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WORKING PAPER #193

TEACHING IN THE WAY HUMAN BRAINS LEARN

FIRST RESULTS FROM ACTIVE PLAYFUL LEARNING

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Teaching in the way human brains learn: First results from Active Playful Learning

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About the Center for Universal Education

For over two decades, the Center for Universal Education (CUE) has been at the forefront of global policy research focused on inclusive education and skills development.

CUE collaborates closely with networks of international partners to accelerate educational progress and systems change so that all learners–especially the most marginalized–can develop a breadth of skills to thrive in a rapidly changing world.

Introduction

"We want a society run by people who are smart, yes, but who are also wise, perceptive, curious, caring, resilient, and committed to the common good."
David Brooks 2024, 40

Education, especially in public or state schools, transforms societies. It promotes innovation and supports social mobility (e.g., Chetty et al. 2011; Hyman 2017, 268-270; Jackson and Mackevicius 2024, 422-427; Winthrop et al. 2013, 5, 13). Our current model of education helped move the United States (U.S.) and other countries into the Industrial Age (Darling-Hammond 2022, 54; Winthrop et al. 2017, 14). However, it is less effective at developing the skills needed for individuals to thrive in this Information Age and beyond.

One way to adapt education for our time is through what we call Active Playful Learning (APL), a pedagogical framework that is evidence-based, practical, and uniquely co-designed with scientists and educators. It simultaneously maintains the focus on traditional content, like math and reading, while also supporting a broader suite of skills. The approach brings more agency to both teachers and students, and promotes more joyful and deeper learning (Blinkoff et al. 2023, 16; Hirsh-Pasek et al. 2022; Nesbitt et al. 2023, 2-5). This paper is the first report of a large-scale, multi-site U.S.-based study that examines APL in classrooms with teachers. The participating teachers engaged in instructional coaching on APL, and measures evaluated the intervention's effects on teachers' instruction, as well as their students' classroom experiences. Here we describe APL, the study, and preliminary results from the pilot year.

Exploring the wider educational context

Two factors can inform the evolution of the education system. The first is that scientists have discovered a great deal about how children learn. Currently, just a few of those discoveries make their way into classrooms. The "factory model," in which teachers deliver information to passive students in large groups and learning is rote, remains the dominant mode of education around the world (Darling-Hammond 2024, 218, 220; also see Winthrop et al. 2017, 15, and Baines et al. 2003 and Christopher and Nesbitt 2023 for empirical studies of this trend). The science suggests that children achieve deeper learning when they are active agents (e.g., DeCaro and Rittle-Johnson 2012, 560-561) and when the learning experience fosters social interactions (e.g., Trawick-Smith et al. 2016, 438, 440), such as with peers and teachers. The second factor is that children will be more engaged in learning and better prepared for the 21st century workplace if they develop a corresponding set of skills that will enable them to thrive in the

classroom and beyond. Retention and recitation of facts is less valuable when generative artificial intelligence (AI) can retrieve information in seconds. Since today's students live in the Information Age, their success relies on a wider array of skills, including collaboration, communication, curiosity, creative problem-solving, adaptability, and critical thinking (Golinkoff and Hirsh-Pasek 2016, 12-13, 15-19; Winthrop et al., 2017, 20-21). The gap between what education was and what it could be is creating a global crisis.

There is growing international momentum to think about student outcomes and instruction from this wider perspective. For example, a review of education policy documents from 102 countries indicated that 76 countries aimed to promote 21st century skills in their students to make them more innovative and effective learners. Despite some variability by country, the most frequent skills cited were communication, creativity, critical thinking, and problem-solving (Care et al. 2016, 7-9).

Recent efforts by the Organization for Economic Cooperation and Development (OECD) and the United Nations Education, Scientific and Cultural Organization (UNESCO) reflect an international expansion of education, from focusing solely on student achievement outcomes, such as reading and math assessment scores, to transforming the learning environment to promote a wider array of skills and competencies. For example, the OECD's Future of Education and Skills 2030 Project aims, among other outcomes, to promote students' agency, interdisciplinary knowledge, and social and emotional skills; and to support the curation of learning environments to foster those goals (OECD 2019, 5, 12-14). UNESCO's Happy Schools initiative helps schools become joyful learning environments that "…enable school community members to embody positive attitudes and attributes that support lifelong learning, such as collaboration, communication, understanding, empathy, motivation, engagement, curiosity, resilience, and empowerment (UNESCO 2024, 17)." Changes to national education policies around the world, including in India (Government of India, Ministry of Human Resource Development 2020, 7-11), South Korea (Lee et al. 2023, 385-386), and Ghana (Ghana Education Service 2025), particularly highlight playful learning as a beneficial instructional method to enable all children to develop both academic competencies and fundamental approaches to learning that will help them continue to adapt to new challenges in the 21st-century.

These shifts in perspective and policy are driven by an accumulation of evidence from the science of learning, an interdisciplinary field that combines evidence from education, psychology, neuroscience, linguistics, computer science, sociology, and anthropology, among other fields. The science of learning emphasizes how learning occurs in context, and how to craft learning processes that are more effective inside and outside the classroom (Meltzoff et al. 2009, 284; Sawyer 2014, 1).

Components of the APL approach presented here were introduced in the book "Making Schools Work: Bringing the Science of Learning to Joyful Classroom Practice," an evidence-informed and practical guide to the application of the science of learning in classrooms co-authored in 2022 by a team of scientists and educators. This work built both on academic papers that identified principles of how children learn based on the science of learning (Hirsh-Pasek et al. 2015, 7-19; Zosh et al. 2018, 4-8) and the book "Becoming Brilliant: What Science Tells Us About Raising Successful Children." This book identified what students need to learn—skills that are essential for success in the 21st century (Golinkoff and Hirsh-Pasek 2016).

The APL approach continued to evolve in subsequent academic publications (Blinkoff et al. 2023, 16-18; Nesbitt et al. 2023, 2-5). As this evolution was underway in 2023, a group of scientists and educators from the U.S. came together to connect theory to practice and develop APL as an alternative pedagogical framework for use in real classrooms. Teachers were trained on the APL approach through a combination of workshops and individualized and collaborative coaching, thereby making findings from the science of learning usable for—and with—teachers. This study adopted a train-the-trainer model in which local instructional coaches received training on the APL approach from the study team. This method enabled the local coaches to collaborate with participating teachers on APL implementation in a way that is intended to foster sustainability of APL in schools.

This working paper describes how the theory of APL evolved, along with preliminary results from the implementation of APL in schools in four U.S. states: Virginia, Texas, Illinois, and California.

