



With the support of the LEGO Foundation

LEARNING THROUGH Play

Foundational Research on
Teacher Professional Development

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Introduction



The aspiration of the LEGO Foundation is to support children to become creative, engaged, lifelong learners, who thrive in a constantly changing world by experiencing the benefits of learning through play. Learning through play offers deep learning experiences that are joyful, meaningful, active, engaged, iterative, and social. The LEGO Foundation has identified several pedagogies that can be playful and afford these types of active learning experiences. These pedagogies include active learning, cooperative learning, experiential learning, guided discovery learning, inquiry-based learning, problem-based learning, project-based learning, and Montessori education (Parker & Thomsen, 2019).

Bringing learning through play pedagogies to schools and children requires major investments in teacher professional development (TPD) that builds teachers' understanding of the value of learning through play, enables them to build and practice strategies and skills to support learning through play in the classroom, and supports their ongoing development as facilitators of this approach to teaching and learning. The LEGO Foundation funded Education Development Center (EDC) to conduct foundational research on the elements of effective TPD, the conditions that enable and support teacher implementation of learning through play pedagogies, and approaches to measuring teacher and student outcomes related to learning through play.

EDC's research is guided by the following questions:

- 1. What are the components and characteristics of effective TPD interventions, particularly those that support learning through play pedagogies?**
- 2. What are the enabling conditions that may moderate the impact of TPD interventions and the implementation of these pedagogies in classrooms?**
- 3. How do existing research and evaluation studies of interventions aligned with learning through play measure teacher and/or student outcomes?**

This report brings together a review of existing research, exploration of existing programs, and interviews with teachers to illuminate the potential of TPD to support learning through play as well as the challenges present in this work. The goal of this report is to inform efforts to further this work in the United States. Given the specific conditions and challenges that arise from the U.S. context, we prioritize and focus our review on research based in the United States. However, we do include research and programs outside of the United States that can inform our understanding.

The report is organized into the following sections:

- 1. Effective TPD and examples from the field: Research on and exploration of the elements of effective TPD:**
 - Models and theories of TPD
 - Elements of effective TPD
 - Examples of TPD aligned with learning through play
- 2. Enabling and supporting conditions for TPD: Research on the mediating factors and systems that influence TPD and its effectiveness:**
 - Role of conditions in TPD
 - Teacher conditions
 - Classroom conditions
 - School and system conditions
- 3. Measuring teacher and student outcomes: Review of existing instruments used to measure teacher and student outcomes from TPD and learning through play pedagogies:**
 - An overview of how TPD is evaluated
 - Measurement of teacher outcomes
 - Measurement of student outcomes
- 4. Imagining TPD for learning through play: Based on what has been learned through this research, how might TPD for learning through play be approached?**

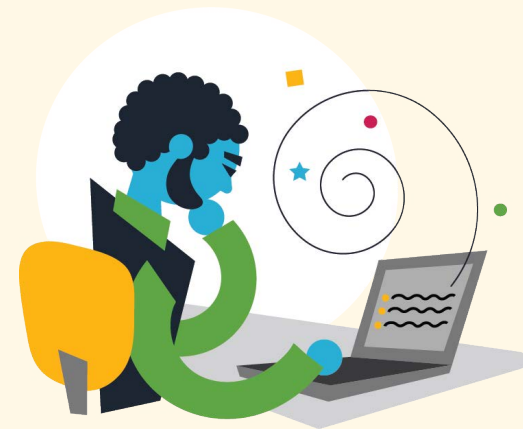
A detailed description about the approach and methods for developing this report is included in **Appendix A**.

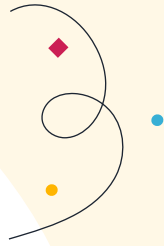
Teaching Today in the United States



When considering the landscape of TPD in the United States, it is important to situate TPD in the current context of school and teaching in this country. Below we describe some aspects of schools and teaching in the United States that influence TPD implementation and approaches.

The education system in the United States is fragmented, localized, and political, and unlike many countries, there is no national curriculum. The Common Core standards, introduced in 2010, were an effort to establish national education standards for mathematics and English language arts. While most states have adopted them, many states have their own standards, and the Every Student Succeeds Act passed in 2015 prohibits the U.S. Department of Education from encouraging adoption of the Common Core Standards. Similarly, the Next Generation Science Standards have been adopted by only 20 states.





A 2020 report highlighted the increased explicit demands placed upon K–12 teachers today, including increased content standards and deeper learning goals, an increasingly diverse student body, and calls for greater support of students’ social-emotional growth.

In 2020, the National Academies of Sciences, Engineering, and Medicine (National Academies) authored the consensus study *Changing Expectations for the K–12 Teacher Workforce* (Floden et al., 2020). The report highlighted the increased explicit demands placed upon K–12 teachers today, including increased content standards and deeper learning goals, an increasingly diverse student body, and calls for greater support of students’ social-emotional growth. According to a recent *EducationWeek* survey, a typical teacher works about 54 hours a week with less than half of that time on instruction (Najarro, 2022).

Teacher labor markets are highly localized. Each state has its own rules and regulations regarding licensure, tenure, and promotion. Workplace conditions vary widely, from leadership, resources, and mentoring to school-level characteristics and student demographics. In addition, the presence and role of teacher unions vary across states (Floden et al., 2020). In 2015–2016, approximately 70% of teachers belonged to a union or employees association (National Center for Education Statistics [NCES], n.d.). The National Education Association (NEA) emphasizes the role that unions play in providing equitable access to TPD, ensuring that teachers receive adequate time and support, and that teacher evaluation is aligned with TPD and vice versa (National Education Association [NEA], 2018).

While all teachers participate in some form of TPD, the relevance of it to their teaching responsibilities varies greatly. For example, the 2018 National Survey of Science and Mathematics Education found that only 36% of elementary school and 57% of middle school grade science teachers participated in discipline-focused TPD in the previous 12 months, and the majority of K–8 science teachers who had engaged in TPD had less than 6 hours of it (Banilower et al., 2018). Due to the COVID-19 pandemic, schools received an infusion of funds through the American Rescue Plan, which have been used to support TPD. However, much of that TPD has been focused on supporting students emotional and mental health.¹

Effective Teacher Professional Development



Models and Theories of TPD

Investigations of effective TPD often start with an articulated or assumed model or theory of change of how teachers learn and grow, change their classroom practice, and implement strategies to improve student outcomes.

Guskey’s model of teacher change (1986) has served as the basis for much of the understanding and research on TPD for many years. This model identifies three major goals of TPD:

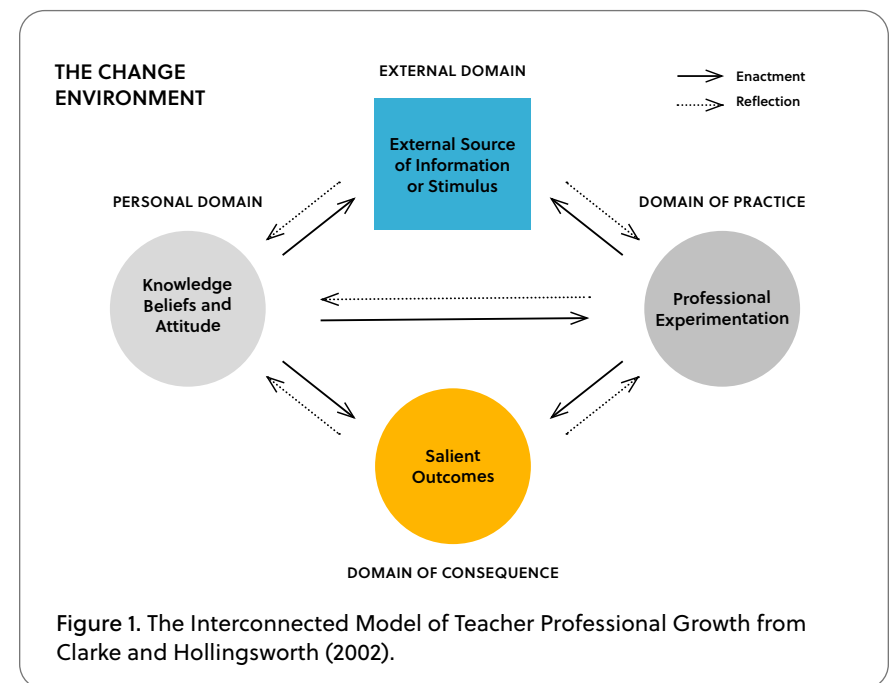
1. Change in teacher classroom practice,
2. Change in teacher attitudes and beliefs, and
3. Change in learning outcomes for students.

Guskey posits that student outcomes precede and lead to teacher change in attitudes or belief. This model of change requires that teachers put their learning into practice before practices that teachers find effective are embraced, deepened, and sustained.

Building on this model, Clarke & Hollingsworth (2002) consider the interplay between beliefs and practice when it comes to teacher change, growth, and development. Their research using the Interconnected Model of Teacher Professional Growth (**Figure 1**) emphasizes the role that the process of enactment and reflection play in mediating teacher change.

The World Bank has a significantly simplified model of TPD that includes three stages: access, engage, and apply (Quota et al, 2022). While simple, this model provides a framework for defining and evaluating the processes and mechanisms that may or may not be effective, as well as the challenges and barriers that can arise.

These models have been instrumental in moving TPD away from the onetime and deficit model approach that dominated the landscape in the 20th century, shifting TPD from something that is done to teachers to something that teachers, as active learners, participate and engage in (Clarke & Hollingsworth, 2002). We highlight these models and theories of change to situate the research on effective TPD within broader ideas of how TPD is imagined to work. However, we found little research that empirically addresses these theories (Garrett et al., 2021).



The Role of Adult Learning Theory in TPD

Clarke & Hollingsworth (2002) encourage the understanding of professional development and growth as learning, thereby situating TPD within the body of learning theory and research. However, little research on TPD draws explicit connection to adult learning theory. Adult learning theory is more commonly cited in professional development designs by human resource professionals in corporate settings, such as developing training for new or veteran employees or in the medical field as new technologies and discoveries demand change in practice (Reed et al., 2016). Although there have been similar radical changes in technologies and pedagogies in school settings, adult learning theory is only beginning to be applied to teachers and now offers a new way of examining and evaluating TPD (Sims & Fletcher-Wood, 2021). Rothwell (2020) suggests that it is critical to move away from a training model that is focused on providing instruction to a facilitating model that encourages adult learners to question and respond for themselves from their own unique perspectives and given their personal and professional backgrounds.

Core tenets of adult learning include

1. The learner's need to know
2. Self-concept of the learner
3. Prior experience of the learner
4. Readiness to learn
5. Orientation to learning
6. Motivation to learn

(Knowles, 1978).



Involving adults in the planning of learning experiences increases the likelihood that these tenets will be addressed. Crucial to adult learning theory, and thus TPD, is that adults see themselves as learners, capable of and ready to learn new skill sets (Aspen Institute, 2018). For teachers, this means that they believe themselves capable of learning and implementing new strategies in their classrooms. This, however, can be particularly difficult for veteran teachers who are confident in the skills they already possess and do not see the need to or feel they can learn new skills (see **Teacher Conditions**, for a discussion on how teacher disposition can influence TPD).

The basis of adult learning theory defines adults as self-directed learners who learn when the content is relevant to their everyday life and when their learning supports problem-solving in their current contexts, as well as acknowledges the lived-experiences adult learners bring to their learning (Knowles et al., 2020). When considering teachers as adult learners, it is important to recognize their prior experience in the classroom as it relates to their current learning; it is important then, that TPD allows time for reflection on prior practices (Lucas Education Research, 2021a). Along those lines, adult learning theory also recognizes that a one-size-fits-all approach is less effective, and that learning experiences need to be adjusted based on prior experience (Popova et al., 2018).

Further, adult learning theory highlights the importance of engaging expert facilitators in TPD. Trust and relationships are important for adult learners, meaning it is important to bring in experts and fellow practitioners to create a community of practice and learning, ensuring that teacher practice is front and center of all professional development activities (Richards et al., 2021). It is important that teachers believe those who are delivering professional development are on the same team as they are, wanting to better their practice with the shared goal of improving student outcomes.

Research on Effective TPD

Before diving into the elements of effective TPD, what is known about ineffective—referred to as “traditional”—TPD?

Traditional TPD typically consisted of one-time learning opportunities for teachers. These either took place in the school prior to or during the school year or at conferences. This format for TPD was flawed as it treated teachers as passive learners and covered a variety of topics instead of focusing on a particular practice (i.e., it was broad rather than deep). Traditional TPD was a one-off experience, removed from teacher practice, and without space or time for teacher reflection (Rucker, 2018). Traditional TPD’s heavy reliance on workshops also reflected a one-size-fits-all approach with little consideration for teacher needs or experience (Zdonek, 2016). There is little evidence that this traditional model of professional development had any positive impact on student achievement. To illustrate, a 2007 study (Yoon et al., 2007) of 1,300 professional development programs found that only nine met the What Works Clearinghouse standards. Of these nine, three offered one-time, limited professional development that showed no statistically significant positive outcomes on student achievement. The discourse around TPD shifted in the early 2000’s, and that included a shift from isolated, episodic teacher professional development experiences to reframing TPD as professional *learning* for teachers throughout their careers. In a 2018 blog post, the U.S. Regional Educational Laboratory Program distinguished the term *professional development* from the term *professional learning*, with the former being something

that “happens to” teachers and the latter being when teachers “practice what they are learning in their own teaching contexts” (Scherff, 2018).



A lot of times the [school] district buys a curriculum and then we have a PD around it and it’s a salesperson and they’re not really giving us what we need ... it was so scripted and you could tell the woman just was reading her script and getting paid from the company, but it didn’t follow the lead of what the staff really needed, and even our coordinator apologized afterwards.

—Kindergarten Teacher, Watertown, MA

Main Sources of Guidance

There is no shortage of guidance on the elements and standards of high-quality TPD offered by researchers, professional associations, governmental organizations, and nongovernmental organizations (NGOs). However, the extent to which the guidance is based on research varies. Clear, common definitions of TPD, much less effective TPD, have been lacking in the field (Popova et al., 2018). However, most research on TPD defines *effectiveness* as yielding positive student outcomes (Kennedy, 2016; Darling-Hammond, 2020; Floden et al., 2020). Following, we provide a summary of some of the most cited guidance for effective TPD, and then offer more details on research about practices and characteristics.

Perhaps the two most cited sources for guidance on effective TPD in the United States are Darling-Hammond et al.'s (2017) synthesis *Effective Teacher Professional Development* and the Learning Forward's **Standards for Professional Learning** (Learning Forward, 2022).² Darling-Hammond's synthesis is based on a review of 35 rigorous studies that link TPD, teacher practice, and student outcomes. Learning Forward's standards are based on research as well as input from practitioners and engagement with state agencies. While these two sets of guidance overlap, they are also complementary. Darling-Hammond focuses on attributes and characteristics (**Figure 2**) of an intervention. Learning Forward considers context and systems, and their standards represent goals and outcomes for effective TPD rather than specific strategies. The revision of their standards in 2022 included organizing them into three areas—conditions for success, transformational processes, and rigorous content for each learner—and adding three standards that specifically address equity. The NEA report *Great Teaching and Learning: Creating the Culture to Support Professional Excellence* (2018) describes the characteristics of professional supports at different phases of a teacher's career. In addition to citing the Learning Forward standards, the report emphasized that successful TPD for professional teachers includes extended study of theory embedded with opportunities for practice over an extended time, peer coaching, and an atmosphere of collaboration and a culture of peer learning. The report also recommended that professional learning should have clear outcomes in mind and should not focus on overly scripted practices.

The World Bank (Quota et al., 2022) offers concise and simple guidance for effective in-service TPD based on four evidence-based principles. To be effective and lead to student outcomes, TPD should be tailored, practical, focused, and ongoing. These principles align with the above guidance and research on effective

7 Characteristics of Effective TPD

1. Is content focused
2. Incorporates active learning
3. Supports collaboration
4. Uses models of effective practice
5. Provides coaching and expert support
6. Offers feedback and reflection
7. Is of sustained duration

Figure 2. 7 characteristics of effective PD
(Darling-Hammond et al., 2017)



TPD. In addition to these principles, research on World Bank TPD programs found that programs that included career incentives, subject focus, lesson enactment, and initial face-to-face trainings were linked to greater student outcomes (Popova et al., 2018).

