Professional Development and Teacher Education

Learning is the acquisition of knowledge or skills through experience, study, or by being taught. In the K-12 landscape, the focus of learning involves the development of skills related to reasoning, critical thinking, problem solving, communication, and creativity as well as understanding the big ideas related to cultures, economic and political systems, the sciences, and problems of the 21st century. This focus is embedded into rigorous academic standards adopted by states and international communities. So, how does this learning happen and what kind of teaching can support this learning? For educators, and the community at large, the answer to these two questions can feel elusive. Understanding that quality teaching is significant to student achievement, teacher professional development (PD) is a critical lever for developing effective teachers. Unfortunately, most teacher PD has not lived up to its intent but things are starting to change.

New discoveries in the science of learning and development (SoLD), along with advances in education technologies and tools, present opportunities for innovating teacher PD. Emerging models of teacher education that center on teacher agency and competency-based approaches, rather than primarily knowledge acquisition, also hold promise, as do developments in teacher practice spaces.

While the COVID-19 pandemic has further challenged the K-12 education community, shining a light on longstanding inequalities in access, resources, and funding, as Prof. Fernando M. Reimers noted in his keynote session at the J-WEL Connections event in April 2021, it has also created an opportunity for innovation. To help teachers and students adapt to these shifting learning contexts and the challenges of the 21st century, researchers and others working in education have identified key areas in teacher education and professional development for transformative possibility:

- Designing playful, project-based, and student-driven learning experiences
- Integrating the science of learning and development (SoLD) into teacher education programs
- Refocusing teacher education curriculum away from knowledge acquisition
- Prioritizing equity in pre-service and in-service training
- Creating more teacher practice spaces and opportunities
- Increasing access to high-quality continuing teacher education and professional development, including through online programs
- Establishing a culture of teacher agency
Figure 1: Graphic record from Prof. Fernando M. Reimers’ keynote session at the J-WEL Connections event in April 2021

MIT Efforts

MIT approaches teacher education through hands-on workshops and faculty mentoring, as well as education in the latest digital learning technologies. Online programs like MITx on edX, OpenCourseWare, Scratch, App Inventor, StarLogo, iLabs, and Curious Learning provide teachers with vast repositories of curriculum and tools. In-person programs like the Science and Engineering Program for Teachers (SEPT), which has worked with over 1,200 teachers from around the world since 1989, and the Edgerton K-12 Program introduce educators to the latest technologies and science education out of MIT.

Scheller Teacher Education Program

The MIT Scheller Teacher Education Program (STEP) uses new educational technologies and design-based research to study and develop solutions to pervasive educational challenges. STEP designs and creates playful, innovative learning experiences to help children build math and science skills; implements and scales these experiences to the classroom; and works with organizations to teach these design and development skills and to build teacher capacity. Currently, the STEP offers several courses, including Educational Theory and Practice, to MIT undergraduate and graduate students interested in teaching and learning careers, as well as courses on edX for interested educators. In addition, The Scheller Teacher Education Program includes a pathway of classes and student-teaching practicum that leads to Massachusetts State Certification in a middle or high school science or mathematics discipline.
STEP also provides several professional development opportunities focused on project-based learning. The Science and Engineering Program for Teachers (SEPT), an annual week-long program that brings educators from around the world to the MIT campus to learn about the latest research and approaches in teaching and learning. While the most recent program could not take place on campus because of the pandemic, the 2020 cohort was able to join a 3-day virtual professional development event, where they attended lectures by MIT researchers, participated in workshops, and shared ideas with other passionate educators.

In partnership with the XQ Institute, an organization dedicated to rethinking the high school experience, MIT STEP provides coaching and design support for interdisciplinary project-based learning (PBL) to teachers from XQ schools. Selected teachers spend a week at MIT during the summer learning about interdisciplinary PBL by designing a project alongside MIT staff and researchers, while also participating in sessions and demonstration lessons that help teachers to explore and practice a variety of inquiry-based and culturally-relevant approaches that foster active and authentic student engagement. The project work aims to map the holistic academic and social skills most relevant for success in the contemporary global economy. In addition to in-person meetings, ongoing virtual coaching involves co-designing with teachers to personalize instruction for students.

**Teaching Systems Lab**
The MIT Teaching Systems Lab (TSL) grew out of a collaboration between MIT STEP, the Woodrow Wilson Academy of Teaching and Learning, and MIT Open Learning. TSL is changing the form of teacher professional development by offering and conducting research on building strong teacher communities through online and blended professional development like the massive online open courses offered by Prof. Justin Reich, Director of the MIT Teaching Systems Lab. These professional development events help teachers learn about and develop innovative, interdisciplinary projects for project-based learning that are student-led and student-driven. TSL also uses simulations and games to develop a new generation of practice spaces that allow teachers to rehearse for and reflect upon important decisions in teaching.