Rethinking 21st century education through the science of learning

One clear message from the science is that children need to learn many skills to thrive in the classroom and beyond—both cognitive skills like reading and math that can be easily measured on a standardized achievement test, and so-called non-cognitive skills like social competencies, self-regulation, and self-esteem (e.g., Heckman 2008, 296-297; also see McCormick et al. 2021, e600 on constrained and unconstrained skills). This wide perspective on educational outcomes is consistent with a breadth of skills approach (Winthrop and McGivney 2016, 13).

As Winthrop and McGivney (2016) wrote after reflecting on advances in technology, changes in labor market trends, and globalization, "The new demands of our societies require cultivating the breadth of skills. *Breadth of skills* [emphasis

added] refers to a range of important skills that include the basics that many education systems currently focus on, such as literacy, numeracy, and content knowledge in academic subjects as well as information literacy, flexibility, and problem solving" (13). Beyond these components, the researchers highlighted the importance of collaboration, communication, critical thinking, and perseverance (Winthrop and McGivney, 2016, 14).

After a comprehensive review of the literature, Golinkoff and Hirsh-Pasek (2016) elaborated on the definition of student success to include a larger set of skills known as the 6 Cs (collaboration, communication, content, critical thinking, creative innovation, and confidence). In their book, "Becoming Brilliant: What Science Tells Us About Raising Successful Children," Golinkoff and Hirsh-Pasek (2016) articulated a vision of achievement that continued to recognize the importance of content mastery, but also urged pursuit of a broader goal: "…raise happy, healthy, thinking, caring, and social children who become collaborative, creative, competent, and responsible citizens tomorrow" (264). A survey of over 1,000 employers conducted by the American Association of Colleges and Universities in 2023 highlighted the continued importance of these skills in the workplace, but also indicated a gap of 21%, on average, between the percentage of employers who viewed a skill as "very important" and perceived students as "very prepared" in that same skill (Finley 2023). Thus, the 6 Cs reflect what children need to know to thrive, including content knowledge and an array of other vital skills, but it is important to ensure that all students achieve these outcomes in the classroom before entering the 21st century workforce.

The promotion of students' 6 Cs is theoretically supported by pedagogical principles, or pillars, of classroom pedagogy rooted in the science of how children learn. The pillars suggest that students learn best through experiences that are active, rather than passive; engaging, but not distracting; meaningful, with clear connections to prior knowledge or skills gained inside or outside the classroom; socially interactive, with opportunities for students to deepen their learning through collaboration with peers and their teacher; iterative, with room for hypothesis testing and learning through trial-and-error; and joyful, with enthusiasm and positivity for learning (Hirsh-Pasek et al. 2015, 7-19; 2020, 3-6; 2022, 11-22; Zosh et al. 2018, 4-8; 2022, 92-99).

Empirical evidence supports associations between each of these instructional principles and learning outcomes (see Nesbitt et al. 2023, 2-4 for a review). The principles are reflected in guided play, a form of pedagogy that lies in the middle of a theoretical continuum from unrestricted free play (entirely conducted by the child) to direct instruction (fully controlled by an adult without child agency) (Zosh et al. 2018, 3-4; 2022, 86). Guided play balances child agency with pursuit of a learning goal (Weisberg et al. 2013, 105; see Skene et al. 2022 for a review of its educational efficacy).

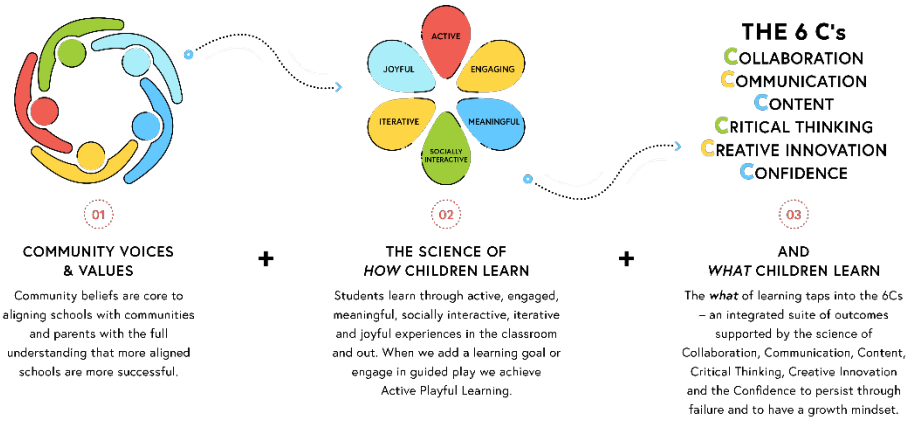
Research on a few methods of instruction that incorporate these principles shows that they bolster student achievement. For example, Montessori preschool students were found to outperform their peers who attended other preschools on measures of math and reading achievement, perspective-taking, and the adoption of a growth mindset. They even expressed greater enjoyment of school activities (Lillard et al. 2017, 8-10). These outcomes can be attributed to the Montessori program's emphasis on hands-on activities and student agency. Beyond early childhood, research on project-based learning (PBL) across primary and secondary grades suggests that student achievement is supported by instruction that incorporates the pillars of active, engaged, meaningful, socially interactive, and iterative learning through the projects (Chen and Yang 2019, 71-72, 75-77; Kokotsaki et al. 2016, 267-271, but see Ferrero et al. 2021 for a review of PBL and the need for more robust research that can guide practice). What is theorized, but less well-documented, is how these principles support children developing the corresponding set of learning skills that support achievement and thriving.

Finally, it is vital to consider the knowledge, skills, and experiences that each student brings into the classroom as assets to support their learning. Thus, APL incorporates students' lived experiences, or community voices and values, into the approach. Instruction linked to children's lives is intended to promote stronger student outcomes, as represented by the 6 Cs. Adoption of this perspective is consistent with recognizing the "funds of knowledge" that students provide—and can and should be leveraged in the classroom to promote instruction (Civil 2016, 46; Moll et al. 1992, 134; see Aronson and Laughter 2016 for a review on the beneficial effects of culturally relevant education). Relationships that educators establish with students' caregivers and other community stakeholders do not displace teachers and their expertise but enable families and communities to provide educators with valuable information to help make instruction more relevant for all students.

The APL approach

The foundational principle that guides APL is simple: If we teach in the way that human brains learn, children will learn better. This aim is rooted in the science of learning and reflected in the present structure of APL as a three-part equation (Figure 1): When sufficient attention is given to community voices and values, then the pillars of how children learn can be implemented more effectively, and students can achieve the 6 Cs. This report describes how APL's theoretical framework was put into practice through a collaborative approach with scientists who study learning working alongside skilled instructional coaches, classroom teachers, and educational administrators. The approach aimed to ensure that key stakeholders were highly involved from the beginning to promote systemic, evidence-informed changes in teachers' pedagogical practices.

