Principles for High-Quality, Standards-Aligned Professional Learning

Introduction to the Principles

Why Professional Learning Principles?

Professional learning aligned to college- and career-ready standards has the power to improve instruction as well as student outcomes. But too often teachers are receiving incoherent professional learning that does not result in effective and equitable instructional practice or improved student achievement.

There is not one "perfect" model of professional learning, but research points to conditions that must be met for it to be effective. Walking into any given professional learning moment can and *should* look different from district to district, school to school, and even teacher to teacher, if it is to meet the unique needs of that setting. The design of each of those experiences must reflect certain research-based non-negotiables, or Principles for High-Quality, Standards-Aligned Professional Learning:

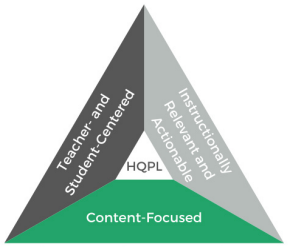
Principle 1: Professional learning must be content-focused. Professional learning builds teachers' content knowledge and pedagogical content knowledge necessary to teach the concepts of their discipline.

Principle 2: Professional learning must be teacher- and student-centered. Professional learning promotes collective responsibility for students' learning and cultivates a dynamic culture for adult learning.

Principle 3: Professional learning must be instructionally relevant and actionable. Professional learning is anchored in the instructional priorities of teachers' daily work and is sustained in a coherent system of collaborative planning, classroom practice, observation, feedback, and continuous cycles of inquiry grounded in evidence of student learning.

These Principles are intended to provide clarity and direction for those charged with selecting or designing professional learning for teachers and those who support teachers. The Principles articulate what needs to be true based on a synthesis of existing knowledge about professional learning, while leaving space for a diversity of structures to match the needs of a local setting. **All three Principles need to be reflected** for professional learning to impact instruction in a meaningful way.

Where did these Principles come from?



High-Quality Professional Learning (HQPL)

Student Achievement Partners developed these Principles for High-Quality, Standards-Aligned Professional Learning by distilling existing research and listening to voices from the field. One of the first stages of the process was to survey the research base and to curate from it the essential features of effective professional learning through a lens of college- and career-ready aligned instruction. Concurrently, Student Achievement Partners interviewed stakeholders, including teachers, instructional coaches, school-building leaders, system leaders and advisors, and designers and deliverers of professional learning to learn about the experiences of the field. This knowledge review resulted in three Principles, each supported by specific descriptors that define the principle operationally to bridge theory and practice.

How can the Principles help?

There are a number of challenges facing those who are designing, selecting, and implementing professional learning. Few resources exist to support school and district leaders in evaluating the wide range of professional learning offerings for quality and alignment to college- and career-ready standards. There is little information on the college- and career-ready standards-aligned literacy and mathematics content teachers should be learning to build on their knowledge and advance their practice. As a result, professional learning is often divorced from the instructional vision and academic priorities of a school or system, pulling teachers in various directions – at times contradictory – and offering little sustained support to teachers in applying what they have learned. A broad understanding of the evidence-based attributes that need to be present to ensure effective professional learning can start to address these challenges. The Principles for High-Quality, Standards-Aligned Professional Learning meet this need. With the common understanding of high-quality professional learning as defined by the three Principles, decision makers can begin wielding more power, whether as consumers or designers of professional learning.

This work of designing and engaging in professional learning is hard, and it is the work of many. The changes suggested by these Principles may not be simple or quick. But this change is necessary, especially for students for whom we can and must do better. When these evidence-based components are in place, teachers will begin to have the support they need to enable powerful learning for all students.

Principles for High-Quality, Standards-Aligned Professional Learning

1. **Content-Focused:** Professional learning builds teachers' content knowledge and pedagogical content knowledge necessary to teach the concepts of their discipline. Consistent with this principle, professional learning must:

   a. Focus on specific instructional strategies and content knowledge in literacy and mathematics[1] that helps teachers teach the standards for their grade and the underlying concepts of the discipline[2] (Ball, 2011; Jensen et al., 2016; Lynch et al., 2019; Schoenfeld, 2014; Weiland et al., 2018).
   b. Anchor pedagogical strategies within the specific context of the instructional materials being used in the classroom to inform and improve student learning (Cobb et al., 2018; Desimone & Garet, 2015; Gallagher, 2016; Jensen et al., 2016; Lynch et al., 2019; Weiland et al., 2018).
   c. Equip teachers with strategies for equitable instruction that provide all students with access to grade-level content and tasks (for example, appropriate scaffolds to access grade-level text, access prior mathematical knowledge in the context of grade-level work) (Ladson-Billings, 1995; Leana, 2011; Peske & Haycock, 2006).
   d. Ground learning in research about how students best acquire specific knowledge and skills (Gay, 2002; Gersten et al., 2010; Jensen et al., 2016; Timperley, 2007).
   e. Project a clear vision of research-based instructional practices that are focused on student learning and support educators to make sense of the practices through hands-on and intellectually engaging approaches (Darling-Hammond et al., 2009; Desimone, 2011; Gersten et al., 2010; Rhoton & Wojnowski, 2006; Timperley, 2007; Willis, 2002).

