

Creating a Formula for Success:

Recommendations from an Evaluation of Florida's Mathematics Professional Development Landscape

PREPARED BY

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WITH GRATITUDE

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Executive Summary

THE UNSOLVED MATHEMATICS PROBLEM

As technological advancements continue to transform our global economy at an increasingly rapid pace, the need to develop the skills and knowledge of the next generation of the workforce is critical for Florida to stay competitive. For the state to meet workforce demands, more students must be competent in core mathematics, as research shows that students with strong math skills are more likely to attend college and fill advanced, higher-earning jobs. (Florida Chamber Foundation, 2017; Henry-Nickle, 2018; Vilorio, 2016). However, there is a significant knowledge gap in our current workforce, with more demand for high-quality and highly technological, technical, and intellectual jobs than the supply of workers to fill those positions (Craig, 2019; U.S. Department of Labor, Bureau of Labor Statistics). This gap has broad ramifications (Hanushek & Peterson, 2014), including the very real costs to local, regional and national economies.

Nationally, the current state of students' mathematical proficiency is predictive of a continuation of the existing knowledge gap, with little more than one-third of eighth-grade students demonstrating proficiency in mathematics (National Science Foundation, 2018; NAEP, 2019). The statistics are even more dire for the country's historically underserved student populations, Black and Latinx students, with only 12-19% of Black and 18-19% of Hispanic eighth-grade students demonstrating proficiency (National Science Foundation, 2018; NAEP, 2019). In Florida, only 46% of students achieved proficiency on the 8th Grade Florida Standards Assessment (FSA) and just 39% of high school students passed the Algebra 1 FSA in Spring 2019 (FLDOE, 2020a).



TEACHERS: OUR BEST SOLUTION

To best address the mathematics illiteracy issue, and therefore assure a well-positioned workforce, it is critical to leverage our most powerful catalyst for change: educators. Research shows that teacher certification, subject matter knowledge, pedagogical

knowledge, and teaching experience are significantly associated with higher student achievement (Akiba et al., 2007; Darling-Hammond & Youngs, 2002; Rice, 2003; Wayne & Youngs, 2003). It is vital for the nation's future economy that all mathematics teachers are adequately prepared and supported in their acquisition and integration of subject matter and pedagogical knowledge so that they can appropriately instruct and support all students, particularly our most underserved populations.

THE STATE OF THE MATHEMATICS EDUCATOR WORKFORCE

Adequately preparing and supporting Florida’s mathematics educator workforce is more critical than ever, as around one-third of teachers in the classroom have not completed a formal teacher preparation program. These teachers go through alternative certification pathways to earn their professional certificate, which vary in timeframe, requirements, and focus on math knowledge and pedagogy. These factors have a significant impact on educators’ instructional beliefs, content knowledge, and level of experience, all of which impact student learning, and ultimately, student achievement in mathematics. Inexperienced and alternatively certified educators are more likely to need more content and instructional training to improve their foundational content and teaching knowledge.

BALANCING THE EQUATION WITH PROFESSIONAL DEVELOPMENT

Specifically cultivating educators’ mathematics knowledge and instructional skills in ways that translate into increased student learning requires intentional, continued investment in ongoing, high-quality professional development (Ball & Cohen, 1999; Jacob & McGovern, 2015).

To be considered high quality and impact student outcomes, professional development must be content-focused, incorporate active learning through practice-based application, support collaboration, use models of effective practice, provide coaching and expert support, offer feedback and reflection, and be of sustained duration (Darling-Hammond et al., 2017).

In addition, champions of promoting quality mathematics education for all must also actively identify and dismantle barriers to access, such as affordability, availability, and accessibility of professional development programs and experiences (UF Lastinger Center, 2016). The need to improve access has only been exacerbated by COVID-19, as educators look for more flexible and remote learning opportunities to support them within their new teaching environments.

AN ANALYSIS OF SECONDARY MATHEMATICS PROFESSIONAL DEVELOPMENT IN FLORIDA

To better understand the current math professional development landscape in Florida, and identify a possible path forward for improving student outcomes, the University of Florida Lastinger Center for Learning analyzed secondary math educators’ experiences with, and perspectives on, available mathematics professional learning opportunities. Researchers conducted a survey and focus group to gather quantitative and qualitative data.