**Teacher Education**

**Integrating the Science of Learning and Development**
Current teaching and assessment approaches still rely on the traditional instructionist model which positions students as passive recipients and teachers as transmitters of facts and procedures. Recent findings from the science of learning and development (SoLD) challenge the assumptions underlying these longstanding pedagogical approaches. Specifically, “this growing body of research makes clear that children’s learning and development are shaped by interactions among environmental factors, relationships, and learning opportunities, along with internal cognitive, psychological, physical, social, and emotional processes” (Moore et al., 2020, p. 3). However, a number of factors shape school policies, making it difficult to close the gap.
between SoLD and current teaching and assessment practices. Intervening at the level of teacher education may be a faster and more viable way to bring about these changes. In other words, while education is slow to change at the institution level, change can happen more quickly at the classroom level. Integrating SoLD into teacher education allows a new generation of teachers to ground their classroom practices in the latest research on children’s learning and development (Moore et al., 2020).

A collaborative report from the MIT Playful Journey Lab and the High Meadows Graduate School of Teaching and Learning notes what is missing or lacking from most preservice teacher preparation programs:

- inadequate coursework on social-emotional learning (SEL), which researchers and educators agree is crucial to children’s development;
- little to no discussion of cognitive development, which makes it difficult for teachers to recognize inconsistencies between current pedagogies and the research;
- critical awareness of the systemic nature of racism and other forms of oppression and the role that education plays in inequity.

The researchers provide a case study of the integration of SoLD into a teacher education program at the Woodrow Wilson Graduate School of Teaching and Learning (WWGSTL). Based on the case study, Moore et al. (2020) conclude that successful integration depends on:

- the full support of the administration, faculty, and staff, as well as dedicated resources of time, money, and personnel
- the involvement of personnel with expertise in SoLD, teacher education, and instructional design
- aligning priorities within the field of research on learning and development with the teacher education program’s perspective on teaching, learning, and schooling
- developing or adapting a framework to organize SoLD concepts
- developing a detailed proposal for integrating SoLD into the curriculum, with feedback from faculty incorporated
- developing and compiling resources on the research and their implications for practice, which can be used for designing or revising a course
- providing teacher candidates multiple opportunities to consolidate their understanding of SoLD concepts, including developing an assessment approach that focuses on teacher candidates’ understanding, use of research-based strategies, and ability to evaluate SoLD-based strategies
- collaborating with clinical faculty on a coordinated approach to integrating SoLD into teacher candidates’ fieldwork

A Competency-Based Model of Teacher Education

The High Meadows Graduate School of Teaching and Learning (HMGSTL) is a new competency-based teacher education program, developed in collaboration with MIT. Based on real-world scenarios, practice, and a skills and knowledge-based approach to learning, HM’s master’s degree program teaches a core group of competencies that teachers need to succeed
in the classroom: skills, knowledge, and dispositions. Project-based coursework—called challenges—and classroom practice are used to measure teacher candidates’ level of mastery in these competencies.

In a webinar, “Reimagining Teacher Preparation at the High Meadows Graduate School: A Competency-Based Model,” for J-WEL’s Teacher Education and Professional Development Webinar Series, HMGSTL administrators and faculty mentors introduce the school’s structure, including its competencies, such as ‘Teaching for Justice’; its distinctive challenge-based curriculum; its approach to assessment; and its approach to design and iteration.

Building Equity into Teacher Education & Professional Development
Over the past two decades, education reform efforts have focused on closing achievement gaps. However, in failing to address the structural causes of inequity in education, many of these efforts have been unsuccessful. While racial and ethnic achievement gaps have been gradually declining, progress has been unsteady, with some gaps growing and others unchanged.1 With the COVID-19 pandemic spotlighting inequity in education, among other sectors, the need to prioritize equity in tackling educational challenges is more pressing than ever. Educational equity means understanding that structural barriers place students at different starting points. For teachers, then, prioritizing equity means providing students with individualized resources.

Many teacher education and professional development programs have begun identifying and teaching strategies for creating equitable classrooms, including:2
- asking teachers to reflect on their own biases
- reducing barriers to learning, for instance, by diversifying the curriculum and holding all students to high expectations
- establishing an inclusive learning environment early on
- accommodating different learning styles and disabilities

Nonprofit organizations like the School Reform Initiative (SRI) aim to create intentional learning communities that help teachers recognize and challenge their fundamental assumptions about teaching, learning, students, and the purpose of schools. The SRI’s mission is to create new educational practices that are built on more robust, equitable assumptions. Key efforts in carrying out this mission include:
- developing tools, like dialogue-based protocols, that spark important conversations among educators
- providing and modeling skilled facilitation and coaching
- supporting continued teacher education and professional development

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1 https://cepa.stanford.edu/educational-opportunity-monitoring-project/achievement-gaps/race/
2 https://rossier.usc.edu/seven-effective-ways-to-promote-equity-in-the-classroom/
While many inequalities in education existed before COVID-19, the switch to remote learning and the economic losses caused by the pandemic have worsened and, in some cases, created new inequalities. At the recent MIT School Access and Quality Summit, “Covid-19 Challenges and Opportunities in K-12 Education,” education leaders and researchers discussed how the pandemic will shape school policies moving forward; the effects of the pandemic on learning outcomes; and the economic impact of learning losses.

