Thinkscape to a control site playground found a significant increase in collaboration and collaboration between caregivers and children and content like vocabulary and spatial learning.[137] Research suggests that conversational engagement around specific content like spatial language will help not just literacy, but future STEM knowledge.[93, 140]

Bringing it all together: Leaving the horse and buggy behind

Experts estimate that information is growing at an astounding pace—doubling every 12 hours.[141] Much of what used to require human labor doesn't anymore. While estimates of automation for jobs varies widely by industry and country,[142] it is clear that thinking about learning through the context of breadth, which includes breadth of ages, breadth of context (formal and informal learning) and breadth of skills, is critical for children to succeed in school and beyond.[34] We need to leave the horse and buggy behind and embrace the new "Tesla" model to prepare children for the future workforce. One path to a breadth of skills approach is thinking not only of "how" humans learn, but also "what" they learn—here in terms of the principles articulated in our checklist. This cradle-to-career approach puts in place a strong foundation of core skills that are key for school readiness and career opportunities, and highlight clear pathways to equity in each. With playful learning at the core of this model, the connections between science—what we know about how humans learn—and education become more visible, scalable, and actionable. With the 6 C's overlaid onto the playful learning principles, we see how playful learning will fuel the development of the very skills children will need to succeed in their personal and work lives.

Taking action

To reimagine an education system that adopts playful learning as a method for keeping students engaged and develops a breadth of skills needed to thrive in the 21st century, the following policy recommendations lay the groundwork for this vision to become a reality:

1. **Integrate insights from the science of learning and development into educational practice.** In a recent article, Darling-Hammond and colleagues (2020) advocate for integrating insights from multiple fields including neuroscience, psychology, developmental, and learning sciences to shape more effective educational practices. More specifically, Darling-Hammond et al. emphasize the importance of understanding how developmental processes interact in different contexts and unfold over time for creating educational environments that support students in all areas of their development.[143] For example, the science is clear about how children learn to read, yet millions of children are not proficient in reading by the third grade because many elementary school teachers are not aware of this research, or in some cases they dismiss it. That said, elementary school teachers who receive professional development training on the science of reading find the information valuable and its effectiveness is clear from assessments of their students' reading skills.[144] Education reform and innovation needs to be grounded in the science of learning and development. Boards of education should include research scientists to shape policies that enable schools to provide playful learning environments to promote children's well-being and healthy development. Publishing accessible research findings that are relevant to the needs of educators in news outlets and websites that connect research to practice, such as *Education Week* and *Edutopia*, also helps to support evidence-informed practice.

2. **Develop a new approach to teacher professional development (PD) that focuses on how (the principles of playful learning) and what (the 6 Cs) children learn and gives teachers more ownership over their own**

training. Teacher PD is often viewed as a mandatory practice that does not respect what teachers bring to the table—their experience, expertise, and time. Ironically, teacher PD can often be delivered in a way that ignores best practices for teaching and learning—through didactic instruction with teachers having very little agency or choice. Some schools are taking a different approach by organizing in-house professional learning communities and "un-conferences" where teachers are given the opportunity to collaborate and learn from each other.[145] Our approach leverages the expertise of teachers and does not require them to adopt a specific curriculum, but rather provides an opportunity to collaborate to generate a broad curriculum that requires critical thinking and iterative development The PD in itself can model the 6 Cs so teachers are implementing the principles in their classrooms in the same way that they were trained. Teachers would be given the opportunity to work collaboratively in groups and to think critically about how to infuse the 6 Cs into theme-based curriculum.

3. **Implement and develop new, scalable assessments that target a breadth of skills approach to learning and assess growth in each of these skills individually and collectively.** While standardized tests still serve as accountability mechanisms, many school districts across the U.S. are exploring new assessments that evaluate a breadth of skills. However, unlike traditional academic skills, these skills do not yet have widely adopted assessment tools. Starting in 1997, scholars who oversee PISA, which has traditionally focused on reading, math, and science, have pushed for including tests that assess a wider range of skills including problem solving and creativity. The first of these initiatives will be assessing creative thinking in 2021 with a focus on being persistent and inquisitive.[146] Another method of assessment that is becoming more common in K-12 schools, especially in middle and high schools, is digital portfolios. Digital portfolios are a collection of artifacts that students collect over time to showcase their knowledge about a particular topic or area of study and can be used as a formative tool to monitor student progress and as a summative assessment for teachers to grade according to a rubric at the end of a course.[147-148] Using digital portfolios in addition to or in place of traditional grades places the focus on student-driven learning and provides opportunities for self-assessment and reflection for both students and teachers. For younger students, teachers using the *Tools of the Mind* curriculum engage preschoolers and kindergarteners in weekly one-on-one learning conferences that allow children to reflect on their correct and incorrect answers and play a lead role in their learning.

[1] Anyon, Jean. "Social Class and the Hidden Curriculum of Work." *Journal of Education* 162, no. 1 (1980): 67-92.

[2] Serafini, Frank W. "Dismantling the Factory Model of Assessment." *Reading and Writing Quarterly* 18, no. 1 (2002): 67-85.

[3] Vinovskis, Maris A. ***From A Nation at Risk to No Child Left Behind: National Education Goals and the Creation of Federal Education Policy.*** New York, NY: Teachers College Press, 2009.

[4] No Child Left Behind Act of 2001, U.S. Code 20 (2002).

[5] Council of Chief State School Officers, and National Governors Association Center for Best Practice."About the Standards." 2020, http://www.corestandards.org/about-the-standards/.

[6] Darling-Hammond, Linda. "Race, Inequality and Educational Accountability: The Irony of "No Child Left Behind"." ***Race, Ethnicity, and Education*** 10, no. 3 (2007): 245-60.

[7] Dee, Thomas S., and Brian Jacob. "The Impact of No Child Left Behind on Student Achievement." ***Journal of Policy Analysis and Management*** 30, no. 3 (2011): 418-46.