EMERGING THEMES FROM THE DATA INCLUDE:

- Teachers experience **varying levels of access to ongoing, frequent professional learning opportunities**, with around one-third of educators engaging in just 1 or 2 opportunities over the past two years.
- Only **half** of educators indicated the professional development they experienced **included a majority of the components that constitute high-quality professional learning**.
- A majority of professional development experiences are short in duration with **little to no follow-up to determine if educators actually implement what they learn** in trainings.
- **Educators desire more opportunities** to collaborate with peers, receive ongoing feedback and support from coaches, and reflect on instruction.
- There is a **lack of culturally relevant content, curriculum and appropriate supports** to help students make sense of their learning within their unique context.

CONSIDERATIONS

Effective professional development systems require an integrated, multi-level approach, with local and state education leaders, policymakers, and professional development providers working together to build and offer learning opportunities that meet the needs of our current mathematics educator workforce.

TO ACCOMPLISH THIS VISION, THERE ARE SEVERAL CONSIDERATIONS FOR KEY CHAMPIONS AND DECISION-MAKERS:

- **Revise state professional development standards** to better align with the research on effective professional development.
- Emphasize a **competency-based approach to professional learning** to ensure educators integrate their new knowledge in ways that translate to changed practice.
- Leverage intellectual capital with technology to **create more flexible, tailored, and cohesive learning experiences** for mathematics educators.
- Create environments and structures that allow for **ongoing collaboration, coaching, and reflection opportunities** to promote integration of learning into practice.

Teachers are key agents of transformational change in education and the solution for creating a path for the success of our future generations. Thus, educators need access to a coherent, comprehensive and sustainable professional development system with a framework that encompasses the essential components of high-quality teaching and learning. Such an approach will, in turn, support students to develop the knowledge, skills, and competencies they need to thrive in our state’s current and future economy.

The Mathematics Problem: Effectively Preparing Students for a 21st Century Economy

MATHEMATICS: A FOUNDATIONAL COMPONENT OF OUR SOCIETY

As technological advancements continue to transform our global economy at an increasingly rapid pace, the need to develop the skills and knowledge of the next generation of the workforce is critical for Florida to maintain its position as an economic and political leader. Mathematical competency is a foundational pillar for success in the 21st century workforce, which requires advanced technical as well as critical thinking and problem-solving skills.

Today, employers value and rely on human capital to analyze and solve complex problems, abilities that are developed through a strong mathematics foundation (Torpey, 2012). Mathematical skills develop individuals’ capacity “to approach tasks methodically, pay attention to detail, and think abstractly” (Torpey, 2012, p. 3). However, national data indicate that there is a significant gap in workforce skills, with 6.6 million unfilled positions as of July, 2020 (U.S. Department of Labor, Bureau of Labor Statistics, 2020). About 75% of Business Roundtable CEOs reported that they have not been able to fill STEM-related positions (Craig, 2019).



CareerSource Florida (2018) recently conducted a skills gap and job vacancy study. In addition to 247,399 job vacancies, they found that about one-third of employers in Florida experience skills gap with job seekers, as well as with current and former employees. For Florida to meet workforce demands, more students must be competent in core mathematics. Research shows that students with strong math skills are more likely to attend college and fill many of these advanced, higher-earning jobs.

Beyond digital age capabilities, “soft skills,” such as communication; creativity; leadership and strategy; self-management; and collaboration, are also scarce among the workforce. Florida employers reported gaps in soft skills twice as often as technical skills gaps (CareerSource Florida, 2018). Research indicates that mathematics can help individuals develop and master these soft skills (Rohaeti, 2019). Solórzano, Rojas, Vargas, Rueda, & Hernandez Palma (2018) suggest that the problem-solving and brainstorming processes that students engage in by learning and applying mathematics in collaboration with their peers, positively affect the dynamics of interpersonal relationships that favor the acquisition of soft skills. Among the soft skills that are developed through the collaborative problem-solving process in mathematics are assertive communication, adaptability and flexibility, proactivity, initiative or teamwork (Solórzano et al., 2018).