Figure 1. The three-part equation for Active Playful Learning (APL 2023)



Preliminary testing of APL components: Early feasibility studies

Authors of this report conducted a series of initial feasibility studies in school systems, working in close collaboration with local educators to evaluate elements of the APL framework (Hirsh-Pasek et al. 2022, 49-96).

The first study was conducted with educators in a small, underserved community school district in Western Michigan. It built on the efforts of district administrators, who collaborated with families, educators, students, and community partners to develop a new learner profile centered on the 6 Cs and deliver instruction to target those skills. Interviews with teachers, administrators, and other local stakeholders involved in the district's efforts described how instruction targeting the 6 Cs was feasible. Teachers further highlighted how the project enabled them to grow as educators and think differently about their instruction. For example, they described implementing activities that helped students learn to collaborate and exercise agency. Standardized assessment data offered very limited evidence showing that students who received 6 Cs-focused instruction outperformed their peers in typical classrooms at the end of the school year (Hirsh-Pasek et al. 2022, 49-70).

Subsequent tests of feasibility occurred in New Hampshire, where play-based kindergarten was mandated by law in 2018 (New Hampshire Department of Education 2018, 1). The first study offered kindergarten teachers instructional coaching on guided play and the second study added coaching on the 6 Cs. Results showed associations between teachers' participation in the coaching intervention and their professional development in terms of their views on the feasibility and value of guided play, the activities they facilitated in their classrooms, and their students' behaviors. These changes were all consistent with

shifting towards guided play. For example, in one of the studies, independent classroom observations revealed a significant decrease in teacher-led direct instruction, and a significant increase in student engagement, over the school year. Teacher surveys also indicated that students made gains across the 6 Cs (see Blinkoff et al. 2024 and Nesbitt et al. 2025 for further details).

These results offer an initial demonstration of the feasibility and acceptability of professional learning about APL. Further, it supports the use of instructional coaching as a personalized professional development mechanism to put Active Playful Learning into practice.

Studying APL on a larger scale

Beginning in January 2023, efforts were underway to extend APL to school districts in California, Illinois, Texas, and Virginia. Through expanded collaboration with esteemed scholars and former classroom teachers and school administrators from across the U.S., the team enhanced the initial professional learning approaches and created systems to monitor and understand implementation across study sites. Together, individuals brought their expertise to hone multiple elements of the study including evaluation methodology, workshops and trainings, and resources to support teachers' implementation of APL. The work was guided by a set of key priorities that the APL approach must:

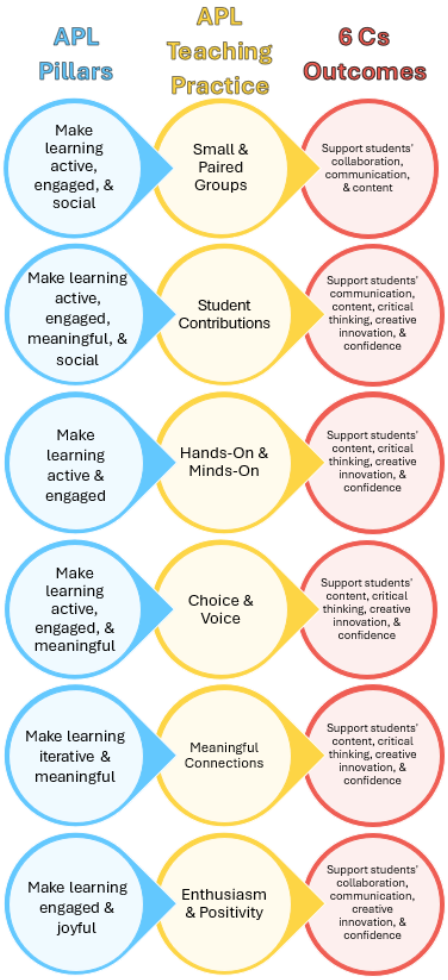
- Focus on universal pedagogical teaching strategies, such as the promotion of active learning and student agency, that can be applied across subject matter and curriculum to support joyful teaching and deeper learning.
- Be relevant and responsive to the needs of students and educators across the U. S., including generalizability across the globe to different educational settings.
- Utilize a coach-based model where teachers have agency to identify professional goals and receive 1-on-1 embedded coaching personalized to teachers’ goals and classroom needs.
- Prioritize not only testing whether the APL approach improves teacher and student outcomes in the early elementary grades, but understanding how and under what conditions APL benefits students, teachers, and schools.
- Examine the facilitators and barriers to implementation to learn from and adapt the program for continuous quality improvement (Hill et al. 2023, 4).

To reach these priorities, a key goal of our first project year was to refine the APL approach (Figure 2) to include the six specific teaching practices listed below. These were intentionally agnostic to content and curriculum, but designed to facilitate active, engaging, social, meaningful, iterative, and joyful learning (the

APL Pillars) by making the pillars more tangible for teachers and coaches, and in turn, to facilitate children's collaboration, communication, content mastery, critical thinking, creative innovation, and confidence (the 6 Cs).

- Use small groups and pairs of students.
- Increase students' contributions to interactions with peers and teachers.
- Support hands-on and minds-on exploration, discovery, and inquiry.
- Give students choice and voice in their own learning.
- Help students connect their learning to other experiences both in and out of school.
- Infuse enthusiasm and positivity into learning experiences.

Figure 2. The Active Playful Learning approach



The APL practices were targeted within our coaching to make implementation of the approach as feasible as possible with teacher agency preserved. Teachers were given the choice to select practices to focus on with their APL coach that aligned with their experience and their classroom's unique needs. A wide array of

support was developed for teachers, including six hours of professional development workshops and guides for each practice. We also produced publicly available videos providing an overview of each APL practice. Most importantly, teachers were provided personalized coaching to help them set and reach goals related to specific APL practices, which were connected to relevant pillars and 6 Cs. APL followed the same evidence-based coaching model used in the latest feasibility study in New Hampshire, which included: (1) sustained coaching with classroom visits every two weeks over the course of a school year, (2) explicit connections to teachers' curriculum and learning goals for students, (3) active, hands-on learning for teachers embedded within their classrooms, and (4) a focus on specific, discrete practices aligned with how students learn. Coaching was prioritized, as evidence suggests better outcomes for teachers and students compared to stand-alone workshops and training (e.g., Blazar and Kraft 2015, 542; Kraft et al. 2018, 569).