[8] National Center for Education Statistics, U.S. Department of Education. "Results from the 2019 Mathematics and Reading Assessments", 2020, https://www.nationsreportcard.gov/mathematics/supportive_files/2019_infographic.pdf

[9] Ravitch, Diane. ***The Death and Life of the Great American School System.*** New York: Basic Books, 2010.

[10] Kim, James S., and Gail L. Sunderman. "Measuring Academic Proficiency under the No Child Left Behind Act: Implications for Educational Equity." ***Educational Researcher*** 34, no. 8 (2005): 3-13.

[11] Hannaway, Jane, and Laura Hamilton. "Performance-Based Accountability Policies: Implications for School and Classroom Practices." Washington, D.C.: Urban Institute, 2008.

[12] Pedulla, Joseph J., Lisa M. Abrams, George F. Madaus, Michael K. Russell, Miguel A. Ramos, and Jing Miao. "Perceived Effects of State-Mandated Testing Programs on Teaching and Learning: Findings from a National Survey of Teachers." Chestnut Hill, MA: National Board on Educational Testing and Public Policy, 2003.

[13] Reback, Randall, Jonah Rockoff, and Heather L. Schwartz. "Under Pressure: Job Security, Resource Allocation, and Productivity in Schools under No Child Left Behind." ***American Economic Journal: Economic Policy*** 6, no. 3 (2014): 207-41.

[14] Smith, Jason M., and Philip E. Kovacs. "The Impact of Standards-Based Reform on Teachers: The Case of "No Child Left Behind"." ***Teachers and Teaching: Theory and Practice*** 17, no. 2 (2011): 201-25.

[15] Markowitz, Anna J. "Changes in School Engagement as a Function of No Child Left Behind: A Comparative Interrupted Time Series Analysis." ***American Educational Research Journal*** 55, no. 4 (2018): 721-60.

[16] Konan, Paul N., Armand Chatard, Leila Selimbegovic, and Gabriel Mugny. "Cultural Diversity in the Classroom and Its Effects on Academic Performance: A Cross-National Perspective." ***Social Psychology*** 41, no. 4 (2010): 230-37.

[17] Klein, Alyson. "The Every Student Succeeds Act: An ESSA Overview." Education Week, 2016, https://www.edweek.org/ew/issues/every-student-succeeds-act/index.html.

[18] OECD. "PISA 2018 Results (Volume I): What Students Know and Can Do." Paris, 2019.

[19] OECD. "United States Country Note Programme for International Student Assessment (PISA) Results from PISA 2018." Paris, 2019.

[20] Schleicher, Andreas. "Pisa 2018 Insights and Interpretations." Paris: OECD, 2019.

[21] Davis, Michelle R. "Microsoft, Verizon, and Other Big U.S. Companies Design Their Ideal High School Courses." Education Week, 2020, https://www.edweek.org/ew/articles/2020/02/05/if-you-could-design-a-high-school.html.

[22] Wagner, Tony. "Rigor Redefined." ***Educational Leadership*** 66, no. 2 (2008): 20-25.

[23] I.B.M. "Capitalizing on Complexity: Insights from the Global Chief Executive Officer Study." 2010.

[24] Career Readiness Partner Council. "Building Blocks for Change: What It Means to Be Career Ready." n.d.

[25] Rojewski, Jay W., and Roger B. Hill. "Positioning Research and Practice in Career and Technical Education: A Framework for College and Career Preparation in the 21st Century." ***Career and Technical Education Research*** 39, no. 2 (2014): 137-50.

[26] Donaldson, Jonan Phillip, and Ayana Allen-Handy. "The Nature and Power of Conceptualizations of Learning." ***Educational Psychology Review*** 32 (2020): 545-70.

[27] Hirsh-Pasek, Kathy, Roberta Michnick Golinkoff, and Diane Eyer. ***Einstein Never Used Flash Cards: How Our Children Really Learn and Why They Need to Play More and Memorize Less.*** Emmaus, PA: Rodale, 2003.

[28] Rodriguez, Vanessa. "The Teaching Brain and the End of the Empty Vessel." ***Mind, Brain, and Education*** 6, no. 4 (2012): 177-85.

[29] Smith, Katy. "Becoming the "Guide on the Side"." ***Educational Leadership*** 51, no. 2 (1993): 35-37.

[30] Sahlberg, Pasi. *Finnish Lessons 2.0: What Can the World Learn from Educational Change in Finland?* New York, NY: Teachers College Press, 2015.

[31] "Schools We Need in Australia." 2019.

[32] Hirsh-Pasek, Kathy, Jennifer M. Zosh, Roberta Michnick Golinkoff, James H. Gray, Michael B. Robb, and Jordy Kaufman. "Putting Education in "Educational" Apps: Lessons from the Science of Learning." *Psychological Science in the Public Interest* 36, no. 1 (2015): 3-34.

[33] Zosh, Jennifer M., Kathy Hirsh-Pasek, Emily J. Hopkins, Hanne Jensen, Claire Liu, Dave Neale, S. Lynneth Solis, and David Whitebread. "Accessing the Inaccessible: Redefining Play as a Spectrum." *Frontiers in Psychology* 9 (2018): 1124.

[34] Golinkoff, Roberta Michnick, and Kathy Hirsh-Pasek. *Becoming Brilliant: What Science Tells Us About Raising Successful Children.* Washington, D.C.: American Psychological Association, 2016.

[35] Gay, Geneva. *Culturally Responsive Teaching: Theory, Research, and Practice.* 3rd ed. New York, NY: Teachers College Press, 2018.

[36] McWayne, Christine M., Fabienne Doucet, and Jeyanthi Mistry. "Family-School Partnerships in Ethnocultural Communities: Reorienting Conceptual Frameworks, Research Methods, and Intervention Efforts by Rotating Our Lens." In *Ethnocultural Diversity and the Home-to-School Link*, edited by Christine M. McWayne, Fabienne Doucet and S. Sheridan. Cham: Springer, 2019.