The inability for Florida’s current workforce to adequately meet current industry demands around technical and non-technical skills is staggering and is stymying the state’s ability to optimize innovation and growth, resulting in lost economic opportunity and suppressed standard of living levels. Taking advantage of those opportunities and meeting industry demands are important for local residents to compete for, obtain, and retain high-quality jobs, resulting in higher salaries and better quality of life (Florida Chamber of Commerce, 2019; Florida Chamber of Commerce, 2021). One of the reasons for the inability to make this happen is the lack of mathematics literacy. Number sense and measurement, algebraic and spatial reasoning, and the problem-solving and analytics skills gained through mathematics are crucial to compete for these and future jobs. Investing in mathematics education is a catalyst for positive change that will benefit all Floridians and help develop skilled workers capable of excelling in the jobs of tomorrow.

SECONDARY MATHEMATICS: KEY FOR COLLEGE AND CAREER READINESS

Successful completion of the secondary mathematics pipeline, comprising Pre-algebra, Algebra 1, Geometry, and Algebra 2, has been identified as an essential link to college readiness and entry, attainment of a bachelor’s degree, and future employment (Vilorio, 2016). Algebraic courses develop students’ skills in identifying patterns, constructing generalizations, and formalizing experiences into symbolic representations (Van de Walle et al., 2013). Shaughnessy (2011) suggests that “if algebra is the language of mathematics, geometry is the glue that connects it” (p. 1). Humans use geometrical thoughts every day to define space and objects, engage in spatial reasoning, and prove statements and arguments using logic (Lappan, 1999; Serin, 2018). Spatial reasoning has been found to be particularly crucial to success in STEM education and is fundamental to career success (Mulligan, 2015).

When considering the evidence, the four “gateway” courses (Pre-algebra, Algebra 1, Geometry, and Algebra 2) are critical components of a high school math education and create a foundation for successful college coursework completion. Being able to successfully teach students and improve their achievement in these critical areas has life-changing implications that contribute to the success of a nation’s workforce and ultimately affect the progress of its society.

U.S. MATHEMATICS ACHIEVEMENT RATES

Multiple validated assessments that are important indicators of economic growth (Hanushek et al., 2016) have found that mathematics achievement in Florida, as well as across the country, has been low and stagnant for years. Among 64 countries that have administered the Programme for International Student Assessment (PISA) in the latest sessions (2015 and 2018), the United States ranks 30th in math with no significant improvement since 2003 (OECD, 2019).

Similarly, the National Science Foundation (2018) found that only 42% of fourth-grade students and 35% of eighth-grade students (12% of Black and 18% of Hispanic) in the US were proficient in mathematics. This is consistent with findings by the National Assessment of Educational Progress (NAEP) that reported 41% of fourth-grade students (20% black and 28% Hispanic), 34% of eighth-grade students (19% black and 20% Hispanic), and 25% of twelve-grade students at or above NAEP proficient levels (NAEP, 2019). These percentages have remained virtually consistent since 2011 for all grade levels. The average national scores also follow the same constant and below-average trend for all grade levels. The US national average score has never been better than basic, which is the lowest level.

MATHEMATICS ACHIEVEMENT RATES IN FLORIDA

Florida's NAEP achievement levels follow similar trends to the nation's rates, with students performing at just above basic since the early 1990s and only slightly increasing over time. Currently, 41% and 31% of Florida's fourth- and eighth-graders, respectively, performed at or above proficient levels, coming in at 27th and 35th nationally. Further, among the 13 states where data is available for twelfth-grade NAEP Math, Florida ranks 11, with only 25% of students performing at or above proficiency level (NAEP, 2019).

Florida's 2018-2019 middle school math students had 55%, 54%, and 46% passing rates on the grades 6, 7, and 8 Mathematics Florida Standards Assessments (FSA), respectively (FLDOE, 2019). Algebra 1 students in Florida had an average 61% passing rate on the FSA Algebra 1 End-of-Course (EOC) exam. However, as shown in Figure 1, there is a notable gap between 9-12 grade test takers, who had a 38.9% passing rate in 2019, and 6-8 grade test takers who had an 88.5% passing rate. Often, Algebra 1 in middle school is limited to students who have performed well in previous math courses, are recommended by their teacher, and/or attend a high-performing or affluent school that promotes Algebra 1 in earlier grades. Restricting middle grade access to "struggling" students has negative social and self-efficacy impact (NCTM, 2013).