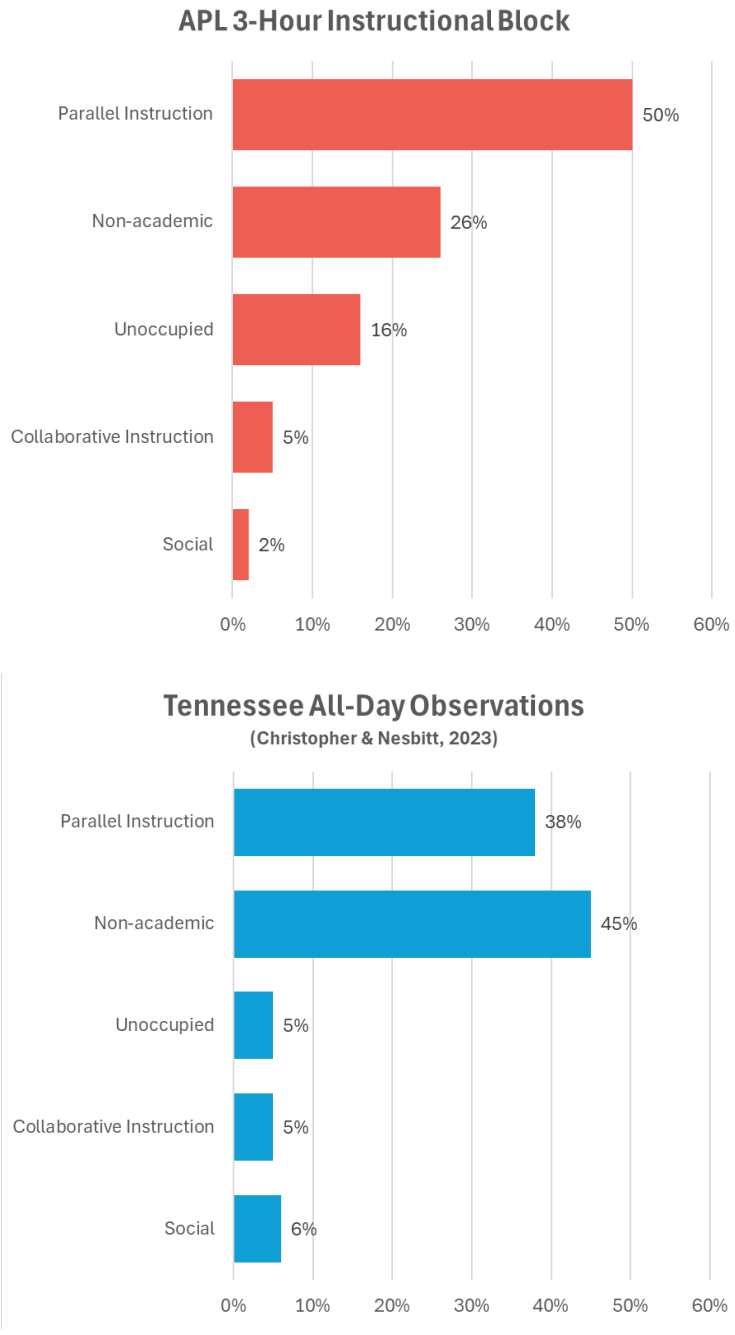
Pilot year 1

Our initial test of the effects of our expanded APL approach was completed over the 2023-2024 school year with 43 kindergarten and 1st-grade classrooms in California, Illinois, Texas, and Virginia. Schools that primarily serve under-resourced communities were prioritized for recruitment. In addition to helping teachers set and make progress toward identified APL practices, coaching aimed to help teachers generalize these practices across subject areas starting with mathematics.

Near the start of the coaching process, classrooms were visited to learn about the existing instructional practices used by teachers and the learning behaviors of students. These 3-hour observations were crucial for understanding the existing learning environments in our classrooms, so they were conducted as early in the intervention as possible, and ideally before coaching occurred (Figure 3). Since APL aims to increase students' active learning and agency, it was eye-opening to find that students spent 50% of the observation, on average, being instructed directly by teachers, typically in teacher-led whole groups with students passively watching. This sharply contrasted with the 5% of the observation that was collaborative instruction, where students interacted with classmates. It was also striking that 26% of the observation was comprised of non-academic routines (e.g., transitions, waiting in line, gathering materials or cleaning up, and classroom management) and for another 16% of the observation period, children were disengaged even when learning opportunities were available to them. Unfortunately, this same pattern of whole group instruction and disengagement was observed in a large-scale study of 100 classrooms from 25 schools conducted in Tennessee (e.g., Christoper and Nesbitt 2023, 4, 7), suggesting that

there is much to be done to make school a place where students are motivated to learn.

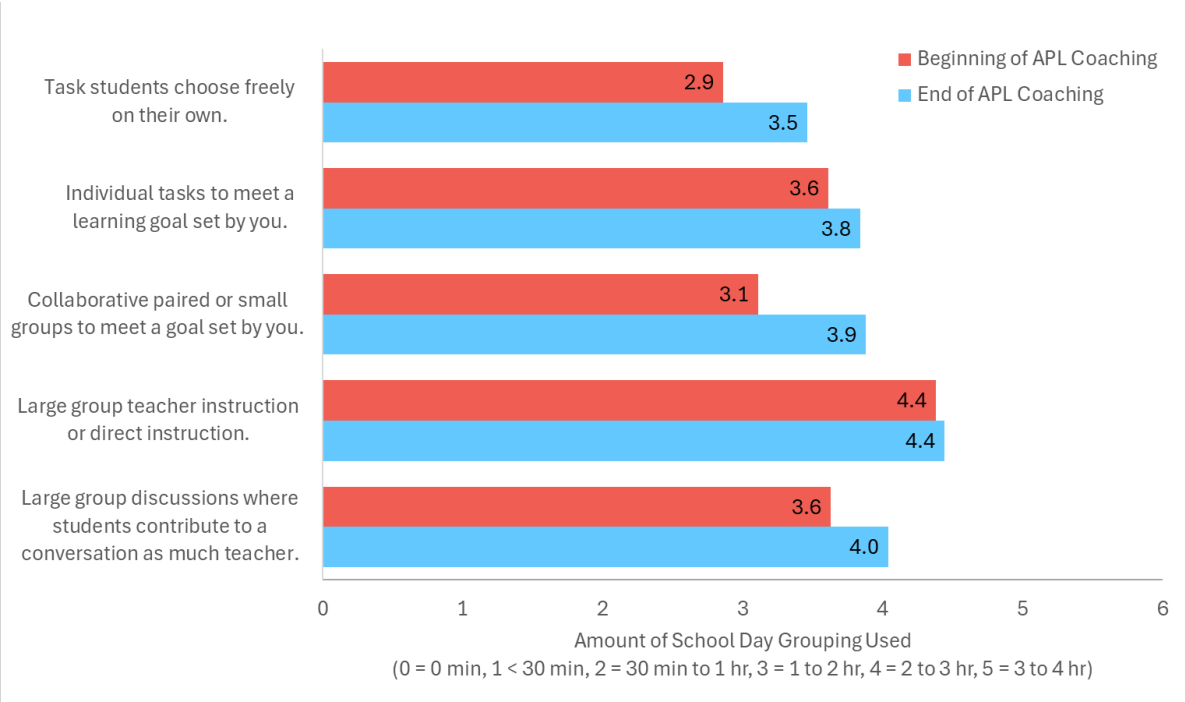
Figure 3. Observations of a kindergarten and first grade school day