[37] Chi, Michelene. T. "Active-Constructive-Interactive: A Conceptual Framework for Differentiating Learning Activities." *Topics in Cognitive Science* 1, no. 1 (2009): 73–105.

[38] Bonawitz, Elizabeth, Patrick Shafto, Hyowon Gweon, Noah D. Goodman, Elizabeth Spelke, and Laura Schulz. "The Double-Edge Sword of Pedagogy: Instruction Limits Spontaneous Exploration and Discovery." *Cognition* 120, no. 3 (2011): 322-30.

[39] Bower, Corinne, Laura Zimmerman, Brian Verdine, Tamara Spiewak Toub, Siffat Islam, Lindsey Foster, Natalie Evans*, et al.* "Piecing Together the Role of a Spatial Assembly Intervention in Preschoolers' Spatial and Mathematics Learning: Influences of Gesture, Spatial Language, and Socioeconomic Status." *Developmental Psychology* 56, no. 4 (2020): 686-98.

[40] Ferrara, Katrina, Kathy Hirsh-Pasek, Nora S. Newcombe, Roberta Michnick Golinkoff, and Wendy Shallcross Lam. "Block talk: Spatial language during block play." *Mind, Brain, and Education* 5, no. 3 (2011): 143-151.

[41] Fisher, Kelly R., Kathy Hirsh-Pasek, Nora Newcombe, and Roberta M. Golinkoff. "Taking Shape: Supporting Preschoolers' Acquisition of Geometric Knowledge through Guided Play." *Child Development* 84, no. 6 (2013): 1872-78.

[42] Han, Myae, Noreen Moore, Carol Vukelich, and Martha Buell. "Does play make a difference? How play intervention affects the vocabulary learning of at-risk preschoolers." *American Journal of Play* 3, no. 1 (2010): 82-105.

[43] Zosh, Jennifer M., Meredith Brinster, and Justin Halberda. "Optimal Contrast: Competition between Two Referents Improves Word Learning." *Applied Developmental Science* 17, no. 1 (2013): 20–28.

[44] Yang, SC-H, and Patrick Shafto. "Teaching versus active learning: A computational analysis of conditions that affect learning." In *Proceedings of the Cognitive Science Society*. 2017.

[45] Ruff, Holly A., and Katharine R. Lawson. "Development of Sustained, Focused Attention in Young Children During Free Play." *Developmental Psychology* 26, no. 1 (1990): 85–93.

[46] Fisher, Anna V., Karrie E. Goodwin, and Howard Seltman. "Visual Environment, Attention Allocation, and Learning in Young Children: When Too Much of a Good Thing May Be Bad." *Psychological Science* 25, no. 7 (2014): 1362-70.

[47] Shafto, Patrick, Noah D. Goodman, and Michael C. Frank. "Learning from others: The consequences of psychological reasoning for human learning." *Perspectives on Psychological Science* 7, no. 4 (2012): 341-351.

[48] Goodwin, Karrie E., Ma. V. Almeda, Howard Seltman, Shimin Kai, Mandi D. Skerbetz, Ryan S. Baker, and Anna V. Fisher. "Off-Task Behavior in Elementary School Children." *Learning and Instruction* 44, no. 8 (2016): 128-43.

[49] Lou, Yiping, Phillip C. Abrami, John C. Spence, Catherine Poulsen, Bette Chambers, and Sylvia d'Apollonia. "Within-Class Grouping: A Meta-Analysis." *Review of Educational Research* 66, no. 4 (1996): 423-58.

[50] Haden, Catherine. A. "Talking About Science in Museums." *Child Development Perspectives* 4, no. 1 (2010): 62–67.

[51] Callanan, Maureen. A., Claudia L. Castañeda, Megan R. Luce, and Jennifer L. Martin. "Family Science Talk in Museums: Predicting Children's Engagement from Variations in Talk and Activity." *Child Development* 88, no. 5 (2017): 1492–504.

[52] Meltzoff, Andrew N., and M. Keith Moore. "Newborn Infants Imitate Adult Facial Gestures." *Child Development* 54, no. 3 (1983): 702–09.

[53] Dewey, John. *Experience and Education.* New York, NY: Touchstone, 1938.

[54] Vygotsky, Lev S. *Mind in Society: The Development of Higher Psychological Processes.* Cambridge, MA: Harvard University Press, 1978.

[55] Berk, Laura. E., Trisha D. Mann, and Amy T. Ogan. "Make-Believe Play: Wellspring for Development of Self-Regulation." In *Play = Learning: How Play Motivates and Enhances Children's Cognitive and Social-Emotional Growth*, edited by D. Singer, R. M. Golinkoff and K. Hirsh-Pasek, 74–100: Oxford University Press, 2006.

[56] Howes, Carollee, Olivia Unger, and Catherine C. Matheson. *The Collaborative Construction of Pretend: Social Pretend Play Functions.* SUNY Press, 1992.

[57] Ramani, Geetha B. "Influence of a Playful, Child-Directed Context on Preschool Children's Peer Cooperation." *Merrill-Palmer Quarterly* 58, no. 2 (2012): 159–90.

[58] Ghafouri, Farveh, and Carol A. Wien. "Give Us a Privacy": Play and Social Literacy in Young Children." *Journal of Research in Childhood Education* 19, no. 4 (2005): 279–91-79–91.

[59] Gopnik, Alison. "Scientific Thinking in Young Children: Theoretical Advances, Empirical Research, and Policy Implications." *Science* 337, no. 6102 (2012): 1623–27.

[60] Schulz, Laura E., and Elizabeth B. Bonawitz. "Serious Fun: Preschoolers Engage in More Exploratory Play When Evidence Is Confounded." *Developmental Psychology* 43, no. 4 (2007): 1045–50-45–50.