For example, in a presentation on “The Economic and Learning Impacts of Covid-19,” John Friedman, Professor of Economics and International and Political Affairs at Brown University, and Shalinee Sharma, CEO and Co-founder of Zearn, examined data to determine how the pandemic has disrupted learning—in particular, whether it has exacerbated existing inequalities in education—and what schools were able to maintain learning for disadvantaged students. They found that remote learning negatively affected educational engagement, with students from disadvantaged backgrounds experiencing more significant learning losses. However, the data also revealed a number of schools with an economically disadvantaged student population that outperformed more affluent schools during the pandemic. Based on their findings, Friedman and Sharma suggested that educators create extended time for students who lost learning and utilize acceleration strategies, rather than over-remediation strategies, in instruction that makes up for lost learning. They also suggested further study of schools with students from disadvantaged backgrounds that maintained learning outcomes.

Professional Development

Online Professional Development

While some in-person aspects of teacher professional development, like events and conferences, cannot be fully transferred to the digital space, administrators from Davidson Academy note that there are many benefits to designing professional development to be online:

- the flexibility and personalization of online learning environments allows for collaborative and teacher-led opportunities
- teachers can take an active role in professional development
- teachers can be grouped based on experience and interests
- the content can be tailored to teachers’ different pedagogical skills, rather than following a scripted curriculum
- smaller and more focused opportunities allow for more hands-on approaches
- professional development can be spaced throughout the school year, situating them alongside teachers’ classroom practices
- online professional development aims to meet teachers where they are, giving them the tools to be their best version

At Davidson Academy, which began as a campus in Reno, NV for gifted middle and high school students and has since developed an online campus to serve more students, the benefits of online professional development shape how course reviews, observations, and workshops take
place. Instead of trying to recreate in-person experiences online, the approach is to create a new experience with the online space as its foundation.

Before the semester begins, a larger intensive course review takes place, where teachers share and receive specific, personalized feedback on their course designs. These pre-semester reviews aim at making the courses 100% ready for students well in advance of the semester start date. According to Davidson Academy’s Director of Online Learning Dr. Stacy Hawthorne and Online Curriculum Coordinator and Humanities Instructor Dr. Jessica Potts, online course reviews benefit not only the teachers, but also the students and support staff.

During the semester, administrators provide two class observations, with new teachers able to request more. To make the process unobtrusive and teacher-led administrators conduct observations via Zoom recordings, rather than joining a live class. From seven competencies, teachers select the ones they would like the administrator to observe, typically including a strength competency and a competency they would like to improve. Benefits of these online observations include immediate feedback and giving teachers agency in the process. By approaching observations as a coaching tool, rather than an evaluative process, Davidson Academy reports outcomes of noticeable improvements on teacher pedagogy.

Along with scheduled course reviews and observations, Davidson Academy’s approach provides teachers with continuous coaching, embedding professional development into all activities throughout the year. Continuous coaching can take the form of:

- mini-workshops
- formative feedback
- trainings based on student surveys
- the use of Microsoft Teams for daily collaboration
- a research channel on Teams to support asynchronous communication
- anonymized shout-outs from parents and families posted to a Teams channel

These online professional development practices encourage creativity among teachers and provide the flexibility to innovate, while also fostering a collaborative and supportive environment. Davidson Academy teachers share that professional development in these contexts feels authentic and personalized, designed to help them find their own voice to use to engage students.

**Practice Spaces**

Despite the growth in online professional development programs, opportunities for teachers to practice pedagogical strategies or build teaching skills in low-stakes settings remain limited. Teacher education programs tend to emphasize coursework, while fieldwork immerses teachers in the challenges of teaching when they are still developing their practice. Once teachers enter the classroom, the stakes become much higher, leaving little room for trial and error. Recognizing the need for more teacher practice spaces, the MIT Teaching Systems Lab (TSL) develops learning environments, inspired by games and simulations, to help novice teachers
rehearse and reflect on their teaching decisions. The TSL’s learning environments provide more targeted opportunities for teachers and teacher candidates to practice specific dimensions of teaching and to identify aspects that can be improved at both the classroom and institutional levels.