2. **Teacher- and Student-Centered:** Professional learning promotes collective responsibility for students' learning and cultivates a dynamic culture for adult learning. Consistent with this principle, professional learning must:

   a. Contribute to a trusting and motivating adult culture where curiosity and improvement are valued, and educators feel safe taking risks and learning from mistakes (Baum & Krulwich, 2016; Davis, 2013; Lynch et al., 2019; Saunders et al., 2009; Timperley, 2007; Willis, 2002).
   b. Challenge educators' mindsets, expectations, attitudes, and biases about students, particularly students facing barriers of racism and/or poverty, so that educators have positive views of student capabilities and high expectations for all students (Cobb et al., 2018; Timperley, 2007; Ukpokodu, 2011).
   c. Require and support teachers to design and deliver instruction that is responsive to and respects the value of all students' backgrounds, languages, cultures, points of view, knowledge, and skills (Gay, 2002; Hammond, 2015; Ladson-Billings, 1995).
   d. Encourage teachers and students to think critically about and respond to how representation of multiple perspectives and identities are evident in instructional materials, taking action when materials are lacking in representation (Gay, 2002; Hammond, 2015; Kozleski, 2010; Ladson-Billings, 1995; Villegas & Lucas, 2002).

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[1] The Principles are intended to inform the creation of coherent and robust professional learning for all teachers while acknowledging the heterogeneity of students and the diversity of educator roles within any school system. Refer to other complementary, evidence-based professional learning resources for information regarding educators working across instructional disciplines and with specific student populations. For example, Professional Development Essentials For Educators of Multilingual Learners and The National Center on Educational Outcomes.

[2] Language demands embedded within college- and career-readiness standards for English language arts, literacy, and mathematics, span interpretive, productive, and interactive linguistic competencies. Such standards require students to acquire and produce ever-increasing English language complexity as they proceed through the grades to engage in—and master—a range of disciplinary practices and performances.

e. Solicit teacher input and feedback to inform the design and delivery of ongoing professional learning (Boston Consulting Group, 2014; Calvert, 2016; Leana, 2011; Ronfeldt et al., 2015; Santagata et al., 2011; Saunders et al., 2009).

f. Build educators' capacity to sustain discipline-specific professional learning through development of school and/or school district content expertise in mathematics and literacy (Calvert, 2016; Desimone & Garet, 2015; Saunders et al., 2009).

3. **Instructionally Relevant and Actionable:** Professional learning is anchored in instruction and is sustained in a coherent system of collaborative planning, classroom practice, observation, feedback, and continuous cycles of inquiry grounded in evidence of student learning. Consistent with this principle, professional learning must:

a. Constantly focus and refocus what educators are learning on implications for improved student learning (Elmore, 2008; Gersten et al., 2010; Guskey & Yoon, 2009; Saunders et al., 2009).

b. Organize learning experiences with teachers and teams who share the same content focus (for example, grouping by subject and grade level) so teachers can target specific, shared learning goals (Calvert, 2016; Desimone, 2011; Rhoton & Wojnowski, 2006; Lynch et al., 2019).

c. Include regular collaborative opportunities for teachers to design, rehearse, and refine instructional practices, tasks, and assignments; examine student work to determine progress; and design the next cycle of learning and teaching (Croft et al., 2010; Darling-Hammond et al., 2009; Garrett et al., 2019; Guskey & Yoon, 2009; Lynch et al., 2019; Moldoveanu & Narayandas, 2016; Rhoton & Wojnowski, 2006; Saunders et al., 2009; Stigler & Hiebert, 1999; Weiland et al., 2018; Yoon et al., 2007).

d. Provide teachers with sustained follow-up, structured feedback, and opportunities to reflect as they transfer what they've learned to the classroom (for example, through observation with a content-specific observation rubric such as the Instructional Practice Guide or other content-specific observation rubrics) (Desimone, 2011; Gulamhussein, 2013; Jensen et al., 2016; Lynch et al., 2019; Russell et al., 1999; Sachs, 2004; Truesdale, 2003; Willis, 2002).

e. Align with the school and/or school district's vision of discipline-specific instructional improvements, and be monitored by analyzing replicable evidence of teacher and student learning (Cobb et al., 2018; Guskey & Yoon, 2009; Jensen et al., 2016).

How These Principles Were Developed

Student Achievement Partners engaged in an evidence-based collaborative design process to create an actionable set of Principles. Key components of the design process included:

Review of Existing Scholarship

Student Achievement Partners surveyed a variety of literature about effective professional learning, including quantitative, qualitative, peer-reviewed, and non-peer-reviewed research. Studies and articles were curated by conducting an internal research identification process and evaluating recommendations from partners and advisors. To distill the list of over 200 studies and articles, Student Achievement Partners first selected papers that utilized rigorous research methods (peer-reviewed, involved treatment conditions and control groups, and larger sample sizes) and included results regarding measurable student achievement. Essential features of effective professional learning associated with improved student achievement were identified. The selected qualitative research elaborated on elements of effective professional learning that were suggested in the quantitative studies. The descriptors in the Principles highlight the themes from the research studies and explanatory articles.