[61] van Schijndel, Tessa J.P., Ingmar Visser, Bianca M.C.W van Bers, and Maartje E.J. Raijmakers. "Preschoolers Perform More Informative Experiments after Observing Theory-Violating Evidence." *Journal of Experimental Child Psychology* 131 (2015): 104–19.

[62] Weisberg, Deena S., Audrey K. Kittredge, Kathy Hirsh-Pasek, Roberta M. Golinkoff, and David Klahr. "Making Play Work for Education." *Phi Delta Kappan* 96, no. 8 (2015): 8–13.

[63] Isen, Alice M. "An Influence of Positive Affect on Decision Making in Complex Situations: Theoretical Issues with Practical Implications." *Journal of Consumer Psychology* 11, no. 2 (2001): 75–85.

[64] Isen, Alice M., Kimberly A. Daubman, and Gary P. Nowicki. "Positive Affect Facilitates Creative Problem Solving." *Journal of Personality and Social Psychology* 52, no. 6 (1987): 1122–31.

[65] Diamond, Adele. "Want to Optimize Executive Functions and Academic Outcomes? Simple, Just Nourish the Human Spirit." *Minnesota Symposium in Child Psychology* 37 (2014): 205–32.

[66] Fein, Greta. "Pretend Play: Creativity and Consciousness." In *Curiosity, Imagination and Play*, edited by P. Gorlitz and J. Wohlwill, 281–304: Erlbaum, 1987.

[67] Singer, Dorothy G., and Jerome Singer. *The House of Make-Believe: Play and the Developing Imagination.* Harvard University Press, 1990.

[68] Russ, Sandra W. *Affect and Creativity: The Role of Affect and Play in the Creative Process.* Routledge, 2013.

[69] Russ, Sandra W., Andrew L. Robins, and Beth A. Christiano. "Pretend Play: Longitudinal Prediction of Creativity and Affect in Fantasy in Children." *Creativity Research Journal* 12, no. 2 (1999): 129–39.

[70] Springer, Mark. *Watershed: A Successful Voyage into Integrative Learning.* Columbus, OH: National Middle School Association, 1994.

[71] Radnor Township School District. "Radnor Middle School Integrated Department." (n.d.).

[72] U.S. Census Bureau. "American Community Survey ". Washington, D.C., 2018.

[73] Dintersmith, Ted. *What School Could Be: Insights and Inspiration from Teachers across America.* Princeton, NJ: Princeton University Press, 2018.

[74] Cook, Deirdre. "Voice Practice: Social and Mathematical Talk in Imaginative Play." *Early Child Development and Care* 162, no. 1 (2000): 51-63.

[75] Ginsburg, Herbert. P., Y. Elise Choi, Luz Stella Lopez, Rebecca Netley, and Chi Chao-Yuan. "Happy Birthday to You: Early Mathematical Thinking of Asian, South American, and U.S. Children." In *Learning and Teaching Mathematics: An International Perspective*, edited by P. Bryant. Hove, UK: Psychology Press, 1997.

[76] Ginsburg, Herbert P., and Sandra Pappas. "Invitation to the Birthday Party: Rationale and Description." *ZDM Mathematics Education* 48 (2016): 947-60.

[77] Neuman, Susan B., and Kathy Roskos. "Literacy Objects as Cultural Tools: Effects on Children's Literacy Behaviors in Play." *Reading Research Quarterly* 27, no. 3 (1992): 202-25.

[78] Singer, Dorothy G., Roberta M. Golinkoff, and Kathy Hirsh-Pasek, eds. *Play = Learning: How Play Motivates and Enhances Children's Cognitive and Social-Emotional Growth.* New York, NY: Oxford University Press, 2006.

[79] Singer, Jerome L. "Cognitive and Affective Implications of Imaginative Play in Childhood." In *Child and Adolescent Psychiatry: A Comprehensive Textbook*, edited by M. Lewis, 252-63. Philadelphia, PA: Lippincott, Williams, & Wilkins, 2002.

[80] Battelle for Kids. "Our Approach." n.d., https://www.battelleforkids.org/networks/edleader21-network/our-approach.

[81] New Hampshire Revised Statutes Annotated § 193-E:2a (2018).

[82] Maryland State Dept. of Education. "Supporting Every Young Learner: Maryland's Guide to Early Childhood Pedagogy Birth to Age 8." Baltimore, MD, 2015.

[83] Klein, Alyson. "5 Big Challenges in Preparing K-12 Students for the World of Work." Education Week, 2020, https://www.edweek.org/ew/articles/2020/02/05/data-5-big- challenges-in-preparing-k-12.html.

[84] Castles, Anne, Kathleen Rastle, and Kate Nation. "Ending the Reading Wars: Reading Acquisition from Novice to Expert." *Psychological Science in the Public Interest* 19 (2018): 5-51.

[85] Commeyras, Michelle. "Promoting Critical Thinking through Dialogical-Thinking Reading Lessons." *The Reading Teacher* 46, no. 6 (1993): 486-94.

[86] Hirsh-Pasek, Kathy. "Raising Brilliant Kids—with Research to Back You Up." By Anya Kamenetz (2018), https://www.npr.org/sections/ed/2018/07/23/627265706/raising-brilliant-kids-with-research-to-back-you-up.

[87] Piazza, Elise A., Liat Hasenfratz, Uri Hasson, and Casey Lew-Williams. "Infant and Adult Brains Are Coupled to the Dynamics of Natural Communication." *Psychological Science* 31, no. 1 (2020): 6-17.

[88] Feldman, Ruth, Charles W. Greenbaum, and Nurit Yirmiya. "Mother-Infant Synchrony as an Antecedent of the Emergence of Self-Control." *Developmental Psychology* 35, no. 5 (1999): 223-31.

[89] Young, Andrew G., Martha W. Alibali, and Charles W. Kalish. "Causal Learning from Joint Action: Collaboration Helps First Graders but Hinders Kindergarteners." *Journal of Experimental Child Psychology* 177 (2019): 166-86.