We focused on examining differences in teachers' APL practices over the time they participated in APL. While findings are based on teachers' and coaches' ratings, which are not without possible bias, they can provide initial insights into the potential promise of the APL scale-up. Teacher-reported data revealed

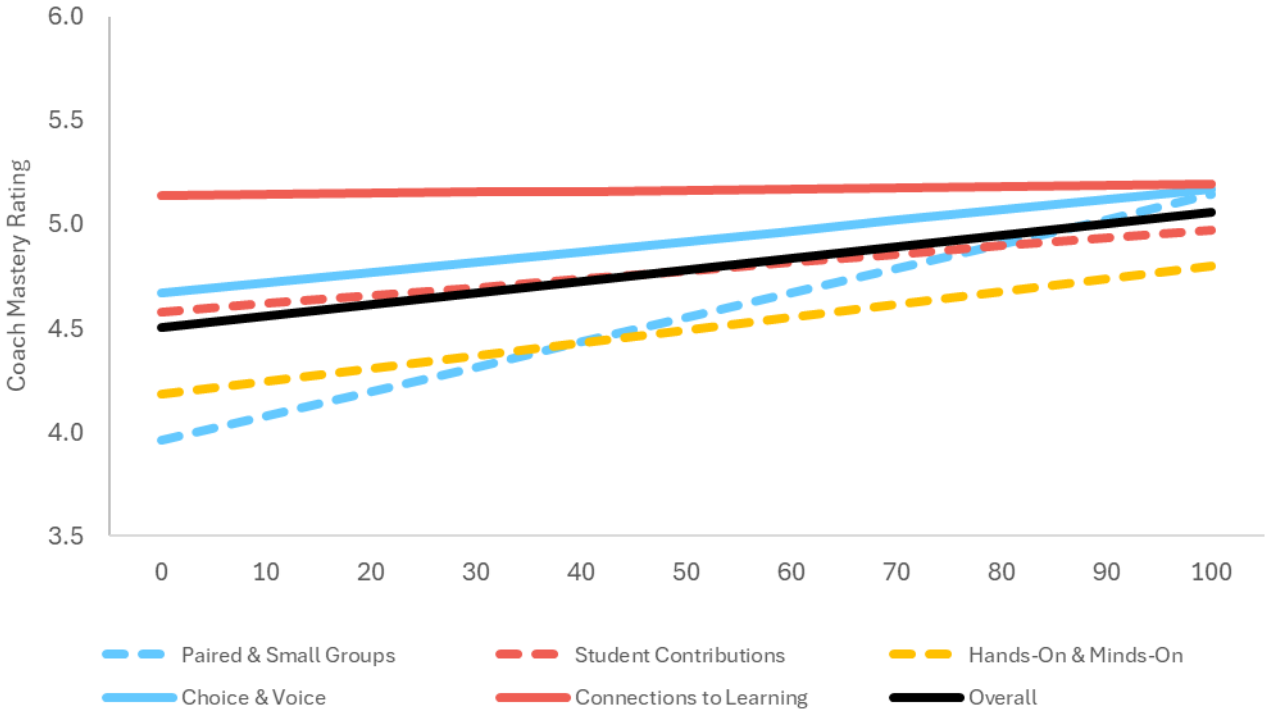
significant increases in the amount of time spent on student-selected instruction, student collaboration in paired and small groups, and large group discussions where students contributed to the conversation as much as the teacher (Figure 4). All these groupings align with APL and were targeted for coaching. It is important to note that large group direct instruction remained unchanged and was still the most frequently reported grouping even at the end of coaching.

Figure 4. Teacher reports of instructional groupings in their classrooms



When looking at specific APL teaching practices, coaches reported a significant increase in teachers' mastery of their goals (black line in Figure 5). Important to our goal of continuous quality improvement, we also found that not all APL practices saw equal progress toward mastery. The greatest growth in mastery was found for the two practices that coaches viewed as having the largest room for growth (Paired & Small Groups and Hands-On & Minds-On). These practices allowed teachers to implement classroom-level changes that could influence student-student and student-teacher interactions, either by changing grouping practices or providing materials to facilitate hands-on learning. We saw less growth in coach ratings of teachers' mastery of the practices that focus on the nature of students' engagement in learning (Student Contributions and Choice and Voice), suggesting a need for additional support to help teachers increase their students' active agency and control in the learning process.

Figure 5. Coach ratings of teachers' APL practice growth



Coaches also reported changes in the underlying APL pillars (Figure 6), including significantly higher ratings at the end of coaching for active, meaningful, social, and iterative learning compared to the beginning of coaching. Ratings for student engagement and joyful learning were also higher but to a lesser extent (Figure 7).

Figure 6. Coach ratings of active, meaningful, social, and iterative learning

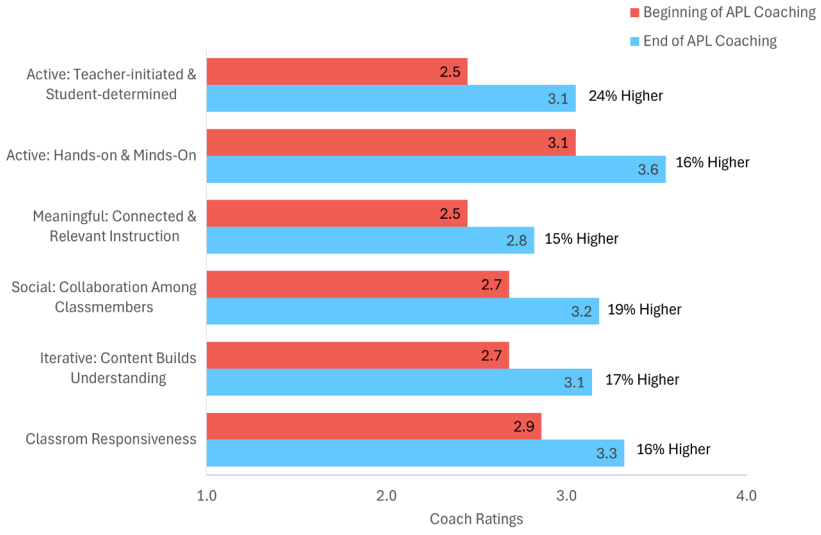
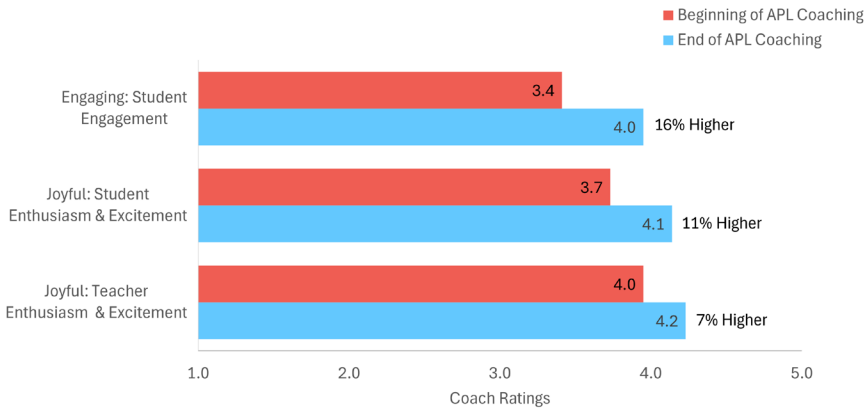


