# THE TRADITIONAL SCHOOL MODEL DISCOURAGES EXPERIMENTATION

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## CONTEXT AND TRENDS

**A typical public school classroom** in the United States looks much the same in 2017 as it did in the mid-19th century: A teacher delivers instruction from the front of the classroom for most of the class as students sit quietly at their desks, tilting over textbooks and scribbling into notebooks. Originally designed in large part to meet the labor needs of the Industrial Revolution, this traditional school model adequately prepared the American youth to work in the factories of the industrializing economy (Robinson & Aronica, 2015, p. xxi; Rose, 2012). Citizens who could follow directives and memorize tasks were in high demand, and in the absence of readily accessible books and libraries on a large scale, teachers became both the definitive source of knowledge and the most efficient way to effectively equip citizens with the employable skills they needed to succeed (Wagner & Dintersmith, 2015, p. 191).

Fast-forward to the 21st century, however, and we live in a world that revolves much less around factories and traditional industry, and much more around technology and information computerization. We no longer need our teachers to foster a citizenry with similar aptitudes, able to follow directives and memorize facts. We need our teachers to produce independent thinkers and innovative trailblazers who can assess the validity and quality of those facts and then apply them to responsibly navigate through, design new opportunities within, and solve the complex challenges of our more globally and digitally connected world (Tanenbaum, 2016). The labor needs of today require students to develop deeper learning skills, such as critical thinking and problem-solving skills, effective communication skills, learning-how-to-learn skills, mastery of core academic content, and academic mindsets (American Institutes for Research, 2016).

To provide our students with these skills, it is crucial that they receive active science, technology, engineering, and math (STEM) education. Recent research has shown that active STEM education helps students become better problem-solvers, innovators, inventors, and logical thinkers. It also helps students to develop self-reliance, technological literacy, and an ability to relate their education to their own culture and history (Morrison, 2006).

According to Vince Bertram (2014), president and CEO of Project Lead the Way, STEM education fosters creativity, curiosity, and a passion for problem-solving, while also allowing students to "understand and appreciate the relevancy of their work to their own lives and the world around them." Furthermore, teaching strategies that support active learning have been shown to increase retention of knowledge, develop higher-order skills such as analysis, synthesis, and evaluation, and increase student retention in STEM fields (Handelsman & Brown, 2016).

Beyond the individual benefits afforded to our students, our nation's economic competitiveness depends on our students possessing these STEM skills. The recent increase of jobs in STEM-specific fields (accounted for about 4 percent of total U.S. employment in 2010; Soergel, 2015) and in jobs that "require significant STEM knowledge and skill in at least one field" (accounted for nearly 20 percent of all jobs, or 26 million jobs, in 2010; Soergel, 2015) is minor in comparison to the profound and growing demand for employees with deeper learning skills such as problem-solving, critical thinking, and creativity. According to a study conducted by IBM in 2008 that surveyed 1,500 organization leaders in 80 different countries, the two most important characteristics in an employee are "adaptability to change" and "creativity in generating ideas," characteristics that the study found were lacking in otherwise qualified candidates (Robinson & Aronica, 2015, p. 18) and that can be developed through effective STEM education.

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STEM teachers play a key role in ensuring that our students receive the strong STEM education they need and deserve. However, time, autonomy, and assessment constraints of the traditional school model hinder their ability to experiment with creative, nontraditional instructional strategies that could help students develop the full range of STEM skills and academic mindsets that research and data show are now needed for all students.

## 02 DISCUSSION

**Mastering the design and implementation of new teaching strategies** such as active STEM learning takes time and requires practice. Teachers must have the flexibility to learn and experiment with new and innovative practices before they can be expected to successfully implement them. However, the time reduced and the pressure induced by the demands for satisfactory student assessment scores can discourage districts and schools from encouraging teachers to experiment with new strategies.

According to a survey conducted by the National Education Association that collected and analyzed phone survey data from 1,500 PreK–12 teachers, 72 percent reported feeling "moderate" or "extreme" pressure from both school and district administrators to improve test scores (Walker, 2014). This pressure to perform on tests disincentives teachers from experimenting with new strategies that are not yet guaranteed to result in high scores.

Furthermore, the time spent taking tests and the time spent preparing for tests cuts down on time that could be spent experimenting with innovative teaching strategies. A recent study found that the average eighth grader in public school spends about 2.3 percent of total classroom time (or 4.22 school days) completing high-stakes testing (Hart et al., 2015). On top of that, the American Federation of Teachers estimated that students in high-stakes testing grades can spend from 60 to over 100 hours a year preparing for testing (Nelson, 2013).

The demands and pressure of testing performance in the traditional school model also lead to a decrease in teacher autonomy and lessen a teacher's ability to think and act creatively in the classroom (Ingersoll & May, 2012). In an interview with National Public Radio, Richard Ingersoll, an expert on teacher turnover and retention at the University of Pennsylvania, explained that lack of autonomy and "feeling that they have no say in decisions that ultimately affect their teaching" is one of the main reasons teachers quit the profession (Phillips, 2015, para. 5).