Empathy Interviews

Student Achievement Partners conducted over 50 empathy interviews with teachers, instructional coaches, school leaders, system leaders, professors, and researchers. Hearing from the diverse voices of people closest to the daily challenges of designing, implementing, and experiencing professional learning provided a practical context for the evidence-based Principles.

Contributions from Partners

Student Achievement Partners engaged with partners and advisors who served as collaborators, lending their expertise and experience to provide valuable feedback at various stages to strengthen the evidence base and message of the Principles.

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Advisory Group

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Special Thanks

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Principles for High-Quality, Standards-Aligned Professional Learning

Annotated Bibliography

Ball, D. L., & Forzani, F. M. (2011). Building a Common Core for learning to teach: And connecting professional learning to practice. *American Educator, 35*(2), 17-39.

This article argues that the Common Core State Standards offer a watershed opportunity to set the work of preparing and developing teachers within a set of shared standards for what constitutes the content of necessary preparation. Exploiting the existence of shared student standards for mathematics and ELA/literacy learning offers the possibility of a common foundation on which a stronger educational infrastructure could be built. The authors also attest that popular opinion is more sympathetic to the idea that skillful teaching is crucial for students' success.

Baum, K., & Krulwich, D. (2016). *The Artisan Teaching Model for instructional leadership: Working together to transform your school.* ASCD.

This book suggests a school structure that deliberately places all teachers in a system that demands intensive collaboration around teaching. As a result, this collaborative process—which includes lesson planning, collaboration, and teaching—helps identify and develop the broader range of skills that demonstrate leadership capacity. In other words, the system described is deliberately designed to identify and develop a broader range of skills than those just identified with classroom teaching.

Boston Consulting Group. (2014). *Teachers know best: Teachers' views on professional development.* Bill and Melinda Gates Foundation.

This research study was conducted by The Boston Consulting Group (BCG) that interviewed and surveyed more than 1,300 stakeholders (teachers, professional development leaders in district and state education agencies, principals, professional development providers, and thought leaders) to identify the needs and opportunities for improvement on professional learning. Teachers described effective professional learning as relevant, hands-on, and sustained over time and the need for these elements consistently emerged throughout the research conducted for this report. The study also named key areas of focus including "improving collaborative and personalized models and identifying key use cases for technology that can improve professional development at scale" to help "address many of the current barriers to effective professional learning."

Calvert, L. (2016). *Moving from compliance to agency: What teachers need to make professional learning work*. Learning Forward and NCTAF.

This paper reports on research conducted by Learning Forward and the National Commission on Teaching & America's Future to "understand the disconnect between the professional learning that teachers need and want and what they actually experience on the job." The report "emphasizes the importance of teacher agency and pinpoints strategies that education leaders and policymakers can use to leverage agency in designing more effective professional learning." By interviewing teachers and school administrators they learned that "the opportunity is ripe to work together to clothe the emperor. Let's bring in our teachers as partners to create job-

embedded, authentic systems of learning for the whole school community. Let's give them the time, the structures, the support, and the choices they need to be fully engaged in improving practice and solving our most pressing educational challenges. When we believe in our teachers, listen to them, and support their continual development, there is no telling what our educators and their students will accomplish."

Cobb, P., Jackson, K., Henrick, E., Smith, T. M., & the MIST Team. (2018). *Systems for instructional improvement: Creating coherence from the classroom to the district office.* Harvard Education Press.

This book reports on the findings from a partnership between the Middle School Mathematics and the Institutional Setting of Teaching (MIST) research team from Vanderbilt University and four large urban school districts. The study investigated what are the necessary elements to supports teachers' development of high-quality instructional practices at scale. The MIST team endeavored to form a true partnership with the districts, rather than to only collaborate with them, so that the research was with rather than on the districts. The researchers found that it is necessary to adopt a systems-wide perspective, from the classroom to the central office, in order to effectively improve instruction at the classroom level. From this perspective, the key elements of the instructional system included teacher professional learning, instructional coaching, instructional materials, assessments, and school and district instructional leadership. Their findings indicate that an effective approach to high-quality instructional practices is one based on a distributed model of instructional leadership carried out by leaders at different levels of the instructional system and is based on "contours of expertise" (work is led by individuals with the greatest expertise on particular aspects of instruction).

Croft, A., Coggshall, J. G., Dolan, M., Powers, E., & Killion, J. (2010). *Job-embedded professional development: What it is, who is responsible, and how to get it done well*. National Comprehensive Center for Teacher Quality, Mid-Atlantic Comprehensive Center, and National Staff Development Council.

This brief focuses on describing specifically what job-embedded professional development consists of and what types of teacher learning opportunities count as being job embedded. It raises a range of questions of how job-embedded professional development can improve teaching practices and student learning outcomes. The brief intended to answer these questions with a focus on job-embedded professional development for teachers only (not for other educators such as principals). This is a review of the research and then a set of policy suggestions for how states, districts, and schools can implement based on best practices. When "skillfully implemented and supported by federal, state, and local policy," job-embedded professional development "constitutes a powerful lever to advance student learning."