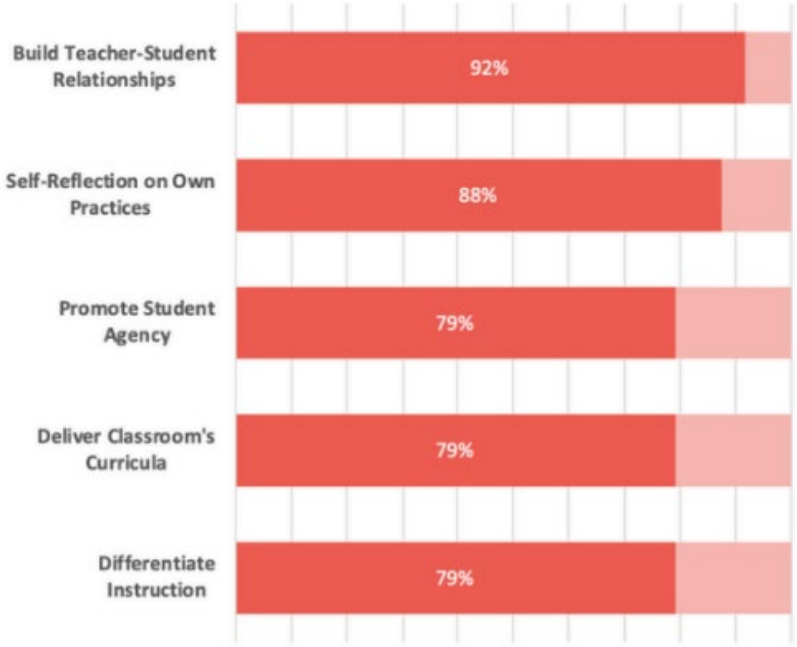
Figure 7. Coach ratings of student engagement and joyful learning



In addition to teacher and coach-reported differences in teaching practices, teachers found APL beneficial to their teaching practices and their students (Figures 8 and 9), with 92% of teachers saying they would recommend APL to a colleague.

Figure 8. Percent of teachers who reported APL was beneficial for their students

Figure 9. Percent of teachers who reported APL was beneficial to their practice



Key takeaways from APL's pilot year

In 2024, Linda Darling-Hammond called to "reinvent" schools. She argued, "Reinvention is necessary because schools in most countries emulate those designed in the image of the factory model of the early 1900s" (218; also see Blumenthal and Pianta 2024, 1). Education systems designed for the 20th century are no longer adequate to prepare 21st century children. Calls to reimagine education for our time are echoed around the globe (e.g., OECD 2019). What is clear is that models based on passive learning and memorization are no longer viable ways to prepare students for a world in which a massive quantity of information lies at their fingertips. It is also clear that we must look at a broader suite of skills if we are to truly prepare students for the workplace of tomorrow (Golinkoff and Hirsh-Pasek 2016, 12-13; McCoy and Sabol 2025, 136-139). Active Playful Learning offers an alternative educational framework that is based on science and is focused on a pedagogical approach, rather than imposing a new curriculum on teachers and students. Such an approach enables educators to adapt principles from the science of learning to current local curricula and contexts.

It is notoriously hard to make changes in the classroom. Randomized controlled trials, largely focused on a narrow set of student outcomes like math and literacy, often generate null results (Jacob et al. 2019, 580). This study took a different approach. Using continuous quality improvement, we asked "What will work?" and "How can we begin to change teacher behaviors in real classrooms in ways that have been associated with changes in student outcomes?" This is a first step, but a promising one. Our results show that teachers can make progress, at least as measured by self-reports and coach reports, in ways that result in practices like more frequent use of small groups and student pairings in the classroom and incorporation of hands-on and minds-on learning that gives students greater agency. This alone is promising because the classrooms we observed were dominated by passive learning and little discussion or student-to-student collaboration. The results presented in this report offer an early demonstration of the feasibility and impact of using the science of learning in the classroom.

In an ongoing iteration of the APL study, we explore the conditions under which APL benefits teachers and students. We further evaluate pre- and post-intervention independent observations of classrooms, and also add comparison classrooms that have not had coaching, and measures of student outcomes, including scores on standardized assessments. We hypothesize that:

- Students in APL classrooms will show greater changes in behavior—and more agency—consistent with their participation in an APL compared to peers in classrooms that did not receive APL coaching.
- Teachers involved in APL will find more pleasure in teaching.
- Students in APL classrooms will have better outcomes on standardized assessments and in their demonstration of behaviors indicative of the 6 Cs.

Even as additional results are forthcoming, the latest findings from the pilot year offer hope. They show that when we teach in the way that human brains learn, teachers are happier, and students are more engaged in their learning.

References

Active Playful Learning. 2023. "Active Playful Learning." Active Playful Learning. https://activeplayfullearning.com/.

Aronson, Brittany, and Judson Laughter. 2016. "The Theory and Practice of Culturally Relevant Education: A Synthesis of Research across Content Areas." *Review of Educational Research* 86 (1):163-206. https://doi.org/10.3102/0034654315582066.

Baines, Ed, Peter Blatchford, and Peter Kutnick. 2003. "Changes in Grouping Practices Over Primary and Secondary School." *International Journal of Educational Research* 39 (1-2):9-34. https://doi.org/10.1016/S0883-0355(03)00071-5

Blazar, David, and Matthew A. Kraft. 2015. "Exploring Mechanisms of Effective Teacher Coaching: A Tale of Two Cohorts from a Randomized Experiment." *Educational Evaluation and Policy Analysis* 37 (4):542-66. https://doi.org/10.3102/0162373715579487.