**TSL practice spaces** and materials include:

- **Swipe Right**, a game initially developed for use in quarterly teaching workshops that allows teachers to practice connecting student strengths and interests to computer science. It includes discussion points for small groups and links to online discussion forums. The game also aims to help teachers in detecting bias.
- **Surfacing and Addressing Unconscious Bias**, which helps teachers to identify where bias may unintentionally affect their students, to develop their skills in addressing bias, and ultimately, to create more equitable classrooms.
- **Eliciting Learner Knowledge (ELK)**, a role-playing game to help teacher candidates practice understanding student preconceptions and questioning strategies.
- **Motivation Station**, an in-person card game that creates scenarios for novice and experienced teachers to practice applying cognitive science principles to motivating students.
- **Committee of N**, a card game that helps pre-service teachers to investigate and discuss the history of schooling in America. The game allows teachers to step back and reflect on professional learning, while also building collaboration, planning, and communication skills.
- **BalderMath**, a game where teachers practice student perspective taking and diagnosing student misunderstanding of math concepts. It can be played in person or online.
- **Metarubrics**, which teach players how to create fun rubrics for use in assessment.
- **Discussion Leader**, an interactive web-based simulation, where teachers can practice strategies for engaging students in productive conversations about difficult topics.
- **Teacher Moments**, interactive media case studies that present novice teachers with short classroom scenarios and gives them spaces to practice their responses to students in the moment.

**Continuing Teacher Education and Development**

For K-12 teachers, continuing education and professional development is necessary for not only improving practice and deepening knowledge, but more practically, for career advancement. Most states also require professional development points (PDP) for recertification in the primary licensing area and for additional licenses. However, existing educational pathways can be costly in terms of both time and finances. The required effort and workload can make teachers feel overwhelmed and even powerless. In response to the lack of teacher agency in teacher education and development (TED), the [National Teachers College (NTC) in the Philippines](https://www.doe.mass.edu/licensure/advance-extend-renew-license.html) has developed a framework for making the experience of pre-service and in-service teacher training “fun and frustration-free,” even for under-resourced teachers.

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3 https://www.doe.mass.edu/licensure/advance-extend-renew-license.html
Since the Universal Access to Quality Tertiary Education Act was signed into law in 2017, providing government subsidies for higher education tuition and fees, teaching has become the second-most enrolled degree program in the Philippines. With the country’s Department of Education mandating annual professional development tracks and the daily challenges of teaching (which pandemic-related school closures increased), teachers find themselves overburdened and unable to pursue quality professional development or training related to their interests. The NTC’s outcome-based education (OBE) framework aims to enhance the quality of TED, while also giving teachers a choice in how they use the skills and knowledge they learn.

- The first goal of the framework is to ensure that pre-service teachers gain enough experience and skills through internships or on-the-job training to be on the same level as beginning in-service teachers. To achieve this goal, the NTC has increased assessment of pre-service training and developed a project-based curriculum that prioritizes skill development and critical thinking, rather than knowledge acquisition.
- A second objective of the OBE framework is to partner with industry—education and others—to define outcomes for graduates. From there, programs consider how to create experiences that generate these outcomes. For teacher education and professional development, the curriculum has been redesigned to connect with what teachers are doing or will do in the classroom.

The NTC accepts students on an open-admissions basis, but is selective in its retention. The OBE framework has created a much shorter learning track for teachers (18-24 months, compared with the 5-7 years previously required). For their capstone project, teacher candidates can pursue a thesis or create an impact project, which explores solutions to a problem related to their school-based interests. The goal is to have projects directly translate to a real-world context. Other innovations include frequent feedback, consistent observations, coaching and mentoring, and “self-propelled learning”—in short, teacher candidates are encouraged to take ownership of their learning.

Conclusions/Recommendations

Many of the innovations in K-12 teacher education and development described in this report are context-specific—developed, implemented, and assessed at particular institutions. Others are relatively new, having emerged in response to the pandemic of the past year. Some remaining challenges include how to sustain and scale these innovations. However, the outcomes so far hold promise for the future of teacher education and professional development.

- Those for which there is supporting evidence—in the form of classroom-based research, external research studies, and the science of learning—are most likely to make an impact.
- More online opportunities will increase access to these efforts, as well as the pace at which teachers can begin integrating new practices into their classrooms.
• Research on professional development supports staggering learning throughout the school year and presenting them in smaller chunks with practice opportunities, rather than in the form of an all-day program, will help with engagement and retention.

• In all cases, creating a culture of teacher agency—in which all members of the education community see teachers as agents of change—is crucial to closing the gap between student needs and teacher capacity.

With continued support, research, and innovation, the lessons learned from the past year and recent developments can help shape the future of teacher education and PD. Giving educators the tools and resources to be their best selves is an investment not only in our teachers but in our children and their futures.