[90] Cooper, Brittany Rhoades, Julia E. Moore, C. J. Powers, Michael Cleveland, and Mark T. Greenberg. "Patterns of Early Reading and Social Skills Associated with Academic Success in Elementary School." *Early Education and Development* 25, no. 8 (2014): 1248-64.

[91] Hirsh-Pasek, Kathy, Lauren B. Adamson, Roger Bakeman, Margaret Tresch Owen, Roberta Michnick Golinkoff, Amy Pace, Paula K.S. Yust, and Katharine Suma. "The Contribution of Early Communication Quality to Low-Income Children's Language Success." *Psychological Science* 26, no. 7 (2015): 1071-83.

[92] Pace, Amy, Rebecca Alper, Margaret R. Burchinal, Roberta Michnick Golinkoff, and Kathy Hirsh-Pasek. "Measuring Success: Within and Cross-Domain Predictors of Academic and Social Trajectories in Elementary School." *Early Childhood Research Quarterly* 46 (2019): 112-25.

[93] Bower, Corinne, Lindsey Foster, Laura Zimmerman, Brian N. Verdine, Maya Marzouk, Siffat Islam, Roberta M. Golinkoff, and Kathy Hirsh-Pasek. "Three-year-olds' spatial language comprehension and links with mathematics and spatial performance." *Developmental Psychology* Advance online publication: http://dx.doi.org/10.1037/dev0001098.

[94] Ribner, Andrew D., Catherine S. Tamis-LeMonda, and Lynn S. Liben. "Mothers' Distancing Language Relates to Young Children's Math and Literacy Skills." *Journal of Experimental Child Psychology* 196 (2020): 104863.

[95] Duff, Fiona J., Gurpreet Reen, Kim Plunkett, and Kate Nation. "Do Infant Vocabulary Skills Predict School-Age Language and Literacy Outcomes?". *The Journal of Child Psychology and Psychiatry* 56, no. 8 (2015): 848-56.

[96] Gonzalez, Jorge E., Sharolyn Pollard-Durodola, Deborah C. Simmons, Aaron B. Taylor, Matthew J. Davis, Minjun Kim, and Leslie Simmons. "Developing Low-Income Preschoolers' Social Studies and Science Vocabulary Knowledge through Content-Focused Shared Book Reading." *Journal of Research on Educational Effectiveness* 4 (2011): 25-52.

[97] Duncan, Greg J., Chantelle J. Dowsett, Amy Claessens, Katherine Magnuson, Aletha C. Huston, Pamela Klebanov, Linda S. Pagani*, et al.* "School Readiness and Later Achievement." *Developmental Psychology* 43, no. 6 (2007): 1428-46.

[98] Ahmed, Sammy F., Sandra Tang, Nicholas E. Waters, and Pamela Davis-Kean. "Executive Function and Academic Achievement: Longitudinal Relations from Early Childhood to Adolescence." *Journal of Educational Psychology* 111, no. 3 (2018): 446-58.

[99] Nguyen, Tutrang, and Greg J. Duncan. "Kindergarten Components of Executive Function and Third Grade Achievement: A National Study." *Early Childhood Research Quarterly* 46 (2019): 49-61.

[100] Halpern, Diane F. *Thought and Knowledge: An Introduction to Critical Thinking.* New York, NY: Psychology Press, 2014.

[101] Walraven, Amber, Saskia Brand-Gruwel, and Henny P.A. Boshhuizen. "How Students Evaluate Information and Sources When Searching the World Wide Web for Information." *Computers & Education* 52 (2009): 234-46.

[102] Bunge, Silvia A., and Elena R. Leib. "How Does Education Hone Reasoning Ability?" *Current Directions in Psychological Science* 29, no. 2 (2020): 167-73.

[103] Garaigordobil, Maite, and Laura Berrueco. "Effects of a Play Program on Creative Thinking of Preschool Children." *The Spanish Journal of Psychology* 14, no. 2 (2011): 608-18.

[104] Florida, Richard. "Where the Creative Class Jobs Will Be." The Atlantic, 2010, https://www.theatlantic.com/business/

archive/2010/08/where-the-creative-class-jobs-will-be/61468/.

[105] Duckworth, Angela L., Christopher Peterson, Michael D. Matthews, and Dennis R. Kelly. "Grit: Perseverance and Passion for Long-Term Goals." *Journal of Personality and Social Psychology* 92, no. 6 (2007): 1087-101.

[106] Dweck, Carol. "Carol Dweck Revisits the "Growth Mindset"." Education Week, 2015, https://www.edweek.org/ew/articles/2015/09/23/carol-dweck-revisits-the-growth-mindset.html.

[107] *Self-Theories: Their Role in Motivation, Personality, and Development.* Philadelphia, PA: Psychology Press, 1999.

[108] Lipko, Amanda R., John Dunlosky, and William E. Merriman. "Persistence Overconfidence Despite Practice: The Role of Task Experience in Preschoolers' Recall Predictions." *Journal of Experimental Child Psychology* 103 (2009): 152-66.

[109] Bustamante, Andres S., Brenna Hassinger-Das, Kathy Hirsh-Pasek, and Roberta M. Golinkoff. "Learning Landscapes: Where the science of learning meets architectural design." *Child Development Perspectives* 13, no. 1 (2019): 34-40.

[110] Hassinger-Das, Brenna, Andres S. Bustamante, Kathy Hirsh-Pasek, and Roberta M. Golinkoff. "Learning Landscapes: Playing the Way to Learning and Engagement in Public Spaces." *Education Sciences* 8, no. 2 (2018): 74.

[111] Playful Learning Landscapes Action Network. "Playful Learning Landscapes." 2019, https://playfullearninglandscapes.com/.

[112] Diamond, Adele. "Executive Functions." *Annual Review of Psychology* 64 (2013): 135-68.