Blinkoff, Elias, Kimberly Turner Nesbitt, Roberta Michnick Golinkoff, and Kathy Hirsh-Pasek. 2024. "Observation of Student and Teacher Behaviors During a Preliminary Active Playful Learning Intervention in Kindergarten Classrooms." *Education Sciences* 14 (6):648. https://doi.org/10.3390/educsci14060648.

Blinkoff, Elias, Charlotte Anne Wright, Molly Scott *et al.* 2023. "Shifting from a Classroom of Reluctant Compliance to a Classroom of Responsive Curiosity." *Young Children* 78 (3):14-22. https://www.naeyc.org/resources/pubs/yc/fall2023

Blumenthal, Howard, and Robert C. Pianta. 2024. *Kids on Earth: The Power & Potential of 5 Billion Minds*. Pre-Publication Edition ed. https://www.socialchangeinnovators.com/site/templates/files/1721654487-Kids%20on%20Earth%20-%20Book%20-%20Pre-Publication%20%20-%207-17-24.pdf

Brooks, David. 2024. "How the Ivy League Broke America." *The Atlantic*. https://www.theatlantic.com/magazine/archive/2024/12/meritocracy-college-admissions-social-economic-segregation/680392/.

Care, Esther, Kate Anderson, and Helyn Kim. 2016. *Visualizing the Breadth of Skills Movement across Education Systems*. The Brookings Institution. https://www.brookings.edu/wp-content/uploads/2016/09/global_20160916_breadth_of_skills_movement.pdf.

Chen, Cheng-Huan, and Yong-Cih Yang. 2019. "Revisiting the Effects of Project-Based Learning on Students' Academic Achievement: A Meta-Analysis Investigating Moderators." *Educational Research Review* 26:71-81. https://doi.org/10.1016/j.edurev.2018.11.001.

Chetty, Raj, John N. Friedman, Nathaniel Hilger, Emmanuel Saez, Diane Whitmore Schanzenbach, and Danny Yagan. 2011. "How Does Your Kindergarten Classroom Affect Your Earnings? Evidence from Project Star." *The Quarterly Journal of Economics* 126 (4):1593-660. https://doi.org/10.1093/qje/qjr041.

Christopher, Caroline, and Kimberly Nesbitt. 2023. "Consistency and Inconsistency in Learning Experiences across the Early Grades." *Frontiers in Education* 8:1265501. https://doi.org/10.3389/feduc.2023.1265501.

Civil, Marta. 2016. "STEM Learning Research through a Funds of Knowledge Lens." *Cultural Studies of Science Education* 11:41-59. https://doi.org/10.1007/s11422-014-9648-2.

Darling-Hammond, Linda. 2022. "Reimagining American Education: Possible Futures: The Policy Changes We Need to Get There." *Phi Delta Kappan* 103 (8):54-57. https://doi.org/10.1177/00317217221100012.

Darling-Hammond, Linda. 2024. "Reinventing Systems for Equity." *ECNU Review of Education* 7 (2):214-29. https://doi.org/10.1177/20965311241237238.

DeCaro, Marci S., and Bethany Rittle-Johnson. 2012. "Exploring Mathematics Problems Prepares Children to Learn from Instruction." *Journal of Experimental Child Psychology* 113 (4):552-68. https://doi.org/10.1016/j.jecp.2012.06.009.

Ferrero, Marta, Miguel A. Vadillo, and Samuel P. Leon. 2021. "Is Project-Based Learning Effective among Kindergarten and Elementary Students? A Systematic Review." *PLoS One* 16 (4):e0249627. https://doi.org/10.1371/journal.pone.0249627.

Finley, Ashley P. 2023. *The Career-Ready Graduate: What Employers Say About the Difference College Make*s. American Association of Colleges and Universities. https://www.aacu.org/research/the-career-ready-graduate-what-employers-say-about-the-difference-college-makes.

Ghana Education Service. 2025. "Early Childhood Education (ECE) Unit." Ghana Education Service. https://ges.gov.gh/early-childhood/.

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

Government of India, Ministry of Human Resource Development 2020. *National Education Policy 2020*. https://www.education.gov.in/sites/upload_files/mhrd/files/NEP_Final_English_0.pdf

Heckman, James J. 2008. "Schools, Skills, and Synapses." *Economic Inquiry* 46 (3):289-324. https://doi.org/10.1111/j.1465-7295.2008.00163.x.

Hill, Carolyn J., Lauren Scher, Joshua Haimson, and Kelly Granito. 2023. *Conducting Implementation Research in Impact Studies of Education Interventions: A Guide for Researchers*. National Center for Education Evaluation and Regional Assistance, Institute of Education Sciences, U.S. Department of Education. http://ies.ed.gov/ncee.

Hirsh-Pasek, Kathy, Roberta Michnick Golinkoff, Kimberly Nesbitt, Carol Lautenbach, Elias Blinkoff, and Ginger Fifer. 2022. *Making Schools Work: Bringing the Science of Learning to Joyful Classroom Practice*. Teachers College Press.

Hirsh-Pasek, Kathy, Helen Shwe Hadani, Elias Blinkoff, and Roberta M. Golinkoff. 2020*. A New Path to Education Reform: Playful Learning Promotes 21st-Century Skills in Schools and Beyond*. The Brookings Institution. https://www.brookings.edu/articles/a-new-path-to-education-reform-playful-learning-promotes-21st-century-skills-in-schools-and-beyond/.

Hirsh-Pasek, Kathy, Jennifer M. Zosh, Roberta Michnick Golinkoff, James H. Gray, Michael B. Robb, and Jordy Kaufman. 2015. "Putting Education in "Educational" Apps: Lessons from the Science of Learning." *Psychological Science in the Public Interest* 16 (1):3–34. https://doi.org/10.1177/1529100615569721.

Hyman, Joshua. 2017. "Does Money Matter in the Long Run? Effects of School Spending on Educational Attainment." *American Economic Journal: Economic Policy* 9 (4):256-80. https://doi.org/10.1257/pol.20150249.

Jackson, C. Kirabo, and Claire L. Mackevicius. 2024. "What Impacts Can We Expect from School Spending Policy? Evidence from Evaluations in the United States." *American Economic Journal: Applied Economics* 16 (1):412-46. https://doi.org/10.1257/app.20220279.

Jacob, Robin T., Fred Doolittle, James Kemple, and Marie-Andree Somers. 2019. "A Framework for Learning from Null Results." *Educational Researcher* 48 (9):580-89. https://doi.org/10.3102/0013189X19891955.