While the characteristics and guidelines described above dominate discussions and research on effective TPD, there is a body of research that offers a different perspective on and approach to understanding the elements of effective TPD. Kennedy's (2016) meta-analysis of research on effective TPD found that the overall design of TPD differed in effectiveness more than specific instructional mechanisms of the TPD, such as coaching. She identifies four categories of TPD based on the approach used to address a central problem of teaching practice: prescription, strategies, insight, and body of knowledge. Analysis suggests that the insight approach, in which teachers are given time and opportunity to make sense of new ideas, is more successful in producing positive student outcomes. Kennedy (2016) argues that "we need to replace our current conception of 'good' PD as

The Learning Forward 2022 Standards for Professional Learning

Rigorous Content for Each Learner

Equity practices: Understand their students' historical, cultural, and societal contexts, embrace student assets through instruction, and foster relationships with students, families, and communities.

Curriculum, assessment, and instruction: Prioritize high-quality curriculum and instructional materials for students, assess student learning, and understand curriculum and implement through instruction.

Professional expertise: Apply standards and research to their work, develop the expertise essential to their roles, and prioritize coherence and alignment in their learning.

Transformational Processes

Equity drivers: Prioritize equity in professional learning practices, identify and address their own biases and beliefs, and collaborate with diverse colleagues.

Evidence: Create expectations and build capacity for use of evidence, leverage evidence, data, and research from multiple sources to plan educator learning, and measure and report the impact of professional learning.

Learning designs: Set relevant and contextualized learning goals, ground their work in research and theories about learning, and implement evidence-based learning designs.

Implementation: Understand and apply research on change management, engage in feedback processes, and implement and sustain professional learning.

Conditions for Success

Equity foundations: Establish expectations for equity, create structures to ensure equitable access to learning, and sustain a culture of support for all staff.

Culture of collaborative inquiry: Engage in continuous improvement, build collaboration skills and capacity, and share responsibility for improving learning for all students.

Leadership: Establish a compelling and inclusive vision for professional learning, sustain coherent support to build educator capacity, and advocate for professional learning by sharing the importance and evidence of impact of professional learning.

Resources: Allocate resources for professional learning, prioritize equity in their resource decisions, and monitor the use and impact of resource investments.

Figure 3. The Learning Forward Standards for Professional Learning, (Learning Forward, 2022).

comprising a collection of design features with a conception that is based on more nuanced understanding of what teachers do, what motivates them, and how they learn and grow” (p. 974).

Other studies and syntheses also contradict some of the more established recommendations on effective TPD. A 2015 study of three large school districts and one charter school network found no common qualities in TPD, such as being sustained or job-embedded, among teachers who improved according to teacher evaluations (Jacob & McGovern, 2015). The National Academies study on the teacher workforce also disputes some elements of effective TPD, finding that duration or frequency of TPD is less related to student outcomes, while factors such as teachers’ participation with colleagues from their school and opportunities for teachers to discuss how to adapt the content or materials to their own school correlate with positive impact on student learning (Floden et al., 2020).

Recommended Practices

Perhaps the most common guidance for effective TPD is that it be a **sustained effort**, meaning that it comprises more than an isolated learning experience. Teachers need time and space to learn, practice, implement, and reflect in order to make changes in their teaching. According to research, effective TPD employs a sustained approach that sets specific and actionable goals and allows teachers to implement learnings over time and receive feedback through follow-up sessions, mentoring, and coaching (Darling-Hammond, et al., 2017; Kuijpers et al., Wubbels, 2010). Research highlights that when designing and implementing TPD, it is important to recognize change as a gradual and challenging process for teachers. It requires time and energy on top of ongoing demands and requirements of the classroom. Implementing new practices means taking risks and potentially risking failure, such



I do like professional development that you check back in on. In the sense of, here’s something that you could take to your classroom. Have you implemented it? Here’s what we’re suggesting. What lesson plans would work well and then you maybe circle back 60–90 days later and share, what’s worked, maybe what didn’t work and then kind of round robin like, ‘I tried this and it was a ball of fire. What do you guys think?’ And then people share their own experiences.

—Middle school teacher, Waltham, MA

as taking a risk that students may not benefit or learn. Further, teachers need time to make sense of practices and adapt what they learn to their own contexts (Kennedy, 2016; Guskey, 2002).

An example of what sustained effort looks like can be found in the evaluation of the eMINTS professional development program, designed to promote inquiry-based learning. Conducted in 2015, it had the highest tier of evidence for student achievement for the What Works Clearinghouse. This TPD program included two years of professional development with significant time for formal TPD, at least 10 hours of coaching each year, and time with a designer to implement a classroom website. The intensive nature of the TPD combined with the necessary resources saw improved mathematics scores for students when compared with their peers (Meyers et al., 2016).

While there have been some attempts to provide guidance on a minimum number of hours for effective TPD, it is equally important to consider what that time is spent on. Research

indicates that the duration of TPD alone is not a clear indicator of quality TPD (Floden et al., 2020). There is consensus that effective high-quality TPD includes some form of **coaching and expert support**, as well as structured opportunities for feedback and reflection (Darling-Hammond et al., 2017; Hill & Papay, 2022). Such follow-up provides additional instruction and guidance to teachers and also builds in accountability. Much of the evidence on coaching comes from the study of literacy coaching programs for kindergarten and early primary grade teachers, and while some studies find coaching valuable, they also highlight the difficulty of scaling coaching programs while maintaining effectiveness (Kraft et al., 2018). While there are few empirical studies focused purely on instructional coaching outside of other forms of support, it has been found that coaching in the context of effective TPD touches on five key components: content focus, active learning, sustained duration, coherence, and collective participation (Desimone & Pak, 2017). Hill and Papay also note that coaching is most effective when the coaches also receive some professional development (2022).

Re-enforcing the idea that not all coaching is equal, Kennedy's (2016) meta-analysis of effective TPD found that the inclusion of coaching in and of itself did not necessarily correlate with effectiveness; coaching designed to use a collaborative, problem-solving approach as part of a strategic TPD program was effective while coaching that was part of a prescriptive program using standards to observe and give feedback on teacher practice was not. A study on coaching in Malaysia found that coaching was most effective when coaches took a "non-authoritative" approach to their roles, not judging teachers and instead advocating for them where appropriate (Mohamed et al., 2019). In addition to the teachers receiving coaching, research indicates that teachers providing the coaching also see benefits, including increased satisfaction in their work and change in pedagogical

practice (Hope et al., 2022). As with other forms of ongoing professional development, the value and impact of coaching are highly dependent on support from administrators in the school and district in allowing time and space for teachers to participate and reflect (Knight, 2006; Hill & Papay, 2022).

When designing and implementing effective TPD, research indicates that **teacher practice** should be front and center and the practices, skills, and strategies, including in the TPD, should be tied to specific subjects and teaching, and perhaps to specific instructional materials (NAS, 2020). However, some research also indicates that TPD should prioritize instructional practice over content knowledge (Hill & Papay, 2022). In any case, it is important that teachers see the direct relevance of professional development (Lucas Education Research, 2021a). TPD should be connected to past and current classroom experiences, with particular emphasis on skills and changes teachers can bring to their current classrooms. These can include planning lessons and units reflective of the learning, looking at student work, and observing other teachers implementing pedagogical changes (Darling-Hammond, et al., 2017). Further, TPD is more effective when it is tied to specific problems of practice and is designed to provide teachers with the skills and strategies to address them (Kennedy, 2016).



[In ineffective TPD], I feel like there is less, how are you actually going to put this into your practice as an educator? The lack of time to think or talk about how it would be implemented.

—Teacher, Watertown, MA

What do teachers think good TPD looks like?

In interviews, teachers shared that effective TPD is authentic. Authentic TPD was defined as including a couple of key qualities:

- It is led by someone with experience using or implementing strategies, approaches, or content in their own classroom.
- It is practice-based (as opposed to theoretical), includes time for planning and practice, and has immediate use or application.

A description of an effective TPD offered by one teacher included “Authenticity...It was genuine that [those leading the TPD] truly wanted you to know what they were teaching and were going to make sure they found the way to get to that learning as opposed to being like, ‘I’m going to give you this information.’”

In addition, teachers’ descriptions of effective TPD confirmed and echoed what we learned in our literature review. According to teachers, effective, high-quality TPD includes:

- **Hands-on learning** and opportunities for teachers to be students.
- **Scaffolding and support** over time, including opportunities to check in on progress.
- **Collaboration time** to work with colleagues around strategy and plans for implementation.
- **Flexibility and differentiation** and the recognition that teachers bring different levels of understanding and needs to their learning.



Along with the alignment with teacher practice, research indicates effective TPD integrates the use of specific curriculum and instructional materials (Floden et al., 2020; Lynch et al., 2019). However, this may be an artifact of the methods and designs of rigorous research. TPD aligned with instructional materials affords the use of specific student assessments as well as comparison studies. Research on teacher learning in the context of curriculum adoption allows for defined indicators of teacher practice and student learning.

Research on Technology in TPD

There has been a proliferation in the development and use of online programs and platforms to support TPD, accelerated by the COVID-19 pandemic. However, as research on the effectiveness of TPD is limited, research on the effectiveness of the use of technology in TPD is even more so. There is a frequent assumption that the elements of effective in-person TPD apply to online TPD without consideration of how practices may differ in an online environment (Lay et al., 2020). A study by Fishman et al. (2013) found no significant differences in teacher and student gains when comparing online and face-to-face TPD. The TPD in this study was designed to support teacher implementation of a high school environmental science curriculum. Fishman et al. (2013) noted that

1. When researching the effectiveness of online TPD, it is critical to be specific about the design features of the TPD in question, and
2. It was not necessarily useful or instructive to compare online and face-to-face TPD without considering those features.

PBS TeacherLine, a completely online TPD platform, was evaluated in 2006 and demonstrated significant positive

results for both teachers (through self-report) and students. The study acknowledged that while teachers' beliefs showed positive change, teachers' practices did not significantly change, demonstrating that online TPD struggles from the same issue of knowledge translating to practice as in-person TPD (Dominguez et al., 2006). Lynch et al.'s meta-analysis of STEM instructional improvement found that while online TPD was effective, programs with an online TPD component had smaller effects on student outcomes relative to programs that did not include an online component (2019).

Lay et al.'s (2020) review of literature on online TPD did identify some affordances of online TPD that may be particularly promising. Specifically, they note that online TPD may support collaborative discourse and formation of communities of learning and practice. A World Bank review on the use of technology in TPD found that technology may help overcome some barriers to TPD due to its connectivity, interactivity, multi-media, and data-processing attributes (Quota et al., 2022).

In addition, new research suggests that self-directed TPD shows promise. Examples include Twitter conversations, Tiktoks, and Facebook teacher groups. These mostly online self-directed styles of professional development have shown promise in helping teachers integrate new technologies in their teaching practice (Artman et al., 2020; Archambault et al., 2010).

TPD Research Focused on Learning Through Play Pedagogies

While there are studies about effective TPD and studies on play-based interventions, there are limited empirical studies of effective TPD for learning through play pedagogies in the

absence of an accompanying student intervention. Much of the research on learning through play pedagogies and interventions focuses on early childhood and preschool learning (Parker & Thomsen, 2019). Further, most of these studies focus on classroom implementation and student outcomes and not on TPD. One available study on the scale-up of playful learning in New Hampshire kindergarten classrooms found student gains in the six Cs: collaboration, communication, content, critical thinking, creative innovation, and confidence. However, these results were indicated through teacher perceptions of student gains. TPD in this program was a very intensive regimen, with coaching occurring every 3 to 4 weeks.

As we reviewed the research on effective TPD practices writ large, we noticed the general lack of guidance or discussion of the pedagogical approaches used in the instruction of teachers beyond the recommendation that TPD include active learning. However, the role of pedagogy was cited in some research on TPD aimed at supporting teachers in making pedagogical shifts. For example, some research notes that it is important in learning through play interventions for teachers to complete hands-on activities as part of the professional development so they play as their students will play (Hynes & dos Santos, 2007). While hands-on activities in TPD have been found to be effective, they too appear to need to be sustained and include guidance on practice. For example, in a study where teachers were invited into a maker's space while at a conference, some teachers noted the usefulness of the activity but needed more direction (Paganelli et al., 2017). Another study focused on STEM integrated classroom experiences consisted of teachers, student teachers, and engineering fellows participating in a week-long course that culminated in an engineering design challenge with 16-weeks of support after. Authors noted that "our findings suggest the importance for PD experiences to go beyond teacher content knowledge and

support teachers in strategies for an enactment of an integrated approach,” meaning that even when using hands-on activities in TPD, sustained follow-up is necessary to support teachers in integrating the new process in the classroom (Estapa & Tank, 2017). Additionally, research indicates that even with hands-on activities, it is difficult to change teachers’ pedagogical and classroom management styles (Hynes & dos Santos, 2007).

To provide further insight into TPD approaches that may support learning through play, we consider research on TPD for three pedagogies that are aligned with learning through play: project-based learning, inquiry-based learning, and Montessori education. For each pedagogy, we define the pedagogy and its connection to learning through play, describe the general approach to TPD, and highlight the characteristics of TPD for a few student interventions that have evidence of impact on student outcomes.

Project-Based Learning

Project-based learning (PBL) is a teaching method in which students learn by actively engaging in real-world and personally meaningful projects. It can allow for and align with many of the elements of learning through play. Key principles of both are that they are collaborative, iterative, and authentic. To these three shared components, PBL adds “disciplinary,” making it a good comparison for learning through play (Grossman et al., 2019).

Guidance for providing TPD for PBL is similar to that for effective TPD in general. Researchers suggest that TPD for PBL should be sustained, build teacher self-efficacy, and include coaching to support implementation (Grossman et al., 2019). Guidance from the Lucas Education Research, a proponent of PBL, cites the role of adult learning theory in the design of TPD for PBL (2021a). Their model highlights the premise that adults learn by doing, and TPD should be problem-based and offer opportunities for reflection.

There is evidence that student-teachers who participate in and plan PBL opportunities as part of a teacher team develop professional identities along with skills, showing that introducing PBL has the potential to shift teacher mindsets leading to pedagogical change in the classroom (Tsybulsky & Muchnik-Rozanov, 2019). This shift in teacher mindset, though, can take a few years and is particularly effective in novice teachers (Aksela & Haatainen, 2019). While professional development on PBL has been found to mold teacher identity in positive ways, it has also been shown that TPD around PBL should focus on teacher self-efficacy as it leads to increased confidence and classroom management, thereby allowing PBL to be implemented effectively (Pan et al., 2022). Teacher confidence in managing students can be encouraged and supported through sustained professional development with a focus on student self-determination practices in their current classrooms, instead of onetime workshops specifically on the theory and definition of PBL (Chiu et al., 2021). One model suggests that novice teachers training to implement PBL should approach implementation in stages: learning the theory, planning with a mentor, and planning on their own. This model allows novice teachers to become comfortable with the pedagogy while having support in the implementation stage (Clark, 2021).

A number of studies have researched the impact and effectiveness of PBL that includes TPD as a program component. Following, we offer some examples of PBL interventions that have been shown to be effective:

- Three PBL interventions for middle school and high school students that have shown evidence of impact (i.e., they met the What Works Clearinghouse standards with reservations) all provided TPD with the characteristics described above: sustained in duration, included coaching and support for implementation, and built teacher self-efficacy.

These interventions were as follows:

- [Evaluation of Learning by Making i3 Project: STEM Success for Rural Schools](#)
 - [Improving Science Achievement—Is It Possible? Evaluating the Efficacy of a High School Chemistry and Physics Project-Based Learning Intervention](#)
 - [G²ROW STEM: Girls and Guys Realizing Opportunities with STEM](#)
- In the summer of 2015, Wake County, North Carolina, partnered with a local nonprofit focused on education to produce a TPD series called “SummerSTEM,” which included five days of professional development in the summer and two full days in the fall in order to integrate PBL into their classrooms. Additionally, teacher teams were paired with local businesses to reinforce their understanding and learnings. This integrated approach led to many positive teacher-level results, including most teachers reporting changing their instruction and increasing collaboration (Germuth, 2018).
 - A design-based research study focused on bringing together science practices from the National Research Council’s *A Framework for K–12 Science Education* (2012) with PBL in elementary science curriculum identifies design principles for materials that promote teacher change in practice at scale (Miller et al., 2021). This study notes that the Framework requires a shift in teaching practice away from traditional approaches that emphasize the role of the teacher as the possessor of knowledge to more constructivist pedagogies and includes the design of both curricular and professional learning materials. The three data-informed design principles for materials are adaptive, responsive, and enjoyable and intellectually satisfying. This study notes that in order for teachers to change their practice over time, they must have

cause to do so, and the Framework materials engaged teachers with a fundamental question about changing practice.