[113] Diamond, Adele, Chris Lee, Peter Senften, Andrea Lam, and David Abbott. "Randomized Control Trial of Tools of the Mind: Marked Benefits to Kindergarten Children and Their Teachers." *PLOS One* 14, no. 9 (2019): e0222447.

[114] Blair, Clancy, Rachel D. McKinnon, and M. Paula Daneri. "Effect of the Tools of the Mind Kindergarten Program on Children's Social and Emotional Development." *Early Childhood Research Quarterly* 43 (2018): 52–61.

[115] Blair, Clancy, and C. Cybele Raver. "Closing the Achievement Gap through Modification of Neurocognitive and Neuroendocrine Function: Results from a Cluster Randomized Controlled Trial of an Innovative Approach to the Education of Children in Kindergarten." *PloS one* 9, no. 11 (2014): e112393.

[116] Blair, Clancy, and Rachel P. Razza. "Relating Effortful Control, Executive Function, and False Belief Understanding to Emerging Math and Literacy Ability in Kindergarten." *Child Development* 78, no. 2 (2007): 647–63.

[117] Diamond, Adele, W. Steven. Barnett, Jessica Thomas, and Sarah Munro. "Preschool Program Improves Cognitive Control." *Science* 318 (2007): 1387–88.

[118] Wilson, Sandra Jo, and Dale C. Farran. "Experimental Evaluation of the Tools of the Mind Preschool Curriculum." In *Society for Research on Educational Effectiveness*. Washington, D.C., 2012.

[119] Lonning, Robert A., Thomas C. DeFranco, and Thomas P. Weinland. "Development of Theme-Based, Interdisciplinary, Integrated Curriculum: A Theoretical Model." *School Science and Mathematics* 98, no. 6 (1998): 312-19.

[120] Rosenbusch, Marcia H. "Preserve the Rain Forests." *The Social Studies* 85, no. 1 (1994): 31-35.

[121] Shanahan, Timothy, Bonita Robinson, and Mary Schneider, eds. "Avoiding Some of the Pitfalls of Thematic Units." *The Reading Teacher* 48, no. 8 (1995): 718-19.

[122] Facella, Melissa A., Kristen M. Rampino, and Elizabeth K. Shea. "Effective Teaching Strategies for English Language Learners." *Bilingual Research Journal* 29, no. 1 (2005): 209-21.

[123] Gardner, J. Emmett, and Cheryl A. Wissick. "Enhancing Thematic Units Using the World Wide Web: Tools and Strategies for Students with Mild Disabilities." *Journal of Special Education Technology* 17, no. 1 (2002): 27-38.

[124] Lo, Clifford. "Integrating Nutrition as a Theme Throughout the Medical School Curriculum." *American Journal of Clinical Nutrition* 72 (2000): 882S-89S.

[125] Nekovei, Deanna L., and Shirley A. Ermis. "Creating Classrooms That Promote Rich Vocabularies for at-Risk Learners." *Young Children* 61, no. 5 (2006): 90-95.

[126] Roessingh, Hetty. "Grandma's Soup: Thematic Instruction for Dual Language Learners." *Young Children* 69, no. 4 (2014): 86-93.

[127] South-South Galaxy. "Project Rangeet: Empowering the Next Generation of "Superheroes" Training Primary School Teachers through a Multi-Language Interactive Digital Platform." United Nations Office for South-South Cooperation, 2020, https://my.southsouth-galaxy.org/en/solutions/detail/project-rangeet-empowering-the-next-generation-of-superheroes.

[128] Project Rangeet. "Project Rangeet: Frequently Asked Questions." n.d.

[129] "Playful Learning Promotes 21st-Century Skills in Schools and Beyond: Case Study, Project Rangeet." 2020.

[130] Beaven, Elizabeth, Alexandra Cady, Brenda Fyfe, and Taniesha Woods Myles, A. "Ideal Pathways: How Ideal Learning Approaches Prepare and Support Early Childhood Educators." Washington, D.C.: Trust for Learning, 2020.

[131] Lillard, Angeline S. "Shunned and Admired: Montessori, Self-Determination, and a Case for Radical School Reform."

Educational Psychology Review 31, (2019): 939-965.

[132] Lillard, Angeline Stoll. ***Montessori: The Science Behind the Genius.*** 3rd ed. New York, NY: Oxford University Press, 2017.

[133] Lillard, Angeline, and Nicole Else-Quest. "The Early Years: Evaluating Montessori Education." ***Science*** 313, no. 5795 (2006): 1893-94.

[134] Lillard, Angeline S., Megan J. Heise, Eve M. Richey, Xin Tong, Alyssa Hart, and Paige M. Bray. "Montessori Preschool Elevates and Equilizes Child Outcomes: A Longitudinal Study." ***Frontiers in Psychology*** 8 (2017): 1783.

[135] Stumacher, Alison. "Four Keys to Effective Classroom Learning Centers." Education Week, 2016,

https://blogs.edweek.org/teachers/coach_gs_teaching_tips/2016/02/four_keys_to_effective_classroom_learning_centers.html.

[136] Bustamante, Andres S., Molly Schlesinger, Kreshnik N. Begolli, Roberta M. Golinkoff, Nabil Shahidi, Shekufeh Zonji, Cristina Riesen, Natalie Evans, and Kathy Hirsh-Pasek. "More Than Just a Game: Transforming Social Interaction and Stem Play with Parkopolis." ***Developmental Psychology*** 56, no. 6 (2020): 1041–56.

[137] Hassinger-Das, Brenna, Itai Palti, Roberta M. Golinkoff, and Kathy Hirsh-Pasek. "Urban Thinkscape: Infusing Public Spaces with Stem Conversation and Interaction Opportunities." ***Journal of Cognition and Development*** 21, no. 1 (2020): 125–47.