Kokotsaki, Dimitra, Victoria Menzies, and Andy Wiggins. 2016. "Project-Based Learning: A Review of the Literature." *Improving Schools* 19 (3):267-77. https://doi.org/10.1177/1365480216659733.

Kraft, Matthew A., David Blazar, and Dylan Hogan. 2018. "The Effect of Teacher Coaching on Instruction and Achievement: A Meta-Analysis of the Causal Evidence." *Review of Educational Research* 88 (4):547-88. https://doi.org/10.3102/0034654318759268.

Lee, Ji Young, Charlotte Anne Wright, Roberta Michnick Golinkoff, and Kathy Hirsh-Pasek. 2023. "Another Case of the Theory to Practice Gap: South Korean Early Childhood Education and Care." *Early Childhood Research Quarterly* 65:385-95. https://doi.org/10.1016/j.ecresq.2023.07.008.

Lillard, Angeline S., Megan J. Heise, Eve M. Richey, Xin Tong, Alyssa Hart, and Paige M. Bray. 2017. "Montessori Preschool Elevates and Equilizes Child Outcomes: A Longitudinal Study." *Frontiers in Psychology* 8:1783. https://doi.org/10.3389/fpsyg.2017.01783.

McCormick, Meghan, Christina Weiland, JoAnn Hsueh *et al.* 2021. "Is Skill Type the Key to the PreK Fadeout Puzzle? Differential Associations between Enrollment in PreK and Constrained and Unconstrained Skills across Kindergarten." *Child Development* 92 (4):e599-e620. https://doi.org/10.1111/cdev.13520.

McCoy, Dana Charles, and Terri J. Sabol. 2025. "Overcoming the Streetlight Effect: Shining Light on the Foundation of Learning and Development in Early Childhood." *American Psychologist* 80 (2):135-47. https://doi.org/10.1037/amp0001432.

Meltzoff, Andrew N., Patricia K. Kuhl, Javier Movellan, and Terrence J. Sejnowski. 2009. "Foundations for a New Science of Learning." *Science* 325 (5938):284-88. https://doi.org/10.1126/science.1175626.

Moll, Luis C., Cathy Amanti, Deborah Neff, and Norma Gonzalez. 1992. "Funds of Knowledge for Teaching: Using a Qualitative Approach to Connect Homes and Classrooms." *Theory Into Practice* 31 (2):132-41. https://doi.org/10.1080/00405849209543534.

Nesbitt, Kimberly Turner, Elias Blinkoff, Roberta Michnick Golinkoff, and Kathy Hirsh-Pasek. 2023. "Making Schools Work: An Equation for Active Playful Learning." *Theory Into Practice* 62 (2):141-54. https://doi.org/10.1080/00405841.2023.2202136.

Nesbitt, Kimberly Turner, Elias Blinkoff, Adalet Baris Gunersel, and Kathy Hirsh-Pasek. 2025. "Feasibility and Acceptability of an Active Playful Learning Intervention for Kindergarten Teachers Using Instructional Coaching." *Early Education and Development* 36 (4): 818–38. https://doi.org/10.1080/10409289.2025.2449688.

New Hampshire Department of Education. 2018. *Play-Based Kindergarten RSA 193-E:2-a Technical Advisory*. New Hampshire Department of Education.

OECD. 2019. *OECD Future of Education and Skills 2030 Project Background*. OECD. https://www.oecd.org/content/dam/oecd/en/about/projects/edu/education-

2040/publications/Project%20background%20E2030%20Introduction_FINAL_rev.pdf.

Sawyer, R. Keith. 2014. “Introduction: The New Science of Learning,” in *The Cambridge Handbook of the Learning Sciences*, edited by R. Keith Sawyer. Cambridge University Press.

Skene, Kayleigh, Christine M. O'Farrelly, Elizabeth M. Byrne, Natalie Kirby, Eloise C. Stevens, and Paul G. Ramchandani. 2022. "Can Guidance During Play Enhance Children's Learning and Development in Educational Contexts? A Systematic Review and Meta-Analysis." *Child Development* 93 (4):1162-80. https://doi.org/10.1111/cdev.13730.

Trawick-Smith, Jeffrey, Sudha Swaminathan, Brooke Baton, Courtney Danieluk, Samantha Marsh, and Monika Szarwacki. 2016. " Block Play and Mathematics Learning in Preschool: The Effects of Building Complexity, Peer and Teacher Interactions in the Block Area, and Replica Play Materials." *Journal of Early Childhood Research* 15 (4):433-48. https://doi.org/10.1177/1476718X16664557.

UNESCO. 2024. *Why the World Needs Happy Schools: Global Report on Happiness in and for Learning.* UNESCO. https://unesdoc.unesco.org/ark:/48223/pf0000389119.

Weisberg, Deena Skolnick, Kathy Hirsh-Pasek, and Roberta Michnick Golinkoff. 2013. "Guided Play: Where Curricular Goals Meet a Playful Pedagogy." *Mind, Brain, and Education* 7 (2):104-12. https://doi.org/10.1111/mbe.12015.

Winthrop, Rebecca, Gib Bulloch, Pooja Bhatt, and Arthur Wood. 2013. *Investment in Global Education: A Strategic Imperative for Business*. The Brookings Institution. https://www.brookings.edu/articles/investment-in-global-education-a-strategic-imperative-for-business/.

Winthrop, Rebecca, and Eileen McGivney. 2016. *Skills for a Changing World: Advancing Quality Learning for Vibrant Societies*. The Brookings Institution. https://www.brookings.edu/wp-content/uploads/2016/05/global_20160809_skills_for_a_changing_world.pdf.

Winthrop, Rebecca, Eileen McGivney, and Adam Barton. 2017. *Can We Leapfrog? The Potential of Education Innovations to Rapidly Accelerate Progress*. The Brookings Institution. https://www.brookings.edu/articles/can-we-leapfrog-the-potential-of-education-innovations-to-rapidly-accelerate-progress/.

Zosh, Jennifer M., Caroline Gaudreau, Roberta Michnick Golinkoff, and Kathy Hirsh-Pasek. 2022. “The Power of Playful Learning in the Early Childhood Setting.” In *Developmentally Appropriate Practice in Early Childhood Programs Serving Children from Birth Through Age 8,* 4th ed., edited by Susan Friedman, Sue Bredekamp, Marie Masterson, Barbara Willer, and Brian L. Wright. NAEYC.

Zosh, Jennifer M., Kathy Hirsh-Pasek, Emily J. Hopkins *et al.* 2018. "Accessing the Inaccessible: Redefining Play as a Spectrum." *Frontiers in Psychology* 9:1124. https://doi.org/10.3389/fpsyg.2018.01124.

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