Darling-Hammond, L., Wei, R. C., Andree, A., Richardson, N., & Orphanos, S. (2009). *Professional learning in the learning profession*. National Staff Development Council.

This report examines what research has revealed about professional learning that improves teachers' practice and students' learning. It describes the relative availability of such opportunities in the United States as well as in high-achieving nations around the world, which have been making substantial and sustained investments in professional learning for teachers over the last two decades.

Davis, J. (2013). Supporting creativity, inclusion and collaborative multi-professional learning. *Improving Schools*, *16*(1), 5-20.

This article connects arguments in the field of integrated and multi-professional working and focuses on the need to promote a strengths-based approach to children, and to providing

services in general (written with a social services perspective). The focus is on promoting creative writing in young children but translates well into the conditions for promoting creative and flexible approaches for teachers in how they approach teaching. The treatment utilized "strength-based and social justice approaches to encourage professionals who work with children and families to recognize the diversity of children and support children and families to collaboratively, creatively, and flexibly develop solutions to their own life issues and their own learning." The author concludes that a culture shift can be achieved that stimulates creativity and innovation [in childhood] if organizations recognize the abilities [of children] to stimulate each other's creativity, support freedom to learn collaboratively, and challenge institutional barriers such as targets and top-down performance indicators.

Desimone, L. M. (2011). A primer on effective professional development. *Phi Delta Kappan*, *92*(6), 68-71.

This article reports on "a growing body of empirical research" that "suggests a core set of features is common to effective professional development." Consequently, "these core features that lead to teacher learning provide a starting point for assessing professional development programs, and they lead to a core conceptual framework for judging whether professional development is doing what we want it to do — increasing teacher knowledge and instruction in ways that translate into enhanced student achievement. When we want to know whether teacher professional development is working, we should first decide how to define professional development, measure its core features, use the conceptual framework to judge whether it's producing the desired results, and keep an open mind about the tools we use to assess its effectiveness."

Desimone, L., & Garet, M. (2015). Best practice in teachers' professional development in the U.S. *Psychology, Society, & Education*, *7*(3), 252-263.

This article summarizes the current knowledge around best practices in professional learning. The authors name five: (a) content focus: activities focused on subject matter content and how students learn that content; (b) active learning: opportunities for teachers to observe, receive feedback, analyze student work, or make presentations, as opposed to passively listening to lectures; (c) coherence: content, goals, and activities that are consistent with the school curriculum and goals, teacher knowledge and beliefs, the needs of students, and school, district, and state reforms and policies; (d) sustained duration: PD activities that are ongoing throughout the school year and include twenty hours or more of contact time; and (e) collective participation: groups of teachers from the same grade, subject, or school participate in PD activities together to build an interactive learning community.

Elmore, R. (2008). *Improving the instructional core*. Harvard University, School of Education.

This paper introduces the idea of the Instructional Core. It argues that anything that cannot point directly to how it improves student learning probably does not. Elmore presents seven principles for effective work with teachers.

Gallagher, A. (2016). *Professional development to support instructional improvement: Lessons from research* (working paper). SRI International.

This paper first acknowledges the issue of nonstrategic use of professional development resources and then moves on to highlight what research tells us about how professional development could be better designed to achieve desired impacts on instruction and student learning. The paper reports "the review suggests that no particular approach to professional development is a silver bullet. Instead, those designing or selecting professional development need to both help teachers envision what it would look like to teach differently and provide them with supports to help teachers bring those practices into the classroom. Professional

development that offers new knowledge and skills combined with program materials that help teachers transfer new ideas into their instruction can be a potent combination for instructional improvement."

Garrett, R., Citkowicz, M., & Williams, R. (2019). How responsive is a teacher's classroom practice to intervention? A meta-analysis of randomized field studies. *Review of Research in Education*, *43*(1), 106-137.

This new meta-study seeks to answer the following three questions. First, how does a teacher's classroom practice respond to intervention? It does, but there is so much heterogeneity of benefit that it is difficult to attribute positive effects directly to causes (no "magic bullets" identified). Second, are specific aspects of classroom practice more or less responsive? Academic content-focused coaching and interventions had better (more statistically significant) results than general classroom coaching (management or affective interventions). Lastly, are particular intervention features (e.g., coaching, video and technology components, intervention length) associated with improvements in classroom practice? Coaching, particularly a mix of in-person and remote, was effective as was teachers having active agency and enough time to absorb and then engage in deliberate practice of the new learning. Teachers having access to various sorts of student data as part of their professional learning was also associated with improvements in classroom practice.

Gay, G. (2002). Preparing for culturally responsive teaching. *Journal of Teacher Education*, *53*(2), 106-116.