[138] Hassinger-Das, Brenna, Jennifer M. Zosh, Nicole Hansen, Meghan Talarowski, Kate Zmich, Roberta M. Golinkoff, and Kathy Hirsh-Pasek. "Play-and-Learn Spaces: Leveraging Library Spaces to Promote Caregiver and Child Interaction." ***Library & Information Science Research*** 42, no. 1 (2020): 101002.

[139] Ridge, Katherine E., Deena Skolnick Weisberg, Hande Ilgaz, Kathryn A. Hirsh-Pasek, and Roberta Michnick Golinkoff. "Supermarket Speak: Increasing Talk among Low-Socioeconomic Status Families." ***Mind, Brain, and Education*** 9, no. 3 (2015): 127-35.

[140] Verdine, Brian N., Roberta Michnick Golinkoff, Kathy Hirsh-Pasek, and Nora S. Newcombe. "Spatial Skills, Their Development, and Their Links to Mathematics." Monographs of the Society for Research in Child Development 82, no. 1 (2017): 7-30.

[141] Alexander, Allen Thomas, Anne-Katrin Neyer, and K. R. E. Huizingh. "Introduction to the special issue: Transferring knowledge for innovation." ***R&D Management*** 46, no. 2 (2016): 305-311.

[142] Arntz, Melanie, Terry Gregory, and Ulrich Zierahn. "The Risk of Automation for Jobs in OECD Countries: A Comparative Analysis." ***OECD Social, Employment and Migration Working Papers***, no. 189 (2016).

[143] Darling-Hammond, Linda, Lisa Flook, Channa Cook-Harvey, Brigid Barron, and David Osher. "Implications for Educational Practice of the Science of Learning and Development." ***Applied Developmental Science*** 24, no. 2 (2020): 97–140.

[144] Hanford, Emily. "Hard Words: Why Aren't Our Kids Being Taught to Read?" APM Reports, American Public Media, 2018, https://www.apmreports.org/story/2018/09/10/hard-words-why-american-kids-arent-being-taught-to-read.

[145] Schwartz, Sarah. "What Do Teachers Really Want from Professional Development? Respect." ***Education Week*** (2019).

[146] Anderson, Jenny. "The Unlikely Champion for Testing Kids around the World on Empathy and Creativity." ***Quartz*** (2019).

[147] Foote, Chandra. J., and Paul J. Vermette. "Teaching Portfolio 101: Implementing the Teaching Portfolio in Introductory Courses." ***Journal of Instructional Psychology*** 28, no. 1 (2001): 31.

[148] Williams, Adam. "Eportfolios: Helping Students Take Control of Their Learning." ***Instructional Technology Education Specialist Research Papers*** 9 (2013).

Appendix

Table 1

Collaboration	
Level 1 ("On My Own"):	We take action on our own without paying attention to others, seeking out help, or noticing if we receive help.
Level 2 ("Side by Side"):	We take action next to others. We act "on our own," but we are aware of others around us. We do not reach out for cooperation or collaboration, remaining focused on our own actions.
Level 3 ("Back and Forth"):	We take action with others, so we take turns while participating in a single project.
Level 4 ("Building it Together"):	We take action and collaborate with others on a shared goal or passion. We solve problems with others.
Communication	
Level 1 ("Raw Emotion"):	We communicate solely based on emotion without much consideration for managing them.
Level 2 ("Show & Tell"):	We communicate and express ourselves to others in a one-sided way.
Level 3 ("Dialogue"):	We engage in real communication, sharing our thoughts and emotions and listening to another person.
Level 4 ("Tell a Joint Story"):	We engage in effective communication, including recognizing the conversational topic and sticking to it, expressing ourselves concisely and effectively, and engaging the other person in discussion.
Content	
Level 1 ("Early Learning/ Situation Specific"):	We are beginning to learn about a topic and know just enough information to get by.
Level 2 ("Wide Breadth/ Shallow Understanding"):	We know more about different topics, or have more details about a topic, but we do not understand the topics deeply.
Level 3 ("Making Connections"):	We know about more topics in detail and have a deeper understanding of them. We make connections between topics and pieces of information, as well as our own experiences. We effectively use executive function skills to learn.
Level 4 ("Expertise"):	We have in-depth knowledge and understanding about various topics. We use and apply our knowledge effectively and correctly. We see connections between things and know how to build on our current knowledge.

Table 1 (continued)

Critical Thinking	
Level 1 (**"Seeing is Believing"**):	We believe whatever information we receive without question.
Level 2 (**"Truths Differ"**):	We realize there are multiple points of view and that information is provided from those perspectives. However, we pick one point of view and accept it as true. Facts are judged as either true, or not true.
Level 3 (**"Opinions"**):	We realize there are multiple points of view and people think differently, yet we accept opinion as "truth." We recognize that others experience different realities, but still rely on our own personal version of reality.
Level 4 (**"Evidence"**):	We realize there are multiple points of view and people think differently. We evaluate the evidence behind positions and make decisions based on it. We take information from different sources and come to our own conclusion or form an opinion. We question authority and use reasoning to understand the reasoning of others and shape our own.
Creative Innovation	
Level 1 (**"Experimentation"**):	We create through experimentation without a grand plan.
Level 2 (**"Means-End"**):	We create with a goal in mind.
Level 3 (**"Voice"**):	We have a certain level of experience and knowledge in an area that supports our creativity while incorporating personal expression.
Level 4 (**"Vision"**):	We exercise our creativity with a goal in mind and preparation and knowledge in that area.
Confidence	
Level 1 (**"Barrel On"**):	We act with persistence, but without thought. We assume that we know a lot about a certain topic.
Level 2 (**"Where Do I Stand?"**):	We have a sense of self developed by comparing ourselves with others. We select problems that we think we can solve.
Level 3 (**"Calculated Risks"**):	We are confident enough that we can take calculated risks, "planned with forethought," and learn from mistakes.
Level 4 (**"Dare to Fail"**):	We are confident enough to fail, knowing that the greatest achievements happen when we step out of our comfort zone.