Inquiry-Based Learning

Inquiry-based learning (IBL) is a pedagogical method in which learners ask questions, try to answer those questions through experimentation, collect data, challenge assumptions, and iterate. It is most often cited as a method for teaching science as it mirrors scientific practices; therefore, most studies around inquiry-based professional development focused on science instruction (Constantinou et al., 2018). However, there is less research available on TPD that focuses on IBL. Below we offer some insights and examples from the available studies and evaluations:

- Some research has found that helping teachers correctly implement IBL in their classrooms requires concentrated training on the method, particularly because teachers themselves rarely experienced this type of learning in their own educational careers (Hofer & Lembens, 2019).
- A 2018 study found a TPD of 6–10 hours of distance learning was not sufficient to increase teachers’ confidence and ability to implement IBL (Rundgren & Rundgren, 2018).
- A continuous professional development model that included one-on-one mentoring throughout the school year found that even a time-intensive model was insufficient in making teachers fully confident in their ability to implement IBL, although participants noted mentoring helped them make concrete changes in their teaching methods (Kurten & Henriksson, 2021).
- In a study of the role of TPD professional learning communities designed to support the adoption of IBL among teachers in

Indonesia, researchers found that a collaborative, interactive environment supported teacher learning and change in teaching practice (Risnanosanti et al., 2023). This study also provided evidence of student outcomes as measured by engagement as well as their ability to demonstrate scientific inquiry practices.

- An evaluation of a teacher intervention in Uganda designed to shift teacher practice to a more inquiry-based practice found student gains in test scores and critical-thinking measures as well as increased engagement. Teacher training included three 2-week trainings during which teachers participated in hands-on and collaborative activities, as well as monthly classroom observations (Ashraf et al., 2022).
- A study on the implementation of IBL using LEGO WeDo robotics kits in Peru suggested that it was as important to change teachers' mindsets and build teachers' confidence as it was to instruct teachers on how to use the materials. Online training (100 hours) addressed scientific concepts, use of WeDo, and curriculum planning (Gall, n.d.).

Montessori Education

Montessori education is a method of teaching that centers self-directed, hands-on learning. It is most often used in early childhood and primary school education and is distinctive from many other pedagogies in that usually entire schools identify as Montessori. Historically, Montessori schools in the United States have been private schools, but there are an increasing number of public Montessori schools.

The fundamental Montessori teacher training requires a change in the teacher's personal and professional identity (Christensen, 2019). This includes being virtuous and moral; observing, reflecting, and guiding in teacher practice; possessing physical

grace; and having a deep understanding of Montessori theory and methodology. In general, the Montessori method is taught pre-service through continuous professional development, with elements of mentorship and mindful reflection, and it has been found to be effective in supporting Montessori teaching methods and leadership abilities (Damore & Rieckhoff, 2021; Saylor et al., 2018). A comprehensive study of statewide public Montessori schools in South Carolina found that teachers felt the need for more training in the Montessori method and curriculum than they were currently receiving, although they were found to have an overall high rate of fidelity with the method in their classrooms (Culclasure, Fleming, & Riga, 2018). In an evaluation of Montessori education in South Carolina public schools, 83% of teachers indicated that they were observed at least two times per year and were provided helpful feedback after observations (63%). Most educators in the study reported that their biggest professional development need was Montessori-specific curriculum and lessons instruction. Others would like to have more training on classroom management strategies and time management, as well as more opportunities for networking and/or collaboration (Riley Institute at Furman, 2021).

While Montessori instruction already tends to be hands-on and based on similar principles as learning through play, an evaluation of implementing a LEGO robotics (LEGO WeDo) curriculum in an early learning Montessori classroom showed that the teacher needed specific training to implement this curriculum (Elkin et al., 2014). The report notes: "Diana expressed that her participation in a professional development institute prior to beginning her curriculum still left her with a lack of confidence and knowledge regarding teaching with LEGO® WeDo™." This report leads to an understanding that even with a background in hands-on pedagogy, more effective TPD is necessary to increase teacher effectiveness around specific learning through play curriculum.

Summary

Guidance and standards for effective TPD highlight the importance of active, content-focused PD; opportunities for practice and collaboration with colleagues; and on-going support through coaching or mentoring. There is also an appreciation that change in practice takes time and requires sustained investment. However, research indicates that even within these guidelines, there is a high degree of variability in approaches to TPD, and that these elements alone do not guarantee effective TPD. For example, coaching that aims to support problem-solving in the classroom rather than prescribed strategies has been found to be more effective. While extended time is considered an element of effective TPD, how that time is used can vary. Effective TPD provides time for teachers to engage in specific content and strategies they can implement in their classroom immediately. Interviews with teachers confirmed this guidance and offered one new ingredient for effective TPD: authenticity. Authentic TPD is led by fellow practitioners with experience doing what the TPD addresses and has immediate use or application.

There has been a proliferation of online TPD, which accelerated during the pandemic. Research on effective online TPD is more limited than that on face-to-face TPD. Online TPD is promising

in that it enables greater access and flexibility and may provide new opportunities for collaboration and support communities of practice. However, some research indicates online TPD (alone) may not be as effective at changing classroom practice.

Research on TPD aligned with learning through play pedagogies confirms much of the guidance on effective TPD—that it be sustained, include collaboration and coaching, and focus on practice. However, research on pedagogies such as PBL and IBL includes greater consideration of the role of pedagogy not just in the classroom but in the design of TPD and approach to teaching teachers. For example, guidance on TPD to support PBL specifically highlights the value of teachers doing PBL themselves. In interviews, teachers noted that effective TPD allows teachers to be students. Some research on TPD in support of active pedagogies also elaborates on the sustained nature of TPD, specifying that TPD is more effective when it allows teachers to iterate, an ingredient cited in active pedagogies. TPD designed to support active pedagogies also gives greater consideration to the role of teacher mindset, beliefs, and confidence. Montessori education highlights the importance of teacher identity and role, and research on related TPD indicates that this work also needs to be closely tied to classroom practice. Research in this area confirms how challenging this work is.

Examples of TPD Programs

In the previous section, we reviewed the literature base around effective TPD and included learning from teacher interviews to elaborate on perceptions of effective TPD. To add to our understanding, we conducted a limited landscape review of existing TPD initiatives and programs.

This section describes insights from nine TPD programs, where the goals, content, or approach align with learning through play (see sidebar). These examples, which are described in detail in

Example TPD Programs

- Amplify
- CodeHS
- Facing History & Ourselves
- Great Minds
- Model Teaching
- My Teaching Partner
- PBLWorks
- Project Lead the Way
- RULER



Appendix B, provide insights into whether and how guidance for effective TPD is embodied in the current TPD landscape. The TPD programs were identified through the literature review, through internet searches on TPD and learning through play pedagogies, and through lists and repositories, such as that offered by the World Bank Coach program.

It is a challenge to learn detailed information about the specific activities, pedagogies, or strategies TPD programs employ without purchasing the materials. It can also be hard to determine the extent to which the findings that related to effective TPD might be embodied in specific programs, unless corresponding research has been published. Most of the programs lacked a published research-base to demonstrate effectiveness.

That said, the information available on these TPD programs does offer insights into if and how they include elements of effective TPD as identified in the research. The extent to which these programs address some of these elements is described below.

- **Sustained TPD experiences:** Many programs conduct their TPD through workshops (in-person or online), webinars, and the distribution of resources. Some programs mention the option for “implementation support” and coaching. While we might theorize that implementation support translates into some form of sustained TPD experience, we cannot be certain. Some TPD programs (such as Facing History & Ourselves) clearly indicate that they include ongoing support and position their program as something that teachers engage in over time.
- **Coaching:** As noted above, a number of TPD programs offer a coaching option; however, for many programs, coaching is an *option* and not integral to the program. There was no information available about how coaching was structured.

- **Practice-based:** A few TPD programs indicate in their publicly available materials that they are designed to address particular problems of practice. For example, My Teaching Partner aims to improve teacher-student interactions. Most of the TPD programs we identified include specific curriculum and instructional materials; that is, they address a problem of practice through the implementation of curriculum. Few TPD programs address pedagogy or changes in instruction without also providing curricula and content for their application.

In addition to considering elements of effective TPD, our review highlighted additional characteristics and considerations that have implications for the design and implementation of TPD:

- **The prevalence of online TPD.** Essentially all TPD now includes some form of online instruction or support. It is clear that TPD providers rely on and leverage technology to deliver instruction and support. Online TPD lends itself to on-demand, self-paced learning, and we identified many resources that could be used to support TPD; however, online TPD does not include structure, sequence, or a system for engagement. We did not include those types of TPD materials in our review.
- **Individual teacher versus school and district offerings.** TPD offerings often vary depending on whether they are designed for individual teachers who self-select based on their

own needs and interests, or they are designed for schools or districts to offer to all of or a group of their teachers. School- and/or district-level TPD is more likely to include an in-person component and additional supports, such as coaching and community of practice features. School and district approaches to TPD are more likely to support collaboration, and may also correlate with a more sustained approach. This variable may also contribute to the enabling and supporting conditions for TPD, as described in the *next section* of this report.

Information about key attributes of the reviewed TPD programs is included in *Table 1*. For more detailed descriptions of these TPD programs, see *Appendix B*.

This review of TPD programs illustrates that there are few widely commercially available TPD programs that reflect or embody all of the elements of effective TPD as defined in the current research. Further, the publicly available information about these TPD programs includes little to no reference to the pedagogy or approaches that guide the TPD itself. These TPD programs rely heavily on online delivery and resources and are often curriculum-based more than practice-based. These characteristics may reflect or result from the need to scale offerings at cost while offering a turn-key, packaged solution to school districts.

Table 1. Example TPD programs and their characteristics

Program	Pedagogy addressed	Content Areas	Grade Levels	Sustained	Coaching	Practice-based	Curriculum-based	Online	In-person	For individuals	For schools / districts
Amplify	Project-based	Math, Science, ELA	K-8	?	X		X	X	X		X
CodeHS	N/A	Computer science	K-12				X	X	X		
Facing History & Ourselves	N/A	Social studies, history, ELA	K-12	X			X	X	X	X	
Great Minds	Constructivist	Science, Math, ELA	K-8		X		X	X	X	X	X
Model Teaching	N/A	Cross-content				X		X		X	X
My Teaching Partner	N/A	Cross-content	K-12	?	X	X		X		X	
PBLWorks	Project-based learning	Cross-content	K-12	X	X	X		X	X	X	X
Project Lead the Way	Project- and problem-based learning	STEM	K-12	X	X		X	X	X	X	X
RULER	N/A	SEL	K-12	X	X		X	X	X		X

Conclusion ■ ★ ●

A literature review on effective TPD illuminates numerous challenges, including defining what constitutes TPD, identifying criteria for effectiveness, and providing evidence of quality and effectiveness.

Recent literature reviews, research syntheses, and meta-analyses all highlight the lack of clear indicators and the scarcity in the evidence base in defining effective TPD. While the research base on effective TPD is limited, some consensus does exist around the key characteristics of effective TPD:

- **TPD should be sustained rather than sporadic.**
- **TPD should include coaching or comparable opportunities for collaboration and support.**
- **TPD should focus on teacher practice, with any theory or content grounded in implications for the classroom.**

However, there is great variability in how these elements are enacted and therefore their demonstrated effectiveness. Sustained TPD means more than a specific threshold of hours in workshops, and research indicates that not all coaching is equally effective. There has been a tremendous increase in the amount of TPD offered online, and it is not clear how these characteristics translate to that setting. Research on its effectiveness is scant, and researchers are acknowledging that more work needs to be done to understand the opportunities and limitations associated with online TPD. However, online TPD may enable collaboration and community of practice, as well as just-in-time and low-cost activities.

Interviews with teachers along with our review of existing TPD indicate that current practice often does not adhere to or reflect what research indicates is effective TPD. The feedback we heard from teachers was that they had more examples of poor TPD experiences than positive ones. Our review of TPD programs that illustrates how few existing TPD programs offered at scale include several of the elements of effective TPD as identified in the literature. Further, few of these TPD programs offer research or evidence of effectiveness. The gap between research and practice with respect to TPD may be a product of the high cost—in time, money, and resources—of implementing sustained, rigorous TPD.

Most of the research on effective TPD, and many of the TPD programs available, include the use of specific curricula and instruction materials. Doing so allows TPD to be practice focused and makes a direct connection with and transfer to teachers' classrooms. From a research perspective, TPD tied to instructional materials enables more reliable measurement and demonstration of efficacy. The fact that our review of TPD programs found few examples of TPD that were practice based and focused on pedagogy rather than on curricula, and that had evidence of effectiveness, may reflect the challenges present in both the implementation of and evaluation of these kinds of TPD initiatives.

The models of TPD included in our review (Guskey, 1986; Clarke & Hollingsworth, 2002; and the World Bank model) along with what is known about adult learning theory are starting points for a shift in how we view effective TPD. Rather than focus on a set of activities, an understanding of how teachers learn and change their practice should guide the design of effective TPD and the use of these effective TPD strategies. Our review of the research indicates that it may be equally important to attend to the overall design and approach to TPD as it is to a focus on checklist of

elements. For all the attention paid to pedagogy in the classroom with students, there is little discussion of the pedagogical approaches used for teaching teachers. Some TPD on PBL emphasizes the need to engage teachers in PBL themselves in order to learn how to use PBL in their teaching.

How may TPD programs integrate learning through play as a pedagogical approach used with teachers in their own learning rather than a content area for teachers to learn about? How does TPD employ specific pedagogies when engaging teachers in learning about their own practice?

As students are the center of many active learning pedagogies, teachers ought to be at the center of TPD. This entails a recognition of their existing knowledge and practice. The shift from the term “teacher professional development” to “teacher professional learning” may be an acknowledgement that teachers are already developed when they engage in new learning.

TPD does not take place in isolation. Teachers operate within a number of systems—school, district, state, and federal—and bring their own experiences, values, and beliefs to bear on any

TPD they experience. The literature on effective TPD has already highlighted the role that teacher motivation plays in teacher outcomes. In the next section, we will further examine the role that enabling and supporting conditions—and barriers—play in the efficacy of TPD interventions.

“

People just do what they know. There’s some challenges to getting people to rethink how to do PD. With all things people are hesitant to change. I think that you would have to create a more positive and thoughtful process towards professional development at this point...I do think you’d have to get a philosophical shift and just say to people like this is cool stuff, right? Let’s do this and let’s do it right. And I think if you could get them on board and create some excitement around [TPD], I think that would be helpful.

—Middle School Teacher, Waltham, MA



Enabling and Supporting Conditions for Teacher Professional Development



The Role of Conditions in TPD

Teachers do not experience TPD in a vacuum. The reality is that TPD happens within systems and in a wide range of contexts.

As described in the Models and Theories of TPD section, published theories and models of TPD largely focus on the process of teacher change and the interaction of teacher learning and practice that ultimately leads to student outcomes. Guskey's (1986) model and the World Bank guidance (Quota et al., 2022) do not reference conditions and supports that may influence TPD, while the Clarke & Hollinsworth's (2002) model acknowledges that teacher professional learning takes place in a "change environment."

Teachers do not experience TPD in a vacuum. The reality is that TPD happens within systems and in a wide range of contexts. This section of the report shares what both guidance and research indicate are the enabling and supporting conditions of effective TPD. Most research in fact identifies barriers, while guidance or standards for TPD tend to describe enabling conditions. One approach to understanding barriers/conditions is categorizing them as internal or external, as identified by Ertmer's research on understanding teachers' use and integration of technology into teaching and learning (1999). In seeking to understand the barriers/conditions that affect TPD, we explore teacher conditions (both internal and external), classroom conditions (external), and school or system conditions (external). While these conditions are discussed separately, it is understood that they do not exist

in isolation; they are all part of a system that can either hinder or support teacher change.

Teacher Conditions

Teacher conditions that influence TPD include both internal and external barriers. Teacher autonomy and support may largely be considered an external barrier, while teachers' willingness to learn is an example of an internal barrier.

Teacher autonomy plays a critical role in a teacher's ability to enact new pedagogies and teaching methods. A report on enabling conditions for scaling PBL by Lucas Education Research notes the role of teacher agency (2021b). Their review of research on successful scaling of PBL found that teachers need to be empowered and trusted to make decisions about curriculum and instruction in their classrooms to meet their students' needs. This type of decision-making requires the relational trust with other teachers as well as administrators that affords autonomy. The NEA described this kind of decision-making ability as "authentic autonomy" and identified it as one of the five keys to transformation in supporting great teaching and learning (2018).

Teacher autonomy extends to include teachers' choice in pursuing professional learning. Teacher motivation and choice in participation in TPD plays a role in its effectiveness, and teacher self-selection or random assignment in TPD interventions has introduced biases into efforts to understand the effectiveness of TPD (Kennedy, 2016; Barrett et al., 2013). Teachers' motivation to shape professional learning experiences and adapt what they learn to their context influences their practice (Lucas Education Research, 2021b). Research indicates that top-down mandates and required participation in TPD leads teachers to be more

resistant to change (Ertmer & Ottenbreit-Leftwich, 2013; Kennedy, 2016).