"Shrinking classroom autonomy," Ingersoll reported, "is now the biggest dissatisfaction of math teachers nationally... This has been a growing issue for math teachers and it's no doubt tied to the testing and accountability environment where math is one of the main subjects tested" (Phillips, 2015, para. 14).

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Furthermore, in a study conducted by the National Center for Education Statistics, in the 2011–12 school year, only 10 percent of natural science and 8 percent of math teachers reported having "a great deal of control" or high autonomy in their public school classrooms (Sparks & Malkus, 2015, p. 11). Compounded with the current shortage of qualified STEM teachers in our nation (Cross, 2016), increasing teacher autonomy and allowing teachers to experiment with innovative teaching strategies that are consistent with the latest research on best and promising practices is crucial to providing a strong STEM education that prepares students for postsecondary and career success in the 21st century.

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## BRIGHT SPOTS

**Harnessing the new wave of technology innovation** through "flipped classrooms" is one approach being used to revolutionize time, autonomy, and assessment demands in an effort to afford teachers more time to experiment with active learning strategies in the classroom. Generally, a flipped classroom is structured so that students watch short lecture videos independently outside of the classroom, and then work collaboratively on activities, projects, experiments, or problem-solving with their peers and teachers inside of the classroom (Meyer, 2013, para. 2). The true value of the flipped classroom, however, is not in the structure but in the ideology. "Ultimately," write Sams and Bennet (2012), "flipped learning is not about flipping the 'when and where' instruction is delivered, although that is part of it. It's about flipping the attention away from the teacher and toward the learner" (p. 3). Perhaps the most famous resource for flipped learning is Khan Academy. In his TEDTalk, "Let's use video to reinvent education," founder Sal Kahn (2016) describes how the videos offered through Khan Academy allow students to adapt the pace of and gain ownership over their learning while also providing teachers with data on students' progress through the material. Other similar platforms that may help facilitate flipped learning include YouTube's Education section, TED, Open Culture, CosmoLearning, LearnersTV.com, and Academic Earth (as cited in Walsh, 2012).

High Tech High (HTH) is another nontraditional school model that is reenvisioning the standards of assessment to carve space for more teacher autonomy and experimentation with innovative STEM learning methods. Featured in the documentary Most Likely to Succeed (Dintersmith, Whitely, & Leibowitz, 2015), HTH is a network of 13 charter schools in the San Diego, California, region in which teachers have the autonomy to shape the multidisciplinary, project-based curriculum for their classrooms. Many of the projects designed by HTH teachers are multi-week, several-month, or even yearlong projects focused on the innovative application of STEM content. For example, one project showcased on the organization's website is Engineering 101 Pop-Up Book! Over the course of seven weeks, students learned about the different fields of engineering and how they play a significant role in their everyday lives by mastering measurements and paper-folding to create a "beautiful, professional exhibition that [the student is] proud of" (High Tech High, 2016, para. 2). At the culmination of projects like these, students have the opportunity to showcase their work through publications or exhibitions organized for the school, parents, and wider community.

Several schools and districts are also remodeling their traditional structure to empower their teachers with more autonomy and greater involvement in decision-making. For example, Teacher-Powered Schools is a growing movement currently in over 100 schools that gives teachers the collective autonomy to design and run their schools, and entrusts them with influence over curriculum, budget, program evaluation, measures for student achievement, and hiring decisions, among others. Teachers at teacher-powered schools throughout the country have shared many stories detailing how this model shifts the traditional paradigm of the teacher as the "sage on a stage" and affords them "the freedom to meet the needs of [their] excited students in the immediate timeframe of now."

## 04 CONCLUSION

**The traditional school model** has existed for over 150 years and is ingrained in an education system that can be exceedingly difficult to change. Change, however, is necessary. Affording STEM teachers the time and autonomy to experiment with more innovative and research-backed teaching strategies enhances STEM teaching and learning for all students, and is vital to the future success of our young people and our nation's global competitiveness. As we work to effect this crucial change, there are noteworthy pockets of innovation, such as the bright spots highlighted in this paper, which the nation and the education community can turn to as both potential models and sources of inspiration.

# ABOUT THE GRAND CHALLENGES WHITE PAPERS

In 2017, 100Kin10 released an unprecedented representation of the big, systemic challenges to preparing and supporting STEM teachers following over two years of extensive research alongside more than 1,500 STEM teachers and hundreds of other education experts. As a part of this work, 100Kin10 commissioned a series of short white papers from well-versed thinkers and practice-oriented researchers to synthesize the most relevant research around the specific challenge areas. Together, they compose a thoughtful and well-rounded examination of the systemic challenges currently facing STEM teaching.

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