Figure 1: "Play as a spectrum" (Zosh et al., 2018)

	Free Play	Guided Play	Games	Co-opted Play	Playful Interaction	Direct Instruction
Initiated by:	child	adult	adult	child	adult	adult
Directed by:	child	child	child	adult	adult	adult
Explicit Learning Goal:	no	yes	yes	yes	yes	yes

Source: ("serious games" as outlined in) Hassinger-Das et al., 2017 in which the game has a learning goal.

Figure 2

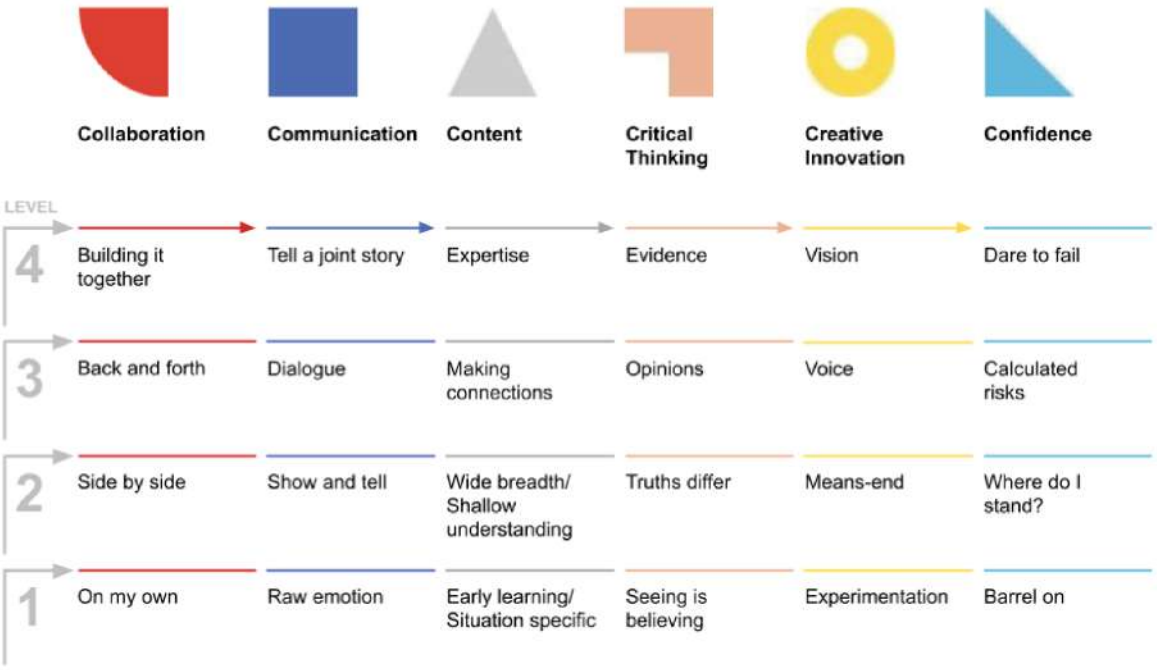

Figure 3: Playful Learning and the 6 Cs Checklist

Directions: Make a checkmark in the box next to each playful learning or 6 Cs element if it is present in the activity you are facilitating or observing.

Part I: Principles of How Kids Learn

- [ ] Active
- [ ] Engaged
- [ ] Meaningful
- [ ] Socially Interactive
- [ ] Iterative
- [ ] Joyful

Part II: The 6 Cs

- [ ] Collaboration
- [ ] Communication
- [ ] Content
- [ ] Critical Thinking
- [ ] Creative Innovation
- [ ] Confidence

Figure 4: Playful Learning and the 6 Cs Checklist Applied to *Tools of the Mind*

Directions: Make a checkmark in the box next to each playful learning or 6 Cs element if it is present in the activity you are facilitating or observing.

Part I: Principles of How Kids Learn

- [x] Active
- [x] Engaged
- [x] Meaningful
- [x] Socially Interactive
- [x] Iterative
- [x] Joyful

Part II: The 6 Cs

- [x] Collaboration
- [x] Communication
- [x] Content
- [x] Critical Thinking
- [x] Creative Innovation
- [x] Confidence

Figure 5 : Playful Learning and the 6 Cs Checklist Applied to the Morpho Butterfly Project (Rosenbusch, 1994)

Directions: Make a checkmark in the box next to each playful learning or 6 Cs element if it is present in the activity you are facilitating or observing.

Part I: Principles of How Kids Learn

- [x] Active
- [x] Engaged
- [ ] Meaningful
- [x] Socially Interactive
- [ ] Iterative
- [x] Joyful

Part II: The 6 Cs

- [x] Collaboration
- [x] Communication
- [x] Content
- [ ] Critical Thinking
- [x] Creative Innovation
- [ ] Confidence

Figure 6: Playful Learning and the 6 Cs Checklist Applied to Project Rangeet

Directions: Make a checkmark in the box next to each playful learning or 6 Cs element if it is present in the activity you are facilitating or observing.

Part I: Principles of How Kids Learn

- [x] Active
- [x] Engaged
- [x] Meaningful
- [x] Socially Interactive
- [x] Iterative
- [x] Joyful

Part II: The 6 Cs

- [x] Collaboration
- [x] Communication
- [x] Content
- [x] Critical Thinking
- [x] Creative Innovation
- [x] Confidence

Figure 7 : Playful Learning and the 6 Cs Checklist Applied to Montessori Education

Directions: Make a checkmark in the box next to each playful learning or 6 Cs element if it is present in the activity you are facilitating or observing.

Part I: Principles of How Kids Learn

- Active ☑
- Engaged ☑
- Meaningful ☑
- Socially Interactive ☑
- Iterative ☑
- Joyful ☑

Part II: The 6 Cs

- Collaboration ☑
- Communication ☑
- Content ☑
- Critical Thinking ☑
- Creative Innovation ☑
- Confidence ☑