Teachers' existing beliefs and conceptions about teaching and learning also shape their experiences in TPD and influence enactment of changes in practice. Adoption of active pedagogies requires teachers to shift their perception of the role of the teacher in the classroom, and teachers' past experiences as both a student and a teacher, values, and beliefs affect their ability to do so (Johnson & Tawfik, 2022; Allen & Heredia, 2021; Letina, 2021; Ertmer & Ottenbreit-Leftwich, 2013). Some teachers may struggle to give up control in the classroom (Walton, 2014). In addition, teachers' content knowledge, experience, and confidence influence their willingness to take risks and subsequent effectiveness in implementing new strategies (Allen & Heredia, 2021; Barrett, et al., 2013; Fitzgerald et al., 2019). As described in the NEA's keys to transformation, teachers' "passion for learning" plays a role in their professional growth (2018).



I have a friend who is a new teacher, and she is teaching in sixth grade...in a very different population. The teachers are all sort of these old curmudgeons and she's like, 'Come, do this PD with me', and they're like, 'no, I don't want to change anything.' The kids love her because she's fun and does fun stuff with them. But she's like working against the grain, and I've never had that. I've always had a culture that was really supportive of these kinds of things.

—Teacher, Watertown, MA

Classroom Conditions

Classroom conditions impact teachers' pedagogical choices and teachers' abilities to enact the strategies and practices that they learn through TPD (Organisation for Economic Co-operation and Development [OECD], n.d.). For example, class size may constrain pedagogical choices. The ideal class size for active pedagogies is 18 students (Wright et al., 2017, as cited in Organisation for Economic Co-operation and Development, n.d.). Teachers have reported challenges with classroom management when implementing active pedagogies, particularly for larger class sizes (Fitzgerald et al., 2019). In 2017–2018, the average class size in the United States was 26 for elementary grades and 25 for middle grades; average class size varies from state to state and from urban to rural areas ([NCES, n.d.](#)).

Additional classroom conditions may specifically affect adoption of IBL and PBL approaches. The school day structure and designated time for each subject area can pose a challenge, particularly for older grades when the school day becomes more segmented (Walton, 2014). Further, teachers are under pressure to cover a breadth of curriculum over the course of the year, and they often are given set milestones for pacing (Fitzgerald et al., 2019; Allen & Heredia, 2021). Time constraints imposed by the classroom structure may make it difficult for teachers to translate their TPD experiences into the reality of their classrooms (Darling-Hammond et al., 2017). IBL and similar active pedagogies take more time and preparation for the teacher, as well as additional materials, resources, and space in the classroom (Fitzgerald et al., 2019). Even with supports in place, one study found that implementation of PBL STEM in grades 5–9 was hindered by its time-consuming nature, classroom management difficulties, and interference with curriculum coverage (Walton, 2014).

What Do Teachers Describe as Enabling and Supporting Conditions for Teacher Change?

In interviews, teachers mentioned the roles that teacher, classroom, and system-level conditions play in their ability to implement changes in practice. According to teachers, there is a need for a growth mindset among teachers. Teachers themselves need to understand that they can and need to grow in their practice. Teachers need to have the confidence of their administrators and support to try new things, get it wrong, reflect on the issues, and try again. Teachers noted the need for a school culture and climate that prioritizes and values their attention to practice. Teachers also shared that sometimes schools are too focused on meeting standards and/or preparing students for national test taking to try new strategies.

In considering barriers to the implementation of more active pedagogies, many teachers cited time as the main barrier: time for their own learning, time over the course of the day to implement new strategies, time in the classroom to engage in activities that take longer, and time in the curriculum when there is so much to cover and a focus on student assessment.



Finally, another classroom condition that may support or hinder teacher change is the response of the students themselves, which is obviously difficult to control or predict. Positive responses from students and increased engagement re-enforce change and motivate teachers to deepen and further changes in practice (Lucas Education Research, 2021b; OECD, n.d.). When initially shifting to active pedagogies, students may struggle with doing

collaborative work, and as with teachers, their own understanding of the role of teacher and student can shape engagement (Walton, 2014).

School and System Conditions

There are numerous factors and conditions at the school, district, and system levels that impact teacher practice and the effectiveness of TPD with respect to student outcomes. These include school leadership and administration, school and district culture and norms, curriculum and student assessment, and teacher evaluation systems. It is noteworthy that Learning Forward's 2022 Standards for Professional Learning include such school and system conditions as part of their "Conditions for Success" (Learning Forward, 2022). At a more basic level, Darling-Hammond et al. (2017) cite system-level challenges related to the identification, selection, and implementation of TPD. The process of finding "effective" TPD that meets the needs—assuming there is consensus about those needs—is in and of itself a challenge.

Research indicates that school leaders play a critical role in teacher change—and specifically in the adoption of active pedagogies. School leaders impact teaching and learning by setting a vision, building a positive school culture, and engaging and supporting teachers in their professional learning. Learning Forward's Standards for Professional Learning call out the role of leadership and a culture of collaboration as conditions for success (2022). TPD that school leaders promote, participate in, and support has been found to have a greater impact on student outcomes, while a lack of administrative support has been cited as a barrier to teacher change (Wagner & Kingston, 2022; Johnson & Tawfik, 2022; Ertmer & Ottenbreit-Leftwich, 2013). A study of the elements of effective TPD in Australia found that while elements

such as sustained effort and opportunities for feedback were important, the principal's commitment to professional learning was also critical in realizing changes in teacher practice (Labone & Long, 2016). Another study found that schools where leaders were engaged in a professional learning network themselves had teachers reporting high-quality implementation of PBL projects (Wagner & Kingston, 2022).

School and district leaders are also instrumental in creating structures to support teachers in their new skill development and implementation. Implementation of new skills and pedagogical approaches is more likely to occur when it is supported by colleagues, administration, departments, and districts (Aspen Institute, 2018; Kuijpers et al., 2010; OECD, n.d.). Research indicates that when school administrators build positive relationships with the teachers in their schools, as well as ensure a culture of continuous improvement, there is increased implementation of change in the classroom; when administrators are open to new ideas, they are more likely to provide teachers the time needed to implement curricular changes (Kilag & Sasan, 2023; Ennes, et al., 2021). Limited opportunities for collaboration and planning can inhibit teacher change (Allen & Heredia, 2021). The need for building-level support aligns with findings that collective participation, that is where multiple teachers from a single school engage in TPD, may enable changes in practice (Walton, 2014).

The focus on accountability and standards for both students and teachers can impede adoption of new pedagogies and practices. For example, the emphasis on standardized testing is specifically challenging to efforts to shift to IBL, and one study found that teacher change in classroom practices varied according to the school's emphasis on test scores over an emphasis on inquiry (Allen & Heredia, 2021; Fitzgerald et al., 2019; Walton, 2014)).

Similarly, teacher evaluations may not be aligned with or support changes, and teachers may receive conflicting messages about what constitutes effective instruction (Allen & Heredia, 2021). The NEA identifies teacher assessment as a key for transformation in professional learning, noting that there should be a "shared vision for what teachers should be able to know and do and assessment should be grounded in teacher reflection on practice and support continuous professional growth" (2018).

Conditions Associated with (In)Equity

In addition to the conditions that exist at the teacher, classroom, and system levels that may constitute barriers to the effectiveness of TPD. There are conditions that should be considered if TPD is deployed as a means of addressing issues of equity, or inequity, in education.

The "achievement gap" continues to be a significant challenge to schools in the United States and around the world (Porter, n.d.). Data indicate that the COVID-19 pandemic has exacerbated existing disparities in achievement for low-income and minority students in the United States (Massachusetts Education Equity Partners, 2022). Education initiatives that seek to improve

Education initiatives that seek to improve outcomes for low-income and historically underserved or historically marginalized students and to address historic inequality often include TPD. However, those same inequalities can create additional barriers and hinder the effectiveness of that TPD.

outcomes for low-income and historically underserved or historically marginalized students and to address historic inequality often include TPD. However, those same inequalities can create additional barriers and hinder the effectiveness of that TPD.

As described in the previous section, teacher autonomy, flexibility related to content and time, and leadership support are enabling conditions—and the lack of these conditions creates a barrier to effective TPD and teacher change. Also, there are challenges that schools in historically underserved communities face that make it more difficult for those enabling conditions to be present. These include the following:

- Teacher turnover: Studies have consistently found that teachers in schools that serve high-poverty, low-achieving students and have a high proportion of students of color are more likely to leave than their counterparts. Research has begun to reframe teacher turnover as a problem of poor working conditions and not a response to student demographics. High turnover leads to less trained teachers, less collegiality, and less trust (Simon & Johnson, 2015). These conditions are the opposite of those conditions found to support teacher change.
- In 1991, Martin Haberman coined the term *pedagogy of poverty*, which reflected the prevalence of direct instruction and strict classroom management in urban schools (defined as low-income schools with a larger proportion of minority students). While research highlights the positive impact of student-centered learning in closing the achievement gap in schools with a high proportion of students in poverty (Friedlaender et al., 2014), it is not clear the extent to which most schools have access to the resources to engage in such reforms. There appears to be little research that looks at the prevalence of active pedagogies in low-income schools.

However, research on the conditions that support TPD and teacher change point to barriers that such schools may face.

- Access to programs does not necessarily translate to equal opportunity, and when students from disadvantaged backgrounds do have access to reforms, they may not benefit equally. A study of a child-centered curriculum in Wales that included play-based approaches found that, while students progressed overall, children living in poverty benefited less. In observations, schools with high levels of disadvantage were observed to have a lower quality of implementation. This was, in part, attributed to the culture of the disadvantaged schools that prioritized a focus on the “basics” and valued teacher-centered pedagogy. These findings suggest that increased resources, supports, and training are needed to improve implementation in disadvantaged settings (Power et al., 2019).

Guidance and standards for TPD by both Learning Forward and the NEA specifically call attention to issues of equity and the importance of valuing the cultures of teachers and students, and creating structures to ensure equitable access to learning for all (Learning Forward, 2022; National Education Association, 2018). While there is little research available that details the specific conditions correlated with issues of equity as related to TPD and teacher change, the reality of the opportunity gap and the information available about high-need schools in general indicate that attention should be paid to understanding and addressing potential barriers. Therefore, it is important to consider the extent to which any TPD specifically addresses or attends to the conditions of the teachers, classrooms, schools, and systems that have been historically marginalized. TPD that may be found to be effective in ideal conditions may not be effective in those conditions that are not ideal.

Conclusion

While our research set out to understand the enabling and supporting conditions for effective TPD, the existing research is instead largely focuses on identifying barriers and challenges.

Much of the current understanding of enabling and supporting conditions for TPD can be considered as internal (teacher level) and external (classroom, school, and system levels), and approaches to addressing and mitigating them need to consider those distinctions. A summary of key conditions identified in this section is offered in *Figure 4* below.

Several studies identifying conditions needed to change classroom practice noted that support for changes in teacher practice at various levels—classroom, school, district, etc.—should happen collaboratively and systematically. Efforts to

support changes in teacher practice cannot be divorced from local contexts, including local perceptions, practices, and demands (Allen & Herendia, 2021). There is an argument that effective TPD should build in activities, supports, and opportunities for teachers to work through potential or perceived barriers to implementation at all levels. If a TPD program aims to work with schools that are underserved—meaning they have large proportions of students experiencing poverty and/or students in a racial or ethnic minority—any TPD needs to be designed to address known challenges and provide additional supports and resources.

A good question to ask about any potential TPD program is, **“Will this TPD prepare teachers to work effectively within their systems?”** In discovering the answer to that question, it is important to include the voices and experiences of those participating in the TPD. This guidance acknowledges the role that teachers’ unique experiences and mindsets, along with situational and organizational factors, play in the reception and efficacy of TPD.

Conditions That Influence TPD and its Effectiveness		
Teacher Conditions	Classroom Conditions	School & System Conditions
<ul style="list-style-type: none"> • Autonomy and flexibility • Willingness to learn • Motivation • Existing beliefs / mindset, including “pedagogy of poverty”* 	<ul style="list-style-type: none"> • Time available during class and/or school day • Competing curriculum requirements • Student response • Access to materials* 	<ul style="list-style-type: none"> • School leadership • School culture • Curriculum and student assessment • Teacher evaluation systems • Teacher turnover*

*Conditions that are exacerbated in historically underserved communities

Figure 4. Enabling and supporting conditions by area.

Measuring Teacher and Student Outcomes



How Is TPD Evaluated?

The evaluation of TPD is challenging due to the wide variation in what constitutes TPD and what evidence indicates effectiveness.

Clear common definitions of TPD, much less effective TPD, have been lacking in the field, and TPD varies greatly, both in its form and in its effectiveness (Popova et al, 2018). Several meta-analyses discuss effective TPD without defining it or its scope, making it difficult to clarify how it is evaluated (Sancar et al, 2021). Based on the models and theories of TPD discussed in the previous sections, most research considers improved student outcomes as the criteria to determine whether TPD is effective. However, it is clear from these same models and theories of change for TPD that there are a number of intermediate outcomes, and it behooves researchers to attend to those prior to investing in the study of student outcomes resulting from TPD. Guskey's (2005) model for evaluating TPD outlines five levels of evaluation that mirror his model of teacher change.

The evaluation model includes:

- 1. Participant reactions,**
- 2. Participant learnings,**
- 3. Organizational support and change,**
- 4. Participants use of new knowledge and skills, and**
- 5. Student learning outcomes.**

He argues that each of these is a prerequisite for the next set of outcomes, and evaluations should establish evidence for each

level before moving ahead. Similarly, Darling-Hammond (2017) defines effective TPD as professional learning that leads to changes in teacher practice, which then leads to improvement in student outcomes.

There is limited research that studies the impact and effectiveness of TPD programs through the evaluation of teacher outcomes. When reviewing examples of TPD initiatives, we found that the evaluations publicly available focused on student outcomes rather than on teacher change. Research that does investigate teacher change largely relies on self-reporting teacher surveys rather than observed change in teacher practice in the classroom (Germuth, 2018; Thurlings & den Brok, 2017). A policy paper from the World Bank (Popova et al, 2018) proposes a standard set of indicators called the In-Service Teacher Training Survey. This survey is a response to the lack of data on TPD and focuses on the characteristics of TPD. The potential value of this survey is that it may support research that correlates characteristics of TPD with student outcomes. However, it does not measure teacher change.

As previously stated in this report, education research has been challenged in offering evidence of a strong and significant impact of TPD on student outcomes, which to some extent, is due to methodological and research design challenges. Among the challenges, research shows that the impact on student outcomes may not be measurable until 1–2 years after the TPD occurs (Kennedy, 2016). Further, there is the question of *what* student outcomes are being measured and the extent to which they align with the TPD's intended teacher practices. For example, a recent meta-analysis (Sims & Fletcher-Wood, 2021;) only looked at evaluations that used student standardized test scores as outcomes, indicating that many researchers define effective TPD through a particular set of student outcomes that may not necessarily reflect change in teacher practice.

Measuring Teacher Outcomes ■ ★ ●

Research and evaluations that focus on teacher outcomes tend to rely on teacher self-reports about their experiences in the TPD and their perceptions of their own practice (Kennedy, 2016; Popova, 2018; Sims & Fletcher-Wood, 2021; Walton, 2014).

Evaluations may also seek teacher self-reports on changes in attitude, subject-matter knowledge, and pedagogical content knowledge (Ertmer & Ottenbreit-Leftwich, 2013). While there is a heavy reliance on teacher self-reported measures, a recent study of mathematics TPD found that teachers' self-reports of learning do not correlate with direct assessment of their learning (Copur-Gencturk & Thacker, 2021). Studies that look beyond teacher self-reports tend to be qualitative and focused on a small number of teachers, examining their changes in practice based on the specific content and goals of the TPD. Observations of practice are tailored to the specifics of the intervention, such as use of particular curricula or adoption of instructional maneuvers.

An example of research that focused on understanding teacher outcomes is the *Early Reading PD Interventions Study* (Garet, et al., 2008), which constructed two outcome measures specific to teachers, in addition to evaluating students' reading achievement:

1. Teachers' knowledge about reading instruction and
2. Teachers' use of research-based instructional practices.

In this experimental study, teachers in the treatment groups who received TPD during the summer and school year scored

significantly higher on the Reading Content and Practices Survey (RCPS), an instrument used to measure teachers' knowledge about reading instruction. Three types of instructional practices were studied: explicit instruction, independent student activity (ISA), and differential instruction (DI). The teachers in the treatment groups used explicit instruction to a significantly greater extent than control group teachers. There were no statistically significant differences between treatment and control groups for ISA or DI. While this study focused on pedagogy around reading, it illustrates one way to measure the effectiveness of TPD on teacher outcomes.