This article is a summary of Gay's book: *Culturally Responsive Teaching: Theory, Research, and Practice* (2000). It argues that teachers need to learn, along with content pedagogy and knowledge, these aspects of cultural responsiveness to be effective with students who come from cultures other than the teacher's own: explicit knowledge about cultural diversity, capacity to alter curricula when greater cultural responsiveness is needed, and demonstrating cultural caring (and caring in general). Another aspect of culturally responsive teaching is cross-cultural communication, designed to ensure everyone is feeling heard and understands what is being communicated. The final aspect of culturally responsive teaching is what Gay terms "cultural congruence," that is, bridging between cultures represented by the students and their families and that of the teacher in such a way that it maximized academic involvement (and success) of the students.

Gersten, R., Dimino, J., Jayanthi, M., Kim, J. S., & Santoro, L. E. (2010). Teacher study group: Impact of the professional development model on reading instruction and student outcomes in first grade classrooms. *American Educational Research Journal*, *47*(3), 694-739.

This research study was conducted in three large urban school districts from three states to examine the impact of a professional development model (Teacher Study Group) "on first grade teachers' reading comprehension and vocabulary instruction, their knowledge of these areas, and the comprehension and vocabulary achievement of their students." The Teacher Study Group modeled a PLC structure where the teachers learned together from the researchers about reading science, but then decided together how they were going to change what they were doing in their classroom as a result. Through classroom observations of teaching practice, significant improvements were seen, and TSG teachers outperformed control teachers on the teacher knowledge measure of vocabulary instruction. This was one of the studies that informed the Mary Kennedy (2016) review of studies as it had the most robust results.

Gulamhussein, A. (2013). *Teaching the teachers: Effective professional development in an era of high stakes accountability*. Center for Public Education.

This paper puts forth a research-based answer to how districts can structure professional development so that teachers change their teaching practices, leading to improved student learning outcomes. First, the paper addresses the complexities of developing an effective professional development program and suggests starting with an assessment of the strengths and weaknesses of current practice in light of new [CCSS] reform demands. Then there is a review of the research about the structure of professional development that truly changes teachers' work and the learning of students. Lastly, the paper touches on what funding effective professional development might look like in a district.

Guskey, T. R., & Yoon, K. S. (2009). What works in professional learning. *Phi Delta Kappan*, *90*(7), 495-500.

This is a popularized summary of the Yoon et al (2007) meta-study done as part of American Institutes for Research. This reports the high-level findings from Yoon's analysis of over 1,300 studies that potentially address the effect of professional development on student learning outcomes. This research synthesis confirms the difficulty of translating professional development into student achievement gains despite the intuitive and logical connection. Those responsible for planning and implementing professional development must learn how to critically assess and evaluate the effectiveness of what they do. This synthesis set the stage for Guskey's stages for evaluation of PD.

Hammond, Z. (2015). *Culturally responsive teaching and the brain: Promoting authentic engagement and rigor among culturally and linguistically diverse students*. Corwin, a SAGE company.

This book ties together culturally responsive classroom practice, particularly the work of bridging academic content to what is known and currently understood by students from various cultures potentially different from that of the teacher with what is known about cognitive science and brain development. Hammond argues for high-quality content and for teachers to be helped in developing skills to connect to and encourage student learning via settled brain research.

Jensen, B., Sonnemann, J., Roberts-Hull, K., & Hunter, A. (2016). *Beyond PD: Teacher professional learning in high-performing systems*. National Center on Education and the Economy.

This report analyzes the way four high-performing systems provide professional learning to their teachers. Shanghai, British Columbia, Singapore, and Hong Kong each score near the top of all jurisdictions tested in mathematics, reading, and science on the Programme for International Student Assessment (PISA). While these systems are quite different, the key to all of them is that collaborative professional learning (teachers working with other teachers to improve curriculum, instruction, school climate, etc.) is built into the daily lives of teachers and school leaders. Accordingly, "for all of these people, professional learning is central to their jobs. It is not an add-on. It is not something done on Friday afternoons or on a few days at the end of the school year. Teacher professional learning is how they all improve student learning; it is how they improve schools; and it is how they are evaluated in their jobs. They work in systems that are organized around improvement strategies explicitly anchored in teacher professional learning."

Kozleski, E. (2010). *Culturally responsive teaching matters!* Equity Alliance at ASU.

This report defines and identifies several key features of culturally responsive teaching. The author elaborates on the importance of culturally responsive teaching in classrooms and for students: "In 2000, Geneva Gay wrote that culturally responsive teaching connects students' cultural knowledge, prior experiences, and performance styles to academic knowledge and intellectual tools in ways that legitimize what students already know. By embracing the sociocultural realities and histories of students through what is taught and how, culturally

responsive teachers negotiate classrooms cultures with their students that reflect the communities where students develop and grow. This is no small matter because it requires that teachers transcend their own cultural biases and preferences to establish and develop patterns for learning and communicating that engage and sustain student participation and achievement."

Ladson-Billings, G. (1995). Toward a theory of culturally relevant pedagogy. *American Educational Research Journal*, *32*(3), 465-491.