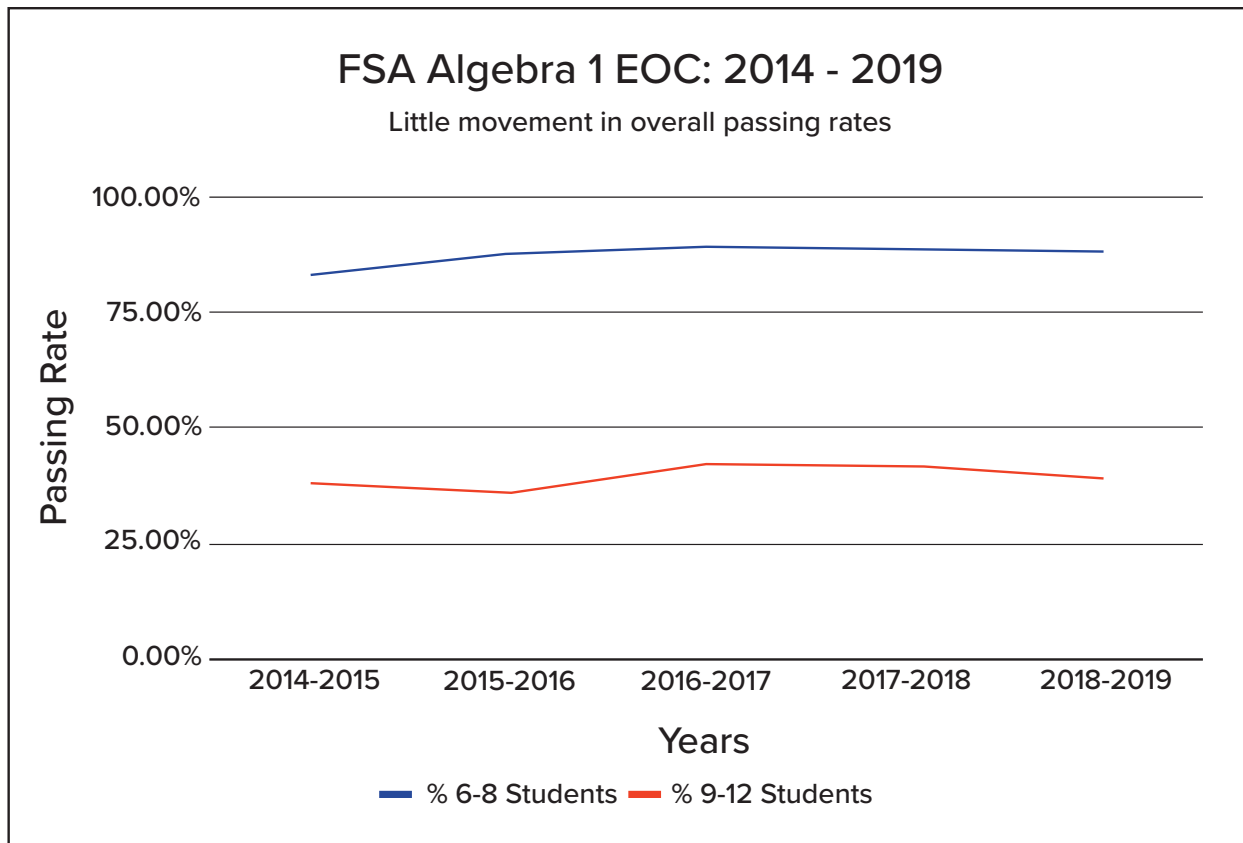


Figure 1. FSA Algebra 1 EOC Passing Rates (Level 3 and Above) for Grades 6-8 and Grades 9-12: 2014-2019

MATHEMATICS ACHIEVEMENT BY RACIAL GROUPS

Similar passing rate trends across racial groups can be seen for both 6-8 grade and Algebra 1 FSA data (Figures 2 and 3), with little improvement for any group, and a clear pattern of groups that consistently demonstrate lower proficiency. Black students consistently have lower passing rates when compared to the rest of the racial groups and the average trend. Hispanic students, though slightly over-performing when compared to the average, are still below the rest of the racial groups, only outperforming the Black students. Asian and White students consistently outperform the other racial groups, clearly demonstrating the ongoing disparity in achievement.