The World Bank provides guidance on TPD monitoring and evaluation, as well as instruments for evaluating teacher outcomes in TPD initiatives. Their technical guidance emphasizes the importance of monitoring implementation and assessing intermediate (teacher) outcomes as well as long-term impact (student outcomes; Akmal, 2022). The World Bank has also developed [Teach Primary](#), an observation tool that is designed to measure the quality of teacher-student interactions. This instrument addresses classroom culture, instructional approaches, and inclusion of socioemotional skills.

It is also worth mentioning the existence of teacher evaluation frameworks that are found outside of specific TPD initiatives. These systems, such as the Danielson [Framework for Teaching](#) and the [Marzano Teacher Evaluation Model](#), offer observation rubrics that are often used as part of teacher evaluation systems and to inform schools and districts on professional development needs (Kettler & Reddy, 2019). These frameworks include a mix of classroom strategies related to areas such as communicating learning goals and engaging students, as well as practices related to classroom management and lesson planning. These frameworks do not reflect or align with a specific pedagogy, but it is possible to find alignment. For example, in a blog post, Larmer (n.d.) articulated how Gold Standard PBL (i.e., high-quality PBL) practices could be embedded within both the Danielson and Marzano framework.

Measuring Student Outcomes

All TPD strives to improve student outcomes, so it is important to look at how student outcomes are measured in research and evaluations of TPD.

Ultimately, TPD’s effectiveness is measured by changes in student outcomes, and this is the criteria used in a number of meta-syntheses of TPD research (Kennedy, 2016; Darling-Hammond, 2017; Sims & Fletcher-Wood, 2021). In the United States, these student outcomes are often measured through traditional academic assessments, such as standardized tests. Learning through play takes a holistic view of children as they learn and develop and highlights the importance of emotional, cognitive,

physical, social, and creative skills—skills not measured through these standardized assessments.

For this report, we reviewed research on student outcomes most aligned with learning through play, focusing on grades K–8 and cognitive and social-emotional competencies. We found Esdal’s (2018) definition of the four competency domains of student learning outcomes, as shown in **Table 2**, useful in framing our review.

Research That Connects TPD and Student Outcomes in Learning Through Play Pedagogies

The *Learning Through Play at School* scoping study (Parker & Thomsen, 2019) found eight pedagogical approaches that are highly relevant to The LEGO Foundation’s definition of *learning through play*. Using this as a starting point, our literature review

Table 2. Four key competency domains for student learning outcomes

	Content Competencies	Cognitive Competencies	Social-Emotional Competencies	Navigational Competencies
Definition	Often discussed as subject-area knowledge, particularly in language arts, mathematics, science, and social studies	Often described as higher order thinking skills, 21st Century skills, or the Four Cs (communication, collaboration, critical thinking, and creativity)	Regularly referred to as noncognitive skills, interpersonal skills, and soft skills and includes self-efficacy, curiosity, perseverance, empathy, and collaboration	Often referred to as college and career skills or transition knowledge and skills that relate to job seeking, career planning, networking, and practical life skills
Measurement	Most often measured using achievement tests, embedded assessments, and performance assessments	Most often measured using performance assessments and portfolios/work sampling	Most often measured using field observations and surveys	Most often measured using portfolios/work sampling, longitudinal data, and administrative data

focused on research measuring student learning outcomes as a result of specific active pedagogical approaches to teaching. In addition, particular attention was paid to articles that named specific classroom interventions and/or measurement scales or instruments. Twenty-six studies on student outcomes of learning interventions that relate to learning through play approaches were identified. A full listing of these studies (including 14 outside of the U.S.) is included in **Appendix E**.

The U.S.-based studies focused on play-based (Johnson & Peabody, 2016) and PBL (Krajcki et al., 2022; Konstantopoulos, 2020; Evans, 2019; and Culclasure, Longest, & Terry, 2019). Very few of the studies measured student learning outcomes in relation to **both** an active learning approach (play-based, project-based, etc.) and TPD connected to this specific approach. Those that did mention TPD were all studies of PBL approaches. As previously mentioned, one challenge is that much of the education research on student outcomes looks at specific interventions (often specific curriculum), with TPD provided as a means of delivering those interventions with little to no focus on how TPD may or may not change teacher practice.

Outside of the United States, research on multiple types of active learning was conducted in several countries, including Argentina (Di Mauro & Furman, 2016); Canada (Pyle et al., 2020; Schonert-Reichl et al., 2009); Columbia (Castano, 2007); Denmark (Project Zero, 2016); India (Shivakumara et al., 2016); Jordan (Asha & Hawi, 2016); Nigeria (Nwosu et al., 2022); Saudi Arabia (Almulla, 2020); Slovenia (Cotic, 2009); Spain (Ferrero et al., 2021); Turkey (Akinoglu & Tandogan, 2007); Uganda (Ashraf et al., 2022); and the United Kingdom (Gibson et al., 2021). Only one of these studies (Nigeria) included TPD as part of the intervention being studied and was specific to science and technology learning in Nigeria (Nwosu et al., 2022). Findings from this study indicate that activity-based learning can advance students'

noncognitive skills and recommended that teachers continue to receive professional development in this approach to learning.

Project-Based Learning Studies

Four research studies on PBL in the United States, conducted between 2019 and 2022, measured both students' academic and content competencies and cognitive and social-emotional competencies while considering TPD as a component of the study (Krajcki et al., 2022; Deutscher, et. al., 2021; Konstantopoulos, 2020; Culclasure et al., 2019).

Following is a brief description of each study. **Table 3** includes additional information on each of these studies.

- 1. Assessing the Effect of Project-Based Learning on Science Learning in Elementary Schools, 2022.** This study of the Multiple Literacies in Project-Based Learning (ML-PBL) science intervention in a third-grade setting found that students who received the intervention had higher scores on a standardized science test and reported higher levels of self-reflection and collaboration when involved in science activities (Krajcki et al., 2022). The measurement instrument used in this study was developed by the research team using items from national assessments and age-appropriate language for third-grade students. The intervention studied was designed to increase students' science knowledge, literacy, and mathematical skills and to support SEL through PBL of science units with accompanying TPD.
- 2. Learning Through Performance Project-Based Learning as a Lever for Engaging the Next Generation Science Standards, 2021.** This study of PBL included a science curriculum that was co-developed by teachers and members of the Stanford Center for Assessment, Learning and Equity (SCALE) team and included corresponding student performance-based

assessments and TPD. Student achievement in treatment and control groups were compared using a matched propensity score design. Students in the treatment group (who received the *Learning Through Performance* science curriculum) outperformed matched students on the Smarter Balanced Assessment Consortium (SBAC) tests in mathematics and English language arts (ELA).

- 3. Putting PjBL to the Test: The Impact of Project-Based Learning on Second Graders' Social Studies and Literacy Learning and Motivation in Low-SES School Settings, 2020.** This PBL study, using an integrated teaching approach in the primary grades, focused on social studies and literacy achievement skills as well as motivation (Konstantopoulos, 2020). Again, the assessments used were developed by the research team and were not validated instruments. The study found that greater consistency of teachers using PBL session plans was associated with higher growth in their students' writing, motivation, and reading.
- 4. Project-Based Learning (PjBL) in Three Southeastern Public Schools: Academic, Behavioral, and Social-Emotional Outcomes, 2019.** This PBL study focused on implementation fidelity and student outcomes measured across K–12 and provides an example of a classroom observation protocol and student and teacher survey items that can be used to assess PBL (Culclasure et al., 2019). The results identified some implementation challenges; however, the perceptions of students and educators regarding the impact and possibilities were quite positive.

A fifth study, *Student Outcomes from High-Quality Project-Based Learning: A Case Study for PBLWorks* (Evans, 2019), is a single teacher case study that examined teacher confidence in implementing PBL using the PBLWorks model. Because of the limitations of single teacher case study research, a full review of this study's design, methods, and results is not included in this brief.

Play-Based Learning Studies

There is little research on student outcomes correlated with TPD from play-based learning. Many studies of play-based learning focus on early childhood, do not address TPD, and use teacher observations of children as a form of measurement. For example, a study of play-based learning in New Hampshire kindergartens relied on teacher reports of student outcomes (Hirsh-Pasek et al., 2022). The **Primary Project** out of Rochester, New York, is an early intervention program designed to help children adjust to the first few years of school (through third grade). Research shows evidence of the program's effectiveness in decreasing school adjustment problems and increasing social-emotional competencies. Measurement tools used in this program included the Teacher–Child Rating Scale (T-CRS) developed by Perkins and Hightower in 2002 to assess student behavior and socioemotional adjustment (Johnson & Peabody, 2016).

Playful Learning and SEL

In interviews, teachers shared that play and playful learning is incredibly important for social and emotional learning (SEL). Teachers noted that SEL skills can be built through play as there is more room for interpersonal experiences. One teacher shared that inquiry-based learning and problem-based learning are usually designed for student collaboration, which can build SEL skills. Another teacher mentioned that play requires student self-direction. While teachers agreed that playful learning supports SEL, it was not always clear that teachers had the guidance or time in the classroom to intentionally support or develop students' SEL.

Table 3. Research studies on PBL with a TPD component

Study	Study Design	Related Research Question(s)	TPD Description	Outcome Measures	Results
<p>Assessing the Effect of Project-Based Learning on Science Learning in Elementary Schools Source link</p>	<p>The study was a randomized controlled trial that sampled teachers of third graders.</p>	<p>What is the main effect of this intervention on third-grade students' science learning? Do PBL treatment students outperform students in the control group on an independent summative science assessment?</p>	<p>TPD included face-to-face learning sessions at the beginning of the school year and as new units were introduced. Additional support was provided every two weeks through virtual meetings with experienced teachers.</p>	<p>The outcome measures used included benchmark tests, science assessments developed by the research team, classroom observations, a SEL instrument, and a teacher survey.</p>	<p>Results found that the treatment students outperformed the control students on the science assessments. A positive treatment effect was found for two of the three constructs on the SEL instrument (reflection and collaboration, but no significant effect on the third construct ownership).</p>
<p>Learning Through Performance Project-Based Learning as a Lever for Engaging the Next Generation Science Standards Source link</p>	<p>This was a quasi-experimental efficacy study of <i>Learning Through Performance</i> (LTP) that sampled design, implementation, and pilot teachers and their students at the middle school level.</p>	<p>How does participation as co-designers and implementers of a performance-based course influence the quality of teachers' instruction and assignments? How does a course that is designed around a series of performance-based assessments impact student engagement in learning? Student learning and performance?</p>	<p>TPD included a five-day summer institute and monthly meetings of a full day throughout the following two academic years. Professional learning sessions were facilitated for teachers during quarterly meetings.</p>	<p>The outcome measures in this study included student engagement, science achievement, and other non-science outcomes.</p>	<p>Results found that the effectiveness of the LTP science curriculum for influencing student learning and performance was moderated by implementation and the capacity of educators to provide high-quality instruction in science. The study found that at least eight full days of TPD on top of summer TPD was needed to effectively deliver the LTP science curriculum.</p>
<p>Putting PjBL to the Test: The Impact of Project-Based Learning on Second Graders' Social Studies and Literacy Learning and Motivation in Low-SES School Settings Source link</p>	<p>The study was a cluster randomized controlled trial that sampled second-grade teachers in low-SES school settings during their first year of implementation.</p>	<p>What is the impact of being in classrooms of teachers randomly assigned to implement, with some PD support, an integrated, project-based approach as compared to business-as-usual (but with a promise to teach a target number of lessons) instruction?</p>	<p>TPD included face-to-face learning sessions at the beginning of the school year and as new units were introduced. Additional support was provided every two weeks through virtual meetings with experienced teachers.</p>	<p>The outcome measures used were developed by the research team and included a social studies assessment, reading assessment, writing assessment, and motivation survey. Classroom observation data were also collected.</p>	<p>Results found the experimental group scored statistically significantly higher than the comparison group on both the social studies measure and the reading measure. However, no statistically significant difference between the control and treatment groups was found for the writing assessment or motivation survey.</p>
<p>Project-Based Learning (Pjbl) in Three Southeastern Public Schools: Academic, Behavioral, and Social-Emotional Outcomes Source link</p>	<p>This study included randomly selected teachers across three schools at the elementary school, middle school, and high school levels.</p>	<p>How do students learning in three PjBL public schools in the southeastern U.S. perform on assessments of a subset of social-emotional outcomes? How do the performances of these students differ from that of a normed sample?</p>	<p>The study design used the assumption that PBL TPD had been provided to teachers prior to the beginning of the study.</p>	<p>For the SEL component of the study, data collection included classroom observation and teacher-completed Devereux Student Strengths Assessments (DESSAs) for each of their students.</p>	<p>Results related to SEL indicated that most elementary school and middle school students scored higher on the DESSA than a nationwide sample.</p>

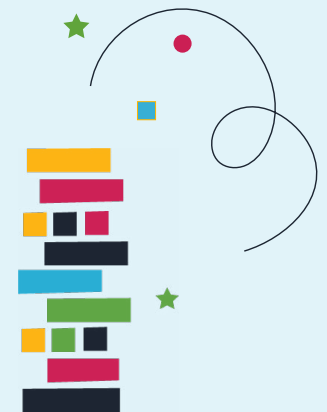
The Current Context of Social and Emotional Learning in the United States

In the United States, attention to social and emotional learning (SEL) in public education has both increased and become a locus of political disagreement and backlash. SEL has been more frequently addressed in early childhood education and primary school. All 50 states have standards related to SEL in preschool, and more than half have standards in K–12. SEL has existed under different names across the decades: character education, 21st century skills, and noncognitive skills. In secondary, postsecondary, and professional settings, they are often referred to as soft skills (Anderson, 2022).

Nationwide, school and district spending on SEL grew roughly **45 percent** between November 2019 and April 2021 (Tyton Partners, 2021). The increase was driven by concerns about student well-being amid a global pandemic and a national reckoning on race and was enabled by a massive infusion of federal recovery funds. However, this increased spending and attention has been accompanied by greater tension, with parents pushing back against curricula. “Conservatives have accused schools of hijacking SEL to promote progressive ideas about race, gender, and sexuality, while liberals have warned of threats to student privacy” (Field, 2022).

An analysis of the debate in *EducationWeek* summarized the issue as follows: “At the heart of the arguments over SEL are common questions: What is the role of education? How should schools define success? What does good character look like? Who should be allowed to define it? Those questions are often intensified by skepticism of national education movements” (Blad, 2020).

There is some indication that the issue may come down to definitions and terminology. One poll found that parents and families across demographic and partisan lines agreed that teaching critical life skills are a part of high-quality education (Sullivan, 2022). But there is confusion about what SEL means and looks like, and perhaps the label “SEL” has become more controversial than the content. Parents may prefer the label “life skills” over “social and emotional learning” (Prothero, 2022).



Instruments and Assessments of Student Outcomes

There are a number of repositories and guides that catalog instruments and assessments of student outcomes related to learning through play. These are reviewed below and organized by outcome area. A detailed list of instruments is included in **Appendix C**.

Social and Emotional Learning (SEL) Outcomes

The Regional Education Laboratory (REL) Mid-Atlantic (Mathematica Policy Institute, 2019) developed a fact sheet that provides a sample of instruments for assessing soft skills based on two sources that provide comprehensive lists of instruments—the **CASEL Assessment Catalog** and the **RAND Education Assessment Finder**—and also includes information on their subscales sample items, cost, and mode of administration. Research on measuring SEL outcomes (Cox et al., 2020; Expanded Learning 360°/365, 2016; Melnick et al., 2017; Denham, Ji & Hamre, 2010; Transforming Education, 2016; and AIR, 2019) also provided reviews of multiple assessments as well as guidance on selecting measurement tools. Additional information about these guides follows:

- **A review of instruments for measuring social and emotional learning skills among secondary school students** (Cox et al., 2020) supports state and local education agencies in identifying reliable and valid instruments to measure three social and emotional learning skills among secondary school students: collaboration, perseverance, and self-regulated learning. The majority of the 16 instruments reviewed are student self-report format. Detailed reliability and validity information of each instrument is included.
- **Expanded Learning 360°/365** (2016) provides a guide to how 10 assessment tools align to SEL-related standards designed

for K–12 students. Most of the assessments described are self-assessment tools and a few are observation tools. A detailed summary of each tool is provided in the full report.