This article is an overview of culturally relevant pedagogy. It traces the earlier work and outlines the seminal research of Ladson-Billings. The research consisted of observing, interviewing, videoing, and interacting together with a group of eight carefully selected teachers who were peer-, parent-, and screening instrument-identified as being effective teachers of African American students. The teachers themselves were part of the action-reflection process that informed the research. From this work, Ladson-Billings extracted core principles that gather together under the umbrella of culturally relevant pedagogy. The teachers in the study all exhibited: caring, personal accountability for student outcomes and the culture of their classrooms, consistently high expectations for each student, willingness to meet students where they were and move them further, and cultural competence/self-awareness.

Leana, C. (2011). The missing link in school reform. *Stanford Social Innovation Review, 9*(4), 30-35.

This study followed more than 1,000 fourth- and fifth-grade teachers in a representative sample of 130 elementary schools across the city between 2005 and 2007. Researchers examined one-year changes in student achievement scores in mathematics. The most striking finding was that "students showed higher gains in math achievement when their teachers reported frequent conversations with their peers that centered on math, and when there was a feeling of trust or closeness among teachers." Thus, "in trying to improve American public schools, educators, policymakers, and philanthropists are overselling the role of the highly skilled individual teacher and undervaluing the benefits that come from teacher collaborations that strengthen skills, competence, and a school's overall social capital."

Lynch, K., Hill, H. C., Gonzalez, K. E., & Pollard, C. (2019). Strengthening STEM instruction in schools: Learning from research. *Policy Insights From the Behavioral and Brain Sciences*, *6*(2), 236–242.

This meta-analysis focuses on 95 studies (published post-1989) focused on classroom-level STEM instructional improvement through professional development, curriculum materials, or both. Findings include that programs including both professional development and curriculum materials are more effective than those that include one or the other. In addition, student outcomes were significantly larger among programs that focused on use of curriculum materials, improving teachers' content and pedagogical content knowledge, and/or how students learn the content. Student outcomes were also larger where there was same-school collaboration, summer workshop time, and ongoing implementation meetings.

Moldoveanu, M., & Narayandas, D. (2016). *The skills gap and the near-far problem in executive education and leadership development* (Working paper #17-019). Harvard Business School.

This paper draws a sharp distinction between procedural ("algorithmic") skills attainment that can be taught in remote, or scalable ways, and the "non-algorithmic" skills (e.g., "creating a welcoming, open communication environment," "conceptualizing a predicament that is acceptable to multiple parties initially at odds," and "credibly and publicly taking responsibility for an error") that need to be learned through on-the-job coaching, co-creating understanding with colleagues, and sustained opportunities to develop such skills.

Peske, H., & Haycock, K. (2006). *Teaching inequality: How poor and minority students are shortchanged on teacher quality*. Education Trust.

This report discusses the impact of teacher quality on student achievement. Based on research, "when it comes to the distribution of the best teachers, poor and minority students do not get their fair share." Therefore, "three states—Ohio, Illinois and Wisconsin—and their three biggest school systems—Cleveland, Chicago and Milwaukee—set out with the Education to tackle this problem. As a result, teams of stakeholders in each jurisdiction were able to collect data on teacher distribution and identify patterns. The teams "found large differences between the qualifications of teachers in the highest-poverty and highest-minority schools and teachers serving in schools with few minority and low-income students. The teams then analyzed the information to determine possible reasons for the patterns, and came up with strategies to achieve a fairer distribution."

Rhoton, J., & Wojnowski, B. (2006). Building ongoing and sustained professional development. In J. Rhotan & P. Shane (Eds.), *Teaching Science in the 21st Century* (pp.113-125). NSTA Press.

This chapter provides essential research that underlays the NSTA science educator principles for effective professional development. Effective professional development must focus on student learning and educator needs, engage and challenge science educators, be sustainable over time, be an interactive activity, be content-specific and collaborative, and integrated with other school initiatives.

Ronfeldt, M., Farmer, S. O., McQueen, K., & Grissom, J. A. (2015). Teacher collaboration in instructional teams and student achievement. *American Educational Research Journal*, *52*(3), 475-514.

This article is based on both a review of the literature and on teacher survey and district performance data from over 9,000 teachers in one large urban district (Miami-Dade). Researchers found that three factors in teacher professional learning collaborations lent themselves to better student outcomes. From prior research, a focus on student work and performance, and a focus on instruction and course content leads to better student outcomes. From their surveys of self-reported satisfaction with the quality and content of collaborative professional learning, they determined the quality of the collaboration matters for student outcomes and teacher improvement as well. Though there are still myriad factors that affect the success of students in schools and teacher effectiveness, these elements should not be dismissed as critical components that can lead to better outcomes in schools.

Russell, S. J., Schifter, D., & Bastable, V. (1999). Teaching to the big ideas. In M. Solomon (Ed.), *The Diagnostic Teacher* (pp. 30-33). Teachers College Press.

This chapter highlights three of the principles developed during TERCs summer training program. The following are frequently recognized universals apropos to high-quality professional learning: regular school-year follow-up support is an indispensable catalyst of the change process for teachers; teacher training should be tied to instructional materials and curriculum; and schoolwide collaboration is essential to reform.

Sachs, S. (2004). Evaluation of teacher attributes as predictors of success in urban schools. *Journal of Teacher Education*, *55*(2), 177-187.