- **The Learning Policy Institute** developed a report to guide states and school districts in choosing SEL measures (Melnick et al., 2017). Their study looked at SEL in conjunction with school climate and level of support for SEL. Four survey instruments were included in this review: CORE Districts SEL Survey, Developmental Assets Profile (DAP), Devereux Student Strengths Assessment (DESSA), and Washoe County School District SEL Survey.
- The **Compendium of Preschool Through Elementary School Social-Emotional Learning and Associated Assessment Measures** (Denham, Ji & Hamre, 2010) provides a listing of SEL tools designed for preschool and elementary grades. Instruments designed for elementary school included some of the instruments reviewed in the Learning Policy Institute’s guide, as well as others, including the Battelle Development Inventory (BDI) and the Behavioral and Emotional Rating Scale-Second Edition (BERS). Each of the instruments was mapped to the core SEL competencies assessed and the type of rater (teacher, parent, peer, self) for each scale. The report provides a detailed description of instruments, including information about their reliability and validity.
- The **Are You READY TO ASSESS Social and Emotional Learning and Development? Tools Index** (AIR, 2019) provides matrices of SEL assessment tools that include information such as assessment name; Web address; organization(s) or individual(s) responsible for development; ages or grades; primary constructs (i.e., topics, categories); information regarding who completes it (youth participants, parents, teachers, etc.); number of items and length of time necessary

to complete; whether a cost is associated with use; and the settings in which the assessment has been used or is applicable for use. This index included previously mentioned assessments, including the BDI, BERS, DAP, DESSA, and T-CRS, as well as many other assessments such as the California Healthy Kids Survey (CHKS), the EPOCH Measure of Adolescent Well-being, and Hello Insight: Social and Emotional Learning.

21st Century Skills Assessment

The [National Center for Improvement of Educational Assessment](#) with support from [PBLWorks](#) conducted literature reviews of five 21st Century skills: creativity, critical thinking, collaboration, self-directed learning, and complex communication (Evans, 2020a; Evans, 2020b; Thompson, 2020; Brandt, 2020, 2021). Within three of the five literature reviews are references to several standardized tests and assessments, as shown in [Table 4](#).

A Matrix of Instruments Related to Learning Through Play

Eighteen instruments were identified and included in a matrix of instruments measuring student outcomes related to learning through play, including those named in the above paragraphs. [Appendix C](#) provides the full matrix with information about each instrument, including instrument name, website, developer, competencies assessed, grade levels, respondent and format, number of items, administration time, and fee for use. The matrix is limited to instruments that are designed to measure multiple skills and competencies.

Across these 18 instruments, 77 competencies were measured (as shown in [Table 5](#)). The matrix includes a crosswalk to show which instruments address the most competencies (see [Appendix D](#)).

Table 4. Standardized tests and assessments related to critical thinking, creativity, and self-directed learning

21st Century Skill	Standardized Test/Assessment
Critical thinking	California Critical Thinking Dispositions Inventory
	California Critical Thinking Skills Test
	Educate Insight's Reasoning Skills and Thinking Mindset
	Watson-Glaser Critical Thinking Appraisal Test
Creativity	Alternative Uses Test
	Assessing the Climate for Creativity
	Consensual Assessment Technique
	Creative Climate Questionnaire
	Creative Environment Perceptions Scale
	Creative Product Semantic Scale
	Creativity Assessment Packet
	Gough's Creative Personality Scale
	Guilford's Tests of Creativity
	Khatena-Torrance Creative Perception Inventory
	Openness Scale of the NEO2 Personality Inventory
	Runco's Ideational Behavior Scale
	SPAF
	Torrance Tests of Creative Thinking
Self-directed learning	Oddi Continuing Learning Inventory
	Personal Responsibility Orientation Self-Directed Learning Scale
	Self-Directed Learning Readiness Scale

Table 5. Competencies represented in student outcomes measures included in our matrix

Student Outcomes Related to Learning through Play			
Academic motivation	Excellence	Mastery orientation	Resilience
Action orientation	Fairness	Navigate emotions	Risk tolerance
Assertiveness	Forgiveness	Optimism, optimistic thinking	Self-awareness
Behavioral self-control	Future orientation	Orientation, other group orientation	Self-confidence
Bravery	Goal-directed behavior, goal orientation	Perseverance	Self-direction, self-management, self-regulation
Commitment to learning	Gratitude	Persistence	Self-efficacy
Competence	Grit	Personal achievement	Social awareness
Connectedness	Growth mindset	Personal responsibility	Social capital
Contribution	Happiness	Perspective	Social competence, social intelligence, social skills
Creativity, self-expression	Honesty	Positive identity	Social connections
Critical action	Hope	Positive regard	Social emotional composite
Critical reflection, reflection	Humility	Positive values	Social perspective taking
Critical thinking	Humor	Prioritizing	Spirituality
Curiosity	Integrity	Proactivity	Susceptibility to peer pressure
Decision-making	Judgement	Problem-solving	Teamwork
Disruptive/externalizing behaviors and internalizing symptoms	Kindness	Prudence	Trust
Emotion regulation	Leadership	Pursue noble goals	Vision
Empathy	Learning interest	Recognize patterns	Zest
Engagement	Love	Relationship management	
	Love of learning	Relationship quality	

The number of competencies represented within these instruments ranged from 3 to 25. While many of these 77 competencies reflect the five super skills outlined in The LEGO Foundation’s learning through play research (cognitive, creative, emotional, physical, and social; Zosh et al., 2022), some of them do not clearly fall under those skills and are reflective of student preferences and perceptions.

Of the full list of 77 competencies, 8 appeared across four or more instruments, as shown in **Table 6**. However, it should be noted that the definitions of these competencies may vary across instruments.

For the purposes of this brief, we highlight four instruments that included at least 15% of the total number of competencies

without making assumptions about how they would be coded to learning through play skills.

1. Hello Insight: Social and Emotional Learning (HI SEL).

Developed by [Algorhythm](#), this tool is a norm-referenced, self-report, pre-post rating scale that assesses social and emotional competencies and items related to students' learning preferences and their experience of program implementation quality for students in grades 5 through 12. The measure takes 10–20 minutes to administer and includes items to assess and report scores for both individual domains of SEL competence and overall assets score for benchmarking growth. The elementary school SEL component includes 37 pretest items and 50 posttest items. Students self-report in either a digital or paper and pencil form. Results are reported via an online dashboard. Additional information can be found on its [CASEL's SEL Assessment Guide](#) page.

2. Holistic Student Assessment (HSA). Developed by Partnerships in Education and Resilience (PEAR), HSA is a data-driven tool to promote social-emotional development for students in elementary school, middle school, and high school. The short form of the measure takes 10 minutes to administer, and the long form takes 15–20 minutes. Students self-report in digital form. Scores are calculated by the assessment developer using nationally representative norms based on a random stratified sample. Scores are norm-referenced and reported as averages, strengths, or challenges for each student. Additional information can be found on its [CASEL's SEL Assessment Guide](#) page.

3. Six Seconds Emotional Intelligence Youth Version (SEI-YV).

Developed by [Six Seconds EQ Network](#), this tool is a strength-based, self-report scale that assesses student SEL competencies and higher-order composites of those competencies for students

Table 6. Competencies most frequently included across instruments in matrix

Competency	Frequency
Self-direction, self-management, self-regulation	13
Relationship management, relationship skills, relationships with peers	9
Self-awareness	8
Social awareness	7
Decision-making, responsible decision-making, positive decision-making	5
Optimism, optimistic thinking	5
Social competence, social intelligence, social skills	4
Self-efficacy	4

in grades 2 through 12. The measure takes 15–20 minutes to administer and includes 99 rating scale items and 4 open-ended items. Students self-report in digital form. Scores are calculated through an algorithm that standardizes the measures using validated international norms. Results are reported via individual reports and through an online dashboard. Additional information can be found on its [CASEL's SEL Assessment Guide](#) page.

4. VIA Character Strengths Survey. Developed by [VIA Institute on Character](#),

this tool is a strength-based assessment of student SEL competencies, administered as a survey for students in grades 4 through 12. The measure takes 10–15 minutes to administer and includes 96 items. Students self-report in digital form. Results are reported via individual reports. Additional information can be found on its [CASEL's SEL Assessment Guide](#) page.

Conclusion

The available research on TPD, when reviewed with the lens of seeking to understand how TPD is evaluated and measured, illustrates the wide range of approaches, definitions, and practices associated with TPD and the lack of clarity around what constitutes “effective” TPD.

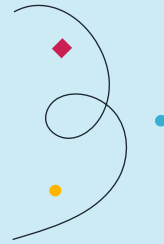
There is consensus that TPD may be considered effective when it results in positive student outcomes. Research and evaluation studies (that are publicly available) tend to jump directly to impact on students and offer little insight into the assessment of the teacher outcomes that presumably lead to student outcomes. In addition, much of the research on TPD in the United States focuses on student outcomes as assessed by standardized testing and traditional measures of academic achievement, which may or may not be well-aligned with the TPD intervention.

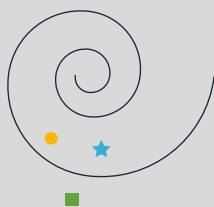
Measurement of teacher outcomes from TPD is largely based on self-report and developed by those designing and implementing the TPD. While we found many studies addressing student outcomes as a result of active pedagogical approaches, the specific interventions that were cited in the research varied and

were often developed locally and did not use national or scaled models. Research on PBL offers the most consideration of TPD and its role in student outcomes. Some studies reviewed multiple interventions, and others described the teaching practice that was studied. The instruments used to measure outcomes were mostly developed by the research team. Some studies included references to the literature used to develop their own tools, but none used a validated tool. While there are numerous validated instruments available that measure many of the outcomes of interest, based on our review of the research, they have not been used in conjunction with research on TPD.

One goal of this report was to understand approaches to evaluation and measurement of TPD so as to inform future TPD efforts. There is a lack of existing measures of teacher change, most likely because a) teacher change is difficult to measure; and b) measures of teacher change are highly dependent on and should be closely aligned with the TPD intervention itself. There are numerous existing measures for student outcomes aligned with learning through play. However, it is critical to connect TPD for learning through play approaches with specific and appropriate student outcomes. The extent to which existing validated measures of these student outcomes align with and would be an appropriate instrument for determining the effectiveness of a particular TPD intervention requires further investigation.

Imagining TPD for Learning Through Play





This report set out to provide foundational research on effective TPD by reviewing literature and research, interviewing teachers, and reviewing existing programs with the goals of learning the characteristics of effective TPD, enabling and supporting conditions of TPD, and evaluation and measurement of TPD. Efforts to understand these elements were focused on TPD efforts in the United States and TPD that aligned with learning through play pedagogies.

Two common refrains throughout this report are that

- 1. The research on and evidence base for effective TPD is limited, and**
- 2. Change in teacher practice is difficult.**

However, the information that is available, along with the gaps, provides some insights into what and how future TPD in support of learning through play may take shape. This section describes a set of potential approaches, strategies, and conditions to consider when designing TPD for learning through play.

★ THEORY OF CHANGE



Teacher conditions

- Autonomy and flexibility
- Willingness to learn
- Motivation
- Existing beliefs and mindset



School and system conditions

- School leadership
- School culture
- Curriculum and student assessment
- Teacher evaluation systems
- Teacher turnover

Student outcomes

are specific, drive TPD design, and result from playful learning experiences.

Increase in **playful learning experiences** in the classroom (activities and interactions)

Classroom conditions

- Time available during class and school day
- Competing curriculum requirements
- Student response
- Access to materials

Enabling Conditions



Develop a Theory and Framework That Starts with the Outcomes

An important first step is defining the goals of any TPD and developing a theory and framework that articulates the mechanisms and levers for change, the expected changes in teacher practice, and the correlating changes in student outcomes. One overarching lesson from this report is that there is often a lack of clear connection between goals and outcomes for TPD and its design. Rather than considering evaluation of implementation and outcomes as an end point, **student outcomes, and the classroom experiences that will support them, should be an input into TPD design.**

Incorporate Elements That Show Promise

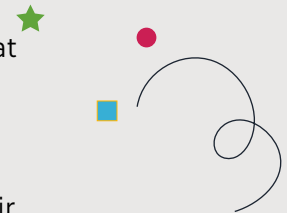
When it comes to the design of TPD, the findings in this report suggest that the following characteristics and components may be beneficial:

- TPD should be **sustained** rather than sporadic.
- TPD should include opportunities for reflection, collaboration, and support, and **coaching** may be an effective way to include those opportunities.
- TPD should be designed with specific goals for **teacher practice** and student learning, rather than focused on theory or subject content.

Strategic integration of technology may support these components, and increase accessibility. However, an over-reliance on online delivery of TPD may compromise effectiveness.

Let Teachers Play

This report offers greater insight into the design of TPD for learning through play, namely, that **teachers should learn through play themselves.** Like learning through play, TPD should be joyful, meaningful, active, engaged, iterative, and social, and it should employ active pedagogies when engaging teachers in learning about their own practice. How can TPD engage teachers in play themselves in order to learn how to use play-based learning in their teaching? As many active pedagogies put students at the center of their learning, **TPD for learning through play should put teachers at the center of their learning.**



Adult learning theory supports this orientation and emphasizes the importance of adults being involved in the design of their own learning experience. TPD should be actively engaging for teachers and can be tailored to varying teacher experiences and needs led by expert facilitators with classroom experience.

Sustained TPD allows teachers to adapt and integrate new pedagogies and strategies into their classrooms and also to shift their beliefs and attitudes around teaching. Engaging in play themselves may also support teachers' shift in beliefs and encourage them to embrace playful learning in their classrooms.



Consider Specific Curricula and Instruction Materials as Part of the TPD

One consideration in the development of future TPD efforts to support learning through play is that most of the research on effective TPD, and many of the TPD programs available, include the use of specific curricula and instruction materials. Doing so allows TPD to be practice focused and makes a direct connection with and transfer to teachers' classrooms. It also affords more rigorous research and evaluation as these materials often come with fidelity of implementation and aligned student assessments. **To what extent can and should TPD on learning through play incorporate instructional materials and curricula?**

Understand and Leverage Context while Addressing Barriers

An additional insight from this report is that **TPD should be designed with an understanding of the enabling and supporting conditions that inevitably shape it.** What makes a TPD program effective goes beyond the quality of the content and delivery. It requires dedicated consideration to the enabling conditions, and more importantly, to the potential barriers that affect teachers' abilities to embrace new classroom practices and pedagogies. The overarching question when considering enabling conditions is, to what extent can these be addressed in the design and implementation of TPD? It is valuable to consider if and how TPD can address internal barriers and build in enabling supports to mitigate external barriers.



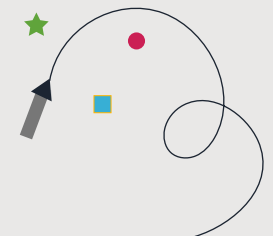


In the process of considering enabling and supporting conditions, it is critical to identify and understand how conditions change in different contexts, and how these conditions may reinforce existing inequities in communities and schools. TPD that seeks to support learning through play in historically marginalized or underserved communities must provide appropriate support and address potential barriers in those settings. Including teachers in identifying supports as well as culturally responsive practices may be a valuable strategy in this work.

Evaluate TPD Using Validated and Independent Measures That Align with Outcomes

Research on effective TPD indicates that evaluation of TPD is challenging. An organization may consider the following when approaching the evaluation of any future TPD efforts:

- Currently, evaluation of teacher outcomes from TPD relies heavily on teacher self-reports of their experiences in TPD and their perceptions of what they learned, which may not provide reliable evidence of changes in practice. Alternative approaches, such as observations or student surveys, require clear definition of what change in practice looks like, and it may be possible to build in activities to understand change in practice over the course of a sustained TPD initiative. Activities could include things such as teacher reflections, activity logs, and insights from coaches.
- While learning through play is associated with the development of a wide range of cognitive, social, emotional, and creative skills, **it would be strategic to identify a subset of student outcomes as the focus and driver for a particular TPD initiative.**
- Many measures exist for a range of student outcomes and may be tailored to provide evidence of student outcomes for TPD. As noted earlier, it is critical that these student outcomes be aligned with the TPD and classroom practices, and that teachers understand these outcomes themselves.
- Any evaluation of teacher and/or student outcomes should be mindful of how much time it takes for change to occur and indicators to be evident. Reliable and valid evaluation of this work is likely a costly endeavor.





At a time when teachers in the United States are leaving the profession at an alarming rate and students are experiencing a range of learning challenges as a result of the COVID-19 pandemic, learning through play has the potential to re-invigorate teachers and transform classrooms. The findings in this report offer potential new directions for bringing about change, while also highlighting the need for more research on if and how TPD can support teachers in incorporating active, playful pedagogies in their classrooms.

Effective TPD that provides teachers with the knowledge, skills, attitudes, and confidence to bring play into their classroom, while challenging, has never been more important.