This two-part research study attempted to refine some of the instruments that purport to predict essential attributes for urban teacher success with students (identified by Gay, Haberman, Ladson-Billings, and others) and apply it to two groups of teachers with five or more years of experience: successful teachers (carefully defined by their success criteria) and unsuccessful teachers (also defined). The desired result was to develop a reliable instrument

that could predict what characteristics would promote teacher success with urban students. Both groups of teachers did equally well on the survey tool. The implications are that urban teachers are equally aware of the attributes of effective teachers, but widely divergent in applying those attributes in practice. The finding points to the need to develop concrete, clear professional learning experiences so teachers can develop and be supported in implementing the practices that would make them successful with urban students.

Santagata, R., Stigler, J. W., Kersting, N., & Givvin, K. B. (2011). Problem implementation as a lever for change: An experimental study of the effects of a professional development program on students' mathematics learning. *Journal of Research on Educational Effectiveness*, *4*(1), 1-24.

This study investigated whether a professional development (PD) program focused on helping teachers better implement "making connection" math problems led to increased teacher content and pedagogical content knowledge as well as increased student learning. Teachers from one of the largest school districts were randomly assigned to the PD program or the control condition (the district's standard PD offerings). A total of 59 sixth-grade teachers, who collectively taught about 3900 students, participated. The experimental PD program focused on teacher learning in three phases: content exploration, lesson analysis, and link to practice. Fidelity of implementation of the PD program was good as sessions were highly attended and participants viewed the program as an important aspect of their professional lives. The PD program did not lead to significantly greater increases in teachers' knowledge or in better maintaining the cognitive demands of math problems. There was a significant effect on student learning as students of treatment teachers scored significantly higher on a quarterly assessment (multiple-choice problems) administered by the school district.

Saunders, W., Goldenberg, C., & Gallimore, R. (2009). Increasing achievement by focusing grade-level teams on improving classroom learning: A prospective, quasi-experimental study of Title I schools. *American Educational Research Journal*, *46*(4), 1006-1033.

This five-year study was a rigorous experimental design to investigate the effects of grade-level teams working collaboratively to improve student learning. The study thoroughly trained school leaders and coaches/instructional leads to run PLCs for their teaching staff. Topics and foci were driven by the school teams. Grade-level meetings were focused on student achievement and pre- and post-tests (Stanford 9) were the measurement of student progress. For two years, teams worked with school leadership only (no results against controls from those years). For the final three years, teams worked with instructional leads and lead teachers (results against controls were phenomenal). Teacher agency was credited with some of the results, since they were gaining skills and knowledge they valued and asked for. The findings conclude that "stable school-based settings, distributed leadership, and explicit protocols are key to effective teacher teams."

Schoenfeld, A. (2014). What makes for powerful classrooms, and how can we support teachers in creating them? A story of research and practice, productively intertwined. *Educational Researcher*, *43*(8), 404-412.

This article is an overview of twenty years of research and application. There are two assumptions Schoenfeld has tested: 1) research and practice live in productive synergy and each can inform the other and 2) research and findings from one discipline, if carefully crafted and controlled, can yield insights more broadly into other fields. Schoenfeld's primary findings are that people's moment-by-moment decision making in teaching math, but extending to *all* knowledge- rich domains, can be modeled as a function of their resources, orientations, and goals. So investments need to be made in demonstrating to teachers how to build classrooms that include the following five dimensions: 1) focused and coherent mathematics, 2) cognitive demand, 3) access to mathematical content, 4) agency, authority, and identity, and 5) uses of assessment.

Stigler, J., & Hiebert, J. *The teaching gap: Best ideas from the world's teachers for improving education in the classroom*. Free Press.

This book primarily explores the best professional learning practices from among the highest performing countries (determined largely by persistent top PISA rankings). Teaching is identified as a cultural and collaborative activity that is learned through informal participation over long periods of time. There is also a focus on student work and student learning as exemplified in the Japanese Study Model (which this book brought to popular awareness). The lesson study model is based on a collaborative, long-term, continuous improvement model that maintains a constant focus on student learning and on the direct improvement in teaching in context. The summary recommendations include to expect continual, gradual, and incremental improvement, maintain a constant focus on student learning goals, focus on teaching, not teachers, make improvements in context of the teaching and in the work of teachers, and build a system that can learn from its own experience.

Timperley, H., Wilson, A., Barrar, H., & Fung, I. (2007). *Teacher professional learning and development.* Ministry of Education, New Zealand.

This international study parallels the work of Culturally Responsive Classroom research in the US. This synthesis was developed to "consolidate the international and New Zealand evidence around the emerging knowledge base about how to promote teacher learning in ways that impact outcomes for the diversity of students in our classrooms." The synthesis identified a number of conditions and principles associated with professional learning that impacted substantively on student outcomes. In summary, such learning required teachers to engage with new knowledge that involved theoretical understandings— typically pedagogical content and assessment knowledge—and the implications of these for practice. The focus of this new knowledge was on the links between teaching and its impact on student learning. The professional learning environment provided teachers with extended opportunities to learn through a variety of activities and assisted them to integrate new learning into alternative forms of practice.