Endnotes

- ¹The White House. (2022, March 11). FACT SHEET: How The American Rescue Plan Is Keeping America's Schools Open Safely, Combating Learning Loss, And Addressing Student Mental Health. <https://www.whitehouse.gov/briefing-room/statements-releases/2022/03/11/fact-sheet-how-the-american-rescue-plan-is-keeping-americas-schools-open-safely-combating-learning-loss-and-addressing-student-mental-health/>
- ² Learning Forward (<https://learningforward.org/>) is the largest nonprofit organization in the United States focused on effective TPD and school improvement. It was formerly known as the National Staff Development Council. It is regularly cited by federal and state departments of education when offering guidance.

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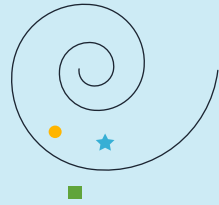
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Appendices



Appendix A: About This Report

Literature Review

We conducted searches through EBSCO and Google Scholar to identify academic articles with references to varying search terms, including teacher professional development for play-based learning, project-based learning, and active learning pedagogy; definitions of and competency domains for student learning outcomes; and metrics, instruments, assessments and measurement of student learning outcomes. We used and/or in our searches to combine keywords effectively. We prioritized peer-reviewed journal articles from the U.S. with a focus on publications from the past five years (2018-2023). We identified a number of literature reviews and meta-analyses on TPD, and review sources for those papers.

Our review prioritized interventions based on integrated pedagogical approaches. The LEGO Foundation's [white paper, *Learning through play at school*](#), describes eight pedagogical approaches that combine child-directed, teacher-guided, and teacher-directed learning and align with the characteristics of playful learning experiences:

1. Active learning,
2. Collaborative and cooperative learning,
3. Experiential learning,
4. Guided discovery learning,
5. Inquiry-based learning,
6. Problem-based learning,
7. Project-based learning, and
8. Montessori education.

Additionally, we expanded our review to better understand the status of social-emotional learning (SEL) and its measurement in the U.S. We also conducted searches on teaching pedagogy research on changing mindsets and equity in active learning pedagogies.

For the purpose of this review, we focused on four key competency domains for student learning outcomes: content, cognitive, social-emotional, and navigational (Edsal, 2018). We chose these four domains because they mapped to the five super skills outlined in [LEGO's learning through play research](#) (Zosh et al., 2022), although creativity and physical skills aren't represented in the domains as much as cognitive and social-emotional skills. We also prioritized a set of documents developed for [PBL Works documents](#) by the Buck Institute for Education and the Center for Assessment in March 2020), that provide a review of literature on measuring five specific 21st Century skills (critical thinking, collaboration, complex communication, self-directed learning, and creativity). A full list of competencies is provided in [Appendix D](#).

Narrowing the competency focus allowed us to identify and review a number of student learning outcomes frameworks aligned with measures of these areas which, in turn, helped us identify specific measurement instruments. To review specific measures and instruments, we also utilized the [CASEL Assessment Catalog](#), the [RAND Assessment Finder](#), and the [Harvard Taxonomy Project](#). This review of the literature also focused on measuring student learning outcomes because of specific learning and/or teacher professional development interventions. [Appendix C](#) provides a listing of instruments that measure these student learning outcomes.

[Appendix E](#) includes articles that were found using search terms related to both student learning outcomes and integrated

pedagogical approaches. Particular attention was paid to articles that named a specific intervention (for student learning and/or teacher professional development) and articles that include named measurement tools.

Landscape Study

At the beginning of this work, The LEGO Foundation provided an initial list of TPD programs and initiatives that aligned in some way with learning through play. Many of these programs focused on the inclusion of STEM content in active learning approaches. EDC identified additional these programs over the course of the literature review, through internet searches on TPD and learning through play pedagogies, and through lists and repositories, such as that offered by the World Bank COACH program.

After an initial review of a large number of identified programs, we selected a smaller set to conduct a more detailed review. The subset was selected to represent programs that were commercially available, had some level internet presence and information, and addressed a range of outcomes applicable to learning through play. For our detailed review, we accessed publicly available information about the TPD program, including any content, and searched for any published research on the effectiveness of the TPD.

Teacher Interviews

We sought to interview teachers who could inform and contextualize our findings on effective TPD through their own experiences. However, given that we did not have a specific TPD program that we were studying or working with, we identified

teachers who might offer relevant insights through existing networks. We did reach out to the teachers who participated in the Tufts University LEGO Education online TPD study, with the hope that they would provide insight looking back on their TPD experience. We received no response, and so conducted outreach to teachers we had connections with through other EDC work and experience and that we understood to have some frame of reference for learning through play-related pedagogies. We were able to interview six teachers or district-level coaches for this sample of convenience. Details on the interview subjects are offered in Table 7.

Table 7. Details of interview subjects

	School	City	State	Description
1.	Public middle school	Waltham	MA	Middle school digital learning teacher implementing Project Lead the Way
2.	School district	Chicago	IL	District-level SEL administrator and coach
3.	Charter elementary school	Chicago	IL	Kindergarten teacher formerly in Chicago Public Schools
4.	Public elementary school	Watertown	MA	Kindergarten teacher using play-based pedagogies
5.	Private middle school	Watertown	MA	Middle school science teacher
6.	Public elementary school	Chicago	IL	Special education teacher

Teacher Interview Guide

Big picture question: What do you think good teacher PD looks like?

1. Describe a transformative teacher professional development/learning experience. (If they have not had a transformative experience, what has been their most positive PD experience?)
 - a. What did you learn?
 - b. What do you think made it particularly transformative/positive?
 - c. How did it differ from other PD experiences?
2. Have you had PD experiences that you would consider “not effective” or useful to you? What were those like?
 - a. Why do you think they were not effective/helpful?
 - b. How could they have been improved?

Big picture question: What supports help you put learning into practice in your classroom?

3. When you think about implementing something new in your classroom, what support enables you to do so?
 - a. Have you ever learned a strategy or classroom practice in PD that you were not able to apply to your classroom? If so, why?
 - b. What conditions or supports do you think allow you to make changes, take risks, and innovate in your teaching practice?

Big picture question: How do you think about how you teach and what your role is as a teacher?

4. What is your personal teaching philosophy? How do you think about your teaching approach or style, and your role as a teacher?
 - a. Do you think that has changed over the course of your career? If so, how and why?
5. How do you see learning through play pedagogies fitting in, or potentially fitting in, to your practice?
 - a. What support do/would you need to implement these pedagogies?
 - b. What barriers might prevent their adoption?

Appendix B: Examples of TPD Programs

Amplify

Amplify offers programs that include curricula and assessment, tutoring models and programs for schools, and TPD services. Services and products are available to schools and districts; they do not cater to individual teachers. Amplify Science is a K–8 curriculum that emphasizes hands-on investigations. Few details are available on their website about their TPD, other than they offer in-person training, coaching, and online workshops.

CodeHS

CodeHS supports the teaching and learning of coding. Their approach aligns with learning through play principles in its emphasis on fun, problem-solving, and creativity. They have developed curriculum pathways for elementary school, middle school, and high school levels, including Advanced Placement courses. They provide a learning management system for their curricula and materials.

Their TPD offerings include online courses, in-person and virtual workshops, and free webinars. They describe their TPD as covering the pedagogy and instructional strategies for teaching computer science. Online courses are 30–40 hours of time, are self-paced, and include support and feedback. Mini-courses of 5 hours are focused on using specific tools or aspects of coding.

Model Teaching

Model Teaching is a TPD provider and course platform offering a wide variety of courses across content areas. They emphasize their course approach as taking teachers through a process of concept mastery, planning, and feedback that leaves teachers with an implementation

plan for the classroom. Model Teaching works with schools and districts to serve as their TPD provider and also offers courses to individual teachers. Courses can be filtered and recommended based on state requirements. Model Teaching works with several universities to offer graduate level credit for select courses.

Courses are available in subject areas (math, reading, social studies); interdisciplinary areas such as 21st Century learning and social and emotional learning; and practice areas such as classroom management, teaching strategies, and special needs students. They do offer courses in specific pedagogies, including IBL, collaborative learning, and PBL.

Great Minds

Great Minds offers curricula and associated TPD in math, science, and ELA with a focus on constructivist learning. They describe their curricula as “knowledge building instructional materials.” Among their offerings is a hands-on science program for grades K–5. The associated TPD and support offerings include online sessions for individual teachers and in-person or online workshops for groups of teachers from a school or district. Workshops are offered at different levels (foundational and sustaining). Great Minds also offers coaching services and implementation support.

Facing History and Ourselves

Facing History is an organization whose mission is to “use lessons of history to challenge teachers and their students to stand up to bigotry and hate” (Facing History, n.d.). This mission requires teachers to shift from more didactic teaching approaches to teaching approaches that encourage students to reconsider their interpretations of history and current events through specific classroom activities and interventions, some of which reflect

an active learning pedagogy. An evaluation of Facing History and Ourselves summer TPD institute, which includes support throughout the following school year, found that teacher’s mindsets and understandings around citizenship showed significant change (Lowenstein, 2003). A more recent randomized controlled trial testing both student and teacher outcomes of a five-day seminar with follow-up coaching and webinars found that teachers showed “significantly greater self-efficacy in all eight assessed domains, more positive perceptions of professional support, satisfaction and growth, and greater personal accomplishment” even though half of the teachers did not fully implement the program (Barr et al., 2015).

My Teaching Partner

My Teaching Partner, developed by the University of Virginia, is a TPD system focused on improving teacher-student interactions. The system includes a video library of examples of best practice, a university-level course designed to improve teachers’ knowledge and application of effective interactions, and Web-mediated individualized coaching. My Teaching Partner has also developed an observational assessment to measure teacher-student interactions. Research on their program indicates that it has a positive impact on student achievement, particularly in classrooms with a higher proportion of students in poverty, and on student engagement. AIR is currently leading a research project to test, scale, and refine the program at the secondary school level.

PBLWorks

PBLWorks, a program of the Buck Institute for Education, provides services, tools, and research to build the capacity of K–12 teachers to implement high-quality PBL and the capacity of school leaders to create a culture for teachers to do so. They are particularly focused on issues of equity and view PBL as a means for all students to succeed, and they prioritize equity in their work. PBLWorks offers research on the effectiveness of PBL as an

instructional practice and has developed a set of rubrics for understanding student skills, as well as standards for Gold Standard PBL. However, they have no published research on the effectiveness of their TPD, and their own research agenda acknowledges the challenge of using student outcomes as a metric for the effectiveness of their TPD programming.

PBLWorks offers evidence on the role that school leaders play in PBL implementation, finding that school leaders’ own PD as well as their support and involvement in TPD lead to increased student outcomes (Wagner & Kingston, 2022). Their PBLWorks Leadership Theory of Action illustrates how leadership, school conditions, and teacher practice are all integral to student experience and student outcomes.

PBLWorks offers TPD for individual educators, schools, districts, regions, and states, as well as international partners. They note that their workshops model the PBL process and are led by seasoned teachers and coaches. The majority of their offerings for individual teachers are 1–3-day online workshops, and they hold an annual conference that enables teachers to take in-person workshops. When working with schools, PBLWorks offers in-person or online workshops, teacher consultancies, and project design coaching. At the district level, PBLWorks offers a comprehensive series of workshops and support for both school leaders and teachers.

Project Lead the Way

Project Lead the Way (PLTW) seeks to improve STEM education through authentic, engaging learning experiences. They have developed curriculum for grades pre-K through 12. Elementary curricula are focused on using exploration and play to develop critical thinking, team work, and problem-solving skills; middle school curricula are focused on building connections to future

careers; and high school curricula include specific content such as engineer, computer science, and biomedical science. PLTW is usually adopted by whole schools or districts.

PLTW offers TPD to help teachers implement their curricula. They offer a variety of online trainings, most of which are 2 days long (16 hours). In addition, PLTW offers schools ongoing support, access to community tools, and additional resources to guide implementation.

PLTW has conducted research on the implementation of their program, but it has not conducted research to specifically determine the effectiveness of their TPD. A research study of PLTW's scaling initiative in the state of Massachusetts found that students participating in PLTW coursework increased standardized test scores in both middle school and high school.

In this study, teachers self-reported increased efficacy and satisfaction as a teacher (Mass STEM Hub, 2019).

RULER

RULER is an approach focused on SEL and aims to build skills of emotional intelligence. The approach includes tools to address climate, self-awareness and social awareness, a process for dealing with situations, and the development of conflict resolution skills. RULER is offered to schools and districts and provides training for teachers as well as school leaders over a period of 2 years. TPD includes a training institute, an online implementation support platform, virtual group coaching sessions, and webinars. One research study found that classrooms in RULER schools had better emotional support, classroom management, and instructional support at the end of the second year of the program (Hagelskamp et al., 2013).

Appendix C. Instrument Matrix

While the history of measuring school-based SEL interventions goes back to the 1950s, we chose to focus on more recent measurement tools in developing our assessment matrix. However, if readers are interested, a meta-analysis of school-based SEL program effectiveness provides an extensive list of assessment measures from the Lorge-Thorndike IQ Level-3 developed in 1954 to the Maastricht University Stress Instrument for Children (MUSIC) developed in 2008 (d’Abreau et al., 2019).

	Name	Developer	Year Developed	Grade Levels	Respondent and Format	Number of Items	Time to complete	Fee for Use	Evidence of Reliability	Evidence of Validity	% of Competencies
1	ACT Tessera	ACT	2016	6 to 12	Student self-report	92	30 Minutes	\$9.99 per student.	Yes	Yes	10%
2	Battelle Developmental Inventory (BDI), 2nd Edition	Riverside Publishing	2004	Birth to 7 years, 11 months	Teacher, observational, other		15 minutes	Full kit with manipulatives and software is \$932.00.	Yes	Yes	4%
3	Behavioral and Emotional Rating Scale-Second Edition: (BERS)	PAR Inc.	2000	Elementary school and middle school	Teacher, parent, self	57 items on student and parent scale	Less than 15 minutes to finish	BERS2 prices include \$198.00 for an introductory kit.	Yes	Yes	5%
4	California Healthy Kids Survey (CHKS)	WestEd	NA	5 to 12	Student self-report	Core module = 130 items; Social & Emotional Health module = 56 items	20–25 minutes	The survey items are free to download, but there are administration fees.	Yes	Yes	12%
5	CORE Districts Social Emotional Learning Surveys	Education Analytics	2014	4 to 12	Student self-report	18 operational SEL items	20–25 minutes	Free	Yes	Yes	5%
6	Developmental Assets Profile (DAP)	Search Institute	2004	3 to 12	Student self-report	58	10–15 minutes	The survey is \$300 for use (including up to 100 surveys). Includes analysis and reporting from the Search Institute.	Yes	Yes	5%
7	Devereux Student Strengths Assessment (DESSA)	Aperture Education	2008	K to 8	Teacher or staff, family	72	10 minutes or less	NA	Yes	Yes	12%
8	The EPOCH Measure of Adolescent Well-being	peggykern.org	2016	Ages 10 to 18	Student	20		Free and publicly available	Yes	Yes	6%

	Name	Developer	Year Developed	Grade Levels	Respondent and Format	Number of Items	Time to complete	Fee for Use	Evidence of Reliability	Evidence of Validity	% of Competencies
9	Hello Insight: Social and Emotional Learning	Algorhythm	NA	5 to 12+ elementary SEL: 3 to 5	Student self-report	Elementary SEL: 37 pretest items and 50 posttest items	10–20 minutes	Membership starts at \$500 to survey up to 50 youth with a onetime \$500 onboarding fee for new organizations.	NA	NA	17%
10	The Holistic Student Assessment (HSA)	Gil G. Noam, The PEAR Institute	2007	3 to 12	Student self-report	30 to 61, depending on the version selected	Short version: 10 minutes; long version: 15–20 minutes	Cost of survey implementation depends on number of participants.	Yes	Yes	16%
11	KIPP Character Growth Card (KIPP CGC)	characterlab.org	2011	Elementary, middle, and high school	Student, teacher, or educator	30		Access may be limited or unavailable.	No	No	9%
12	Panorama Social-Emotional Learning – Student Measures	Panorama Education	2014	K to 12	Student self-report	10 to 62 items, depending on grade level and versions selected by a school or district	10–15 minutes	Annual, per-student license.	Yes	Yes	12%
13	Six Seconds Youth Version (SEI-YV)	Six Seconds EQ Network	2005	2 to 12	Student self-report	99 rating scale questions, 4 open text questions	15–20 minutes	The retail price is \$5 per student. Certified consultants receive a quantity discount based on volume.	Yes	Yes	19%
14	Social Skills Improvement System (SSIS) SEL Rating Forms – Student	Pearson Clinical	2017	3 to 12	Student self-report	46	10–15 minutes	Base cost is \$1.85 per student. Additional materials for administration, such as manuals and pre-assembled kits, can be obtained for a fee.	No	No	6%
15	Social Skills Rating System (SSRS)	American Guidance Services	NA	Preschool through secondary school	Teacher, parent, self		20 minutes		Yes	Yes	4%
16	Tripod Social and Emotional Competency Survey for Students (SEL-C)	Tripod Education Partners	2018	3 to 5 and 6 to 12	Student self-report	28 core SEL items	10–15 minutes	Fees vary based on the number of students surveyed, the number of schools, and the level of client training and support that is desired.	Yes	Yes	12%
17	VIA Character Strengths Survey	VIA Institute on Character	2004	4 to 12	Student self-report	96	10–15 minutes	The VIA Survey and resulting Character Strengths Profile are free of charge.	Yes	Yes	31%
18	WCSD Student Social and Emotional Competency Assessment	Washoe County School District	2012	5 to 12	Student self-report	40	15–20 minutes	WCSD-SECA Long Form is publicly available and free to use.	No	Yes	6%

Appendix D. Crosswalk of Competencies Represented across Instruments in the Matrix

Competency	Instrument																	
	ACT Tessera	Battelle Developmental Inventory (BDI)	Behavioral and Emotional Rating Scale--Second Edition: (BERS)	California Healthy Kids Survey (CHKS)	CORE Districts Social Emotional Learning Surveys	Developmental Assets Profile (DAP)	Devereux Student Strengths Assessment (DESSA)	EPOCH Measure of Adolescent Well-being	Hello Insight: Social and Emotional Learning	Holistic Student Assessment (HSA)	KIPP Character Growth Card (KIPP CGC)	Panorama Social-Emotional Learning – Student Measures	Six Seconds Youth Version (SEI-YV)	Social Skills Improvement System (SSIS) SEL Rating Forms – Student	Social Skills Rating System (SSRS)	Tripod Social and Emotional Competency Survey (Tripod SEL-C)	VIA Youth Survey	WCSD Student Social and Emotional Competency Assessment – Long Form
Academic motivation										x								
Action orientation										x								
Assertiveness										x								
Behavioral self-control, self-control (interpersonal), self-control (school work)				x							x							
Bravery																	x	
Commitment to learning						x												
Competence															x			
Connectedness								x										
Contribution									x									
Creativity, self-expression									x								x	
Critical action									x									
Critical reflection, reflection									x	x			x					
Critical thinking										x								
Curiosity	x										x						x	
Decision-making, responsible decision-making, positive decision-making	x													x		x		x
Disruptive, externalizing behaviors and internalizing symptoms															x			
Emotion regulation				x						x		x						
Empathy				x						x								

Competency	Instrument																	
	ACT Tessera	Battelle Developmental Inventory (BDI)	Behavioral and Emotional Rating Scale-Second Edition: (BERS)	California Healthy Kids Survey (CHKS)	CORE Districts Social Emotional Learning Surveys	Developmental Assets Profile (DAP)	Devereux Student Strengths Assessment (DESSA)	EPOCH Measure of Adolescent Well-being	Hello Insight: Social and Emotional Learning	Holistic Student Assessment (HSA)	KIPP Character Growth Card (KIPP CGC)	Panorama Social-Emotional Learning – Student Measures	Six Seconds Youth Version (SEI-YV)	Social Skills Improvement System (SSIS) SEL Rating Forms – Student	Social Skills Rating System (SSRS)	Tripod Social and Emotional Competency Survey (Tripod SEL-C)	VIA Youth Survey	WCSD Student Social and Emotional Competency Assessment – Long Form
Engagement							x					x						
Excellence																	x	
Fairness																	x	
Forgiveness																	x	
Future orientation																x		
Goal-directed behavior, goal orientation						x		x										
Gratitude				x							x						x	
Grit	x										x	x						
Growth mindset					x							x						
Happiness							x											
Honesty																	x	
Hope																	x	
Humility																	x	
Humor																	x	
Integrity																x		
Judgement																	x	
Kindness																	x	
Leadership	x																x	
Learning interest									x									
Love																	x	
Love of learning																	x	
Mastery orientation									x									
Navigate emotions												x						
Optimism, optimistic thinking				x		x	x		x	x								

Competency	Instrument																	
	ACT Tessera	Battelle Developmental Inventory (BDI)	Behavioral and Emotional Rating Scale-Second Edition: (BERS)	California Healthy Kids Survey (CHKS)	CORE Districts Social Emotional Learning Surveys	Developmental Assets Profile (DAP)	Devereux Student Strengths Assessment (DESSA)	EPOCH Measure of Adolescent Well-being	Hello Insight: Social and Emotional Learning	Holistic Student Assessment (HSA)	KIPP Character Growth Card (KIPP CGC)	Panorama Social-Emotional Learning – Student Measures	Six Seconds Youth Version (SEI-YV)	Social Skills Improvement System (SSIS) SEL Rating Forms – Student	Social Skills Rating System (SSRS)	Tripod Social and Emotional Competency Survey (Tripod SEL-C)	VIA Youth Survey	WCSD Student Social and Emotional Competency Assessment – Long Form
Orientation, other group orientation									x									
Perseverance								x		x							x	
Persistence				x														
Personal achievement													x					
Personal responsibility								x										
Perspective																	x	
Positive identity						x			x									
Positive regard																x		
Positive values						x												
Prioritizing													x					
Proactivity													x					
Problem-solving													x					
Prudence																	x	
Pursue noble goals													x					
Recognize patterns													x					
Relationship management, relationship skills, relationships with peers	x	x	x					x		x			x			x		x
Relationship quality													x					
Resilience	x												x					
Risk tolerance													x					
Self-awareness		x	x	x				x					x	x		x		x
Self-confidence									x									
Self-direction, self-management, self-regulation	x	x	x		x			x		x			x	x	x	x	x	x
Self-efficacy				x	x								x					

Competency	Instrument																	
	ACT Tessera	Battelle Developmental Inventory (BDI)	Behavioral and Emotional Rating Scale-Second Edition: (BERS)	California Healthy Kids Survey (CHKS)	CORE Districts Social Emotional Learning Surveys	Developmental Assets Profile (DAP)	Devereux Student Strengths Assessment (DESSA)	EPOCH Measure of Adolescent Well-being	Hello Insight: Social and Emotional Learning	Holistic Student Assessment (HSA)	KIPP Character Growth Card (KIPP CGC)	Panorama Social-Emotional Learning – Student Measures	Six Seconds Youth Version (SEI-YV)	Social Skills Improvement System (SSIS) SEL Rating Forms – Student	Social Skills Rating System (SSRS)	Tripod Social and Emotional Competency Survey (Tripod SEL-C)	VIA Youth Survey	WCSD Student Social and Emotional Competency Assessment – Long Form
Social awareness			x		x	x						x		x		x		x
Social capital									x									
Social competence, social intelligence, social skills						x		x		x							x	
Social connections								x										
Social emotional composite							x											
Social perspective taking												x						
Spirituality																	x	
Susceptibility to peer pressure																x		
Teamwork	x																x	
Trust										x								
Vision													x					
Zest				x							x						x	
Total Competencies Measured	8	3	4	9	4	4	9	5	13	12	7	9	15	5	3	9	24	5
% of Total Competencies (uncoded)*	10%	4%	5%	12%	5%	5%	12%	6%	17%	16%	9%	12%	19%	6%	4%	12%	31%	6%

*Competencies were not grouped into fewer categories, despite overlap across terms, because we did not want to make assumptions about how they would be coded to learning through play skills.

Appendix E.

Research Studies Reviewed for Measuring Student Outcomes Section

	Country	Year	Article	Authors	Pedagogical Approach	Intervention Name Provided	Included TPD	Grade	Constructs/Skills Measured	Measurement Tool Included
1	United States	2022	Assessing the Effect of Project-Based Learning on Science Learning in Elementary Schools	Krajcki, Schneider, and Peek-Brown	Project-based learning	Yes. A science intervention: <i>Multiple Literacies in Project-Based Learning</i>	Yes	Elem. (3rd)	Academic, social, and emotional learning	No. Does describe the process used to develop the assessment used. Provides a technical report.
2	United States	2021	Learning Through Performance Project-Based Learning as a Lever for Engaging the Next-Generation Science Standards	Deutscher, Holthuis, Maldonado, Pecheone, Schultz, and Wei	Project-based learning	Yes. <i>The Learning Through Performance (LTP) science curriculum</i> (from SCALE)	Yes	Middle (6th–8th)	Student engagement, science achievement, and other non-science outcomes	No. Does include links to the Stanford Center for Assessment, Learning and Equity (SCALE), which hosts multiple assessments and rubrics.
3	United States	2020	Putting PjBL to the Test: The Impact of Project-Based Learning on Second Graders' Social Studies and Literacy Learning and Motivation in Low-SES School Settings	Konstantopoulos	Project-based learning	No. Does include a description of the integrated, project-based approach	Yes	Elem.	Academic (social studies and literacy achievement); and motivation	No. The measures were developed by the research team.
4	United States	2019	Are You READY TO ASSESS Social and Emotional Learning and Development? Tools Index	AIR	Social and emotional learning	NA	No	NA	Social and emotional learning	Yes. The publication includes a review of multiple assessments.
5	United States	2020	A review of instruments for measuring social and emotional learning skills among secondary school students	Cox, Foster, and Bamat	Social and emotional learning	NA	No	High	Social and emotional learning	Yes. The publication includes a review of multiple assessments.
6	United States	2019	Project-Based Learning (Pjbl) in Three Southeastern Public Schools: Academic, Behavioral, and Social-Emotional Outcomes	Culclasure, Longest, and Terry	Project-based learning	No. The publication discusses project-based learning implementation fidelity and measuring student outcomes the same way across the K–12 spectrum.	No	Elem., middle, and high	Academic, social-emotional: creativity, innovation, critical thinking, problem-solving skills, collaboration, teamwork, self-direction, interpersonal skills	Yes. Observation protocol and student survey instruments are included.
7	United States	2019	Student Outcomes from High-Quality Project-Based Learning: A Case Study for PBLWorks	Evans	Project-based learning	No. Does describe the approach of the single teacher case study	Yes	NA	Teacher confidence	No
8	United States	2017	Encouraging Social and Emotional Learning in the Context of New Accountability	Melnick, Cook-Harvey, and Darling-Hammond	Social and emotional learning	NA	No	NA	Social and emotional learning	Yes. The publication includes a review of multiple assessments.
9	United States	2016	Measuring Quality: Assessment Tools to Evaluate Your Social-Emotional Learning Practices	Expanded Learning 360°/365	Social and emotional learning	NA	No	NA	Social and emotional learning	Yes. The publication includes a review of multiple assessments.

	Country	Year	Article	Authors	Pedagogical Approach	Intervention Name Provided	Included TPD	Grade	Constructs/Skills Measured	Measurement Tool Included
10	United States	2016	Measuring MESH: Student and Teacher Surveys Curated for the CORE Districts	Transforming Education	Social and emotional learning	NA	No	NA	Social and emotional learning	Yes. The publication includes a review of multiple assessments.
11	United States	2016	Primary Project: A Play-Based Intervention for Early Childhood	Johnson and Peabody	Play-based learning	Yes. The <i>Primary Project</i> intervention	No	Elem. (PK–3rd)	The T-CRS intervention includes task orientation, behavior control, assertiveness, and peer social skills.	No. Does reference the <i>Teacher– Child Rating Scale</i> and provides citations to other <i>Primary Project</i> outcomes studies.
12	United States	2010	Compendium of Preschool Through Elementary School Social-Emotional Learning and Associated Assessment Measures	Denham, Ji & Hamre	Social and emotional learning	NA	No	Elem.	Social and emotional learning	Yes. The publication includes a review of multiple assessments.
13	Argentina	2016	Impact of an inquiry unit on grade 4 students' science learning	Di Mauro and Furman	Inquiry-based learning	No. Does include description of the 8-week intervention	No	Elem. (4th)	Experimental design skills	No. Does describe a multi-faceted longitudinal study.
14	Nigeria	2022	Effect of the Activity-Based Learning on Basic Science and Technology Students' Noncognitive Skills in South-South Nigeria	Nwosu, Etiubon, and Ofem	Activity-based learning	Yes. The <i>Activity-Based Learning (ABL)</i> intervention	No	Elem.	Students' noncognitive outcomes including, self -efficacy, self-esteem, perseverance, peer relationship, meta cognition	No. Does name an instrument: <i>Basic Science and Technology Students' Noncognitive Outcome 15Questionnaire (BSTNCOQ)</i> .
15	Uganda	2022	The Impact of Learning to Teach by Learning to Learn on Student Outcomes in Uganda	Ashraf, Banerjee, and Nourani	Project-based learning	Yes. The <i>Preparation for Social Action (PSA)</i> intervention	No	Elem. and middle (4th–7th)	Academic, critical thinking, creativity, teacher pedagogy, and effort	No. Does describe a multi-faceted approach to data collection.
16	Spain	2021	Is project-based learning effective among kindergarten and elementary students?	Ferrero, Vadillo, and Leon	Project-based learning	Yes. The study found 11 articles that met their search criteria. Each article describes an intervention.	No	Elem. (PK–5th)	Cognitive skills; content skills (science, social studies, ELA); fitness knowledge	Yes. Includes articles that referenced: <i>Bracken Basic Concept Scale-Revised</i> , <i>Fitness Knowledge Test</i> , and other instruments.
17	United Kingdom	2021	Play-based interventions to support social and communication development in autistic children aged 2–8 years: A scoping review	Gibson, Pritchard, and de Lemos	Play-based learning	Yes. The publication is a review of multiple interventions.	No	Elem.	Social play skills	No
18	Canada	2020	A Model for Assessment in Play-Based Kindergarten Education	Pyle, DeLuca, Danniels, and Wickstom	Play-based learning	No. This study collected teacher classroom practice data to construct an integrated assessment framework for play-based learning.	Yes	Elem. (K)	Three types of play were described: teacher-directed play, guided play, and free play.	No. Does include a framework developed that describes seven pathways to assessment of play-based learning.
19	Saudi Arabia	2020	The Effectiveness of the Project-Based Learning (PBL) Approach as a Way to Engage Students in Learning	Abdullatif Almulla	Project-based learning	No. Does name the sources used to create the intervention	Yes	NA	Multiple learning approaches including project-based learning	No

	Country	Year	Article	Authors	Pedagogical Approach	Intervention Name Provided	Included TPD	Grade	Constructs/Skills Measured	Measurement Tool Included
20	Denmark	2016	<u>Towards a Pedagogy of Play</u>	Project Zero (LEGO funding)	Play-based learning	Yes. <u>The Pedagogy of Play (PoP)</u> intervention	Yes	NA	Choice, wonder, delight	No. Does describe a tool is progress: <i>Indicators of Playful Learning</i> .
21	India	2016	<u>Efficacy of Montessori and traditional method of education on self-concept development of children</u>	Shivakumara, Dhiksha, and Nagarai	Montessori	No. Does describe Montessori and traditional education methods	No	NA	Dimensions of self-concept: physical, social, temperament, education, moral, intellectual	No. Does name an instrument: the <i>Self-concept Questionnaire</i> constructed by Saraswat in 1997.
22	Jordan	2016	<u>The Impact of Cooperative Learning on Developing the Sixth Grade Students Decision-Making Skill and Academic Achievement</u>	Asha and Hawi	Cooperative learning	No. Does describe cooperative learning intervention	No	Middle (6th)	Academic, decision-making skills	No. The measures were developed by the research team.
23	Canada	2009	<u>Identifying Indicators and Tools for Measuring Social and Emotional Healthy Living: Children Ages 5-12 Years</u>	Schonert-Reichl, Stewart Lawlor, Oberle, and Thompson	Social and emotional learning	NA	No	Elem. and middle	Social and emotional learning	Yes. The publication includes a review of multiple assessments.
24	Slovenia	2009	<u>Problem-based instruction in mathematics and its impact on the cognitive results of the students and on affective-motivational aspects</u>	Cotic	Problem-based learning	No. Does describe the project-based model used	No	Elem.	Cognitive (math achievement), affective (student opinions)	No. The measures were developed by the research team, including pre-post surveys.
25	Colombia	2007	<u>Socio-Scientific Discussions as a Way to Improve the Comprehension of Science and the Understanding of the Interrelation between Species and the Environment</u>	Castano	Constructivist science learning	No. Does describe the project-based activities	No	Elem.	Empathy	No
26	Turkey	2006	<u>The Effects of Problem-Based Active Learning in Science Education on Students' Academic Achievement, Attitude and Concept Learning</u>	Orhan Akinoğlu and Ruhan Özkardeş Tandoğan	Problem-based learning	No. Does describe the project-based activities	No	Middle (7th)	Academic skills and attitudes	No. The measures were developed by the research team.



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