Truesdale, W. T. (2003). The implementation of peer coaching on the transferability of staff development to classroom practice in two selected Chicago public elementary schools. *Dissertation Abstracts International, 64*(11). University Microfilms No. 3112185.

This study examined the implementation of peer coaching as compared to no coaching (standard presentation only) on the transferability of staff development in grades one through eight. Quantitative and qualitative data were collected at the beginning and end of the study. The quantitative data were collected by classroom observation of three areas of staff development tallies: low profile interventions, cooperative learning, and higher order thinking. The peer coaching and standard presentation participants reported in journals their responses to three questions probes. The three probes focused on the strategies, attitude, evaluation, and application of low-profile interventions, cooperative learning, and higher order thinking to classroom practice. A qualitative analysis was made by the study director to gather data on variables that could not be included in the statistical treatment.

Ukpokodu, O. (2011). How do I teach mathematics in a culturally responsive way? *Multicultural Education*, *19*(3), 47-56.

This research article asks two questions: why are teachers not teaching subject-specific courses in culturally appropriate ways, and what are those ways in mathematics, specifically? Teachers had several beliefs regarding the first question: 1) mathematics is culture-neutral, 2) convenience and reliance on textbooks guided teacher moves, 3) curricula are standardized around the topics assessed on high stakes tests, and 4) lack of models for what it might look

like. For the second action research question, these themes emerged from the data: 1) deconstruct misguided beliefs about mathematics teaching and learning, 2) integrate culturally relevant content and social and justice issues, 3) utilize culturally responsive instructional strategies, 4) foster communal learning, 5) openness to students' divergent thinking and problem-solving, 6) detrack the mathematics classroom, and 7) teacher's critical consciousness, advocacy, and activism.

Villegas, A. M., & Lucas, T. (2002). Preparing culturally responsive teachers: Rethinking the curriculum. *Journal of Teacher Education*, *53*(1), 20-32.

This article, though geared to teacher educators, formulates what skills and attitudes teachers need to be successful in teaching a wide array of students from varied backgrounds. Villejas and Lucas outline their core components, which resonate with in-service professional learning priorities as well. Culturally responsive teachers are: "socio-culturally conscious, have affirming views of students from diverse backgrounds, see themselves as responsible for and capable of bringing about change to make schools more equitable, understand how learners construct knowledge and are capable of promoting knowledge construction, know about the lives of their students, and design instruction that builds on what their students already know while stretching them beyond the familiar."

Weiland, C., McCormick, M., Mattera, S., Maier, M., & Morris, P. (2018). Preschool curricula and professional development features for getting to high-quality implementation at scale: A comparative review across five trials. *AERA Open*, *4*(1), 1-16.

This article is a review of preschool curriculum and professional development implementation studies. Weiland and the team (all co-authors of the re-examined research for this study) combed through five pre-school curriculum and professional development implementation studies looking for common or critically important trends. Five common features were found most salient for where programs met with success: 1) specific instructional content, 2) inclusion of highly detailed teacher scripts, 3) incorporation of teacher voice, 4) time for planning, and 5) use of real-time data.

Willis, S. (2002). Creating a knowledge base for teaching: A conversation with James Stigler. *ASCD Educational Leadership*, *59*(6), 6-11.

This article presents the ideas of James Stigler, coauthor of *The Teaching Gap*, on ways to improve professional development for educators. Stigler believes professional development should be "directly related to teachers' practice, site-based, long-term, and based on the specific curriculum used at the site." Stigler describes the lesson study approach as an example in which "teachers plan instruction, observe what happens when it's implemented, analyze what went wrong, come up with ideas for improving it, and try doing it again in their classrooms." Stigler's approach to improve teaching includes establishing "standard effective methods" and getting more teachers to implement them. There should be a shift from recruiting and retaining the best teachers to "improving the methods of teaching." The challenge in improving professional development is therefore "creating a knowledge base" so teachers can share their knowledge on effective instructional methods.

Yoon, K. S., Duncan, T., Lee, S. W-Y., Scarloss, B., & Shapley, K. L. (2007). *Reviewing the evidence on how teacher professional development affects student achievement* (REL 2007–No. 033). Regional Educational Laboratory Southwest.

This report is a systematic review of the research-based evidence on the effects of professional development (PD) on growth in student achievement in three core academic subjects (reading/ELA, mathematics, and science). The primary goal of this study was to address the question: what is the impact of teacher participation in professional development on student

achievement? Nine studies emerged as meeting WWC evidence standards, from more than 1,300 screened. Although the number of studies that met evidence standards was small, the average overall effect size of 0.54 was robust and fairly consistent across the nine studies, which the reviewers attributed to the finding that across all forms and content of PD, providing training to elementary school teachers does have a moderate effect on their students' achievement. Further, because the average number of PD contact hours averaged almost 49 hours across the nine studies, Yoon's team concluded that total contact hours must be substantial to get such a robust effect size. Since the studies varied in so many factors, the team was unable to make any conclusions about the effectiveness of PD by form, content, or intensity.

All annotations are adapted or quoted from sources and abstracts