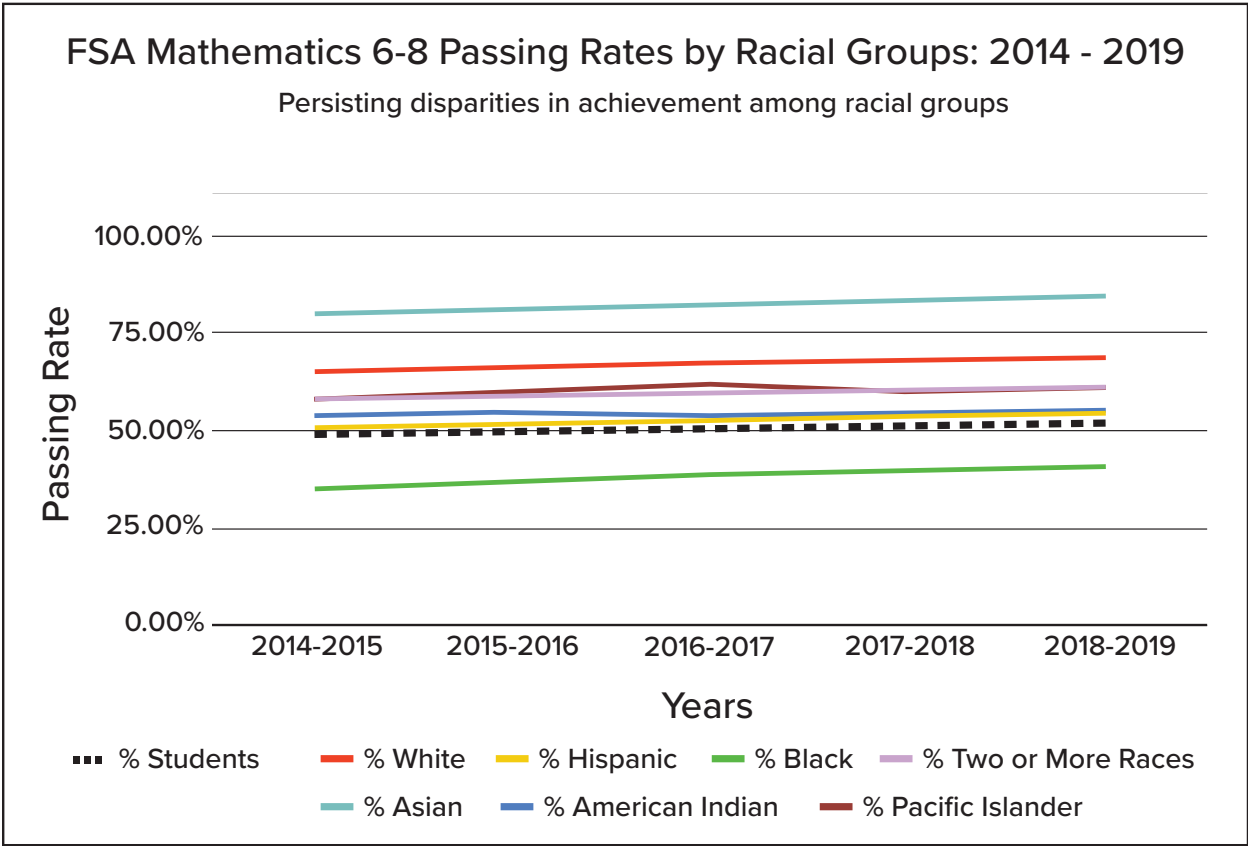


Figure 2. FSA 6-8 Mathematics Passing Rates (Level 3 and Above) for Grades 6-8 by Racial Groups: 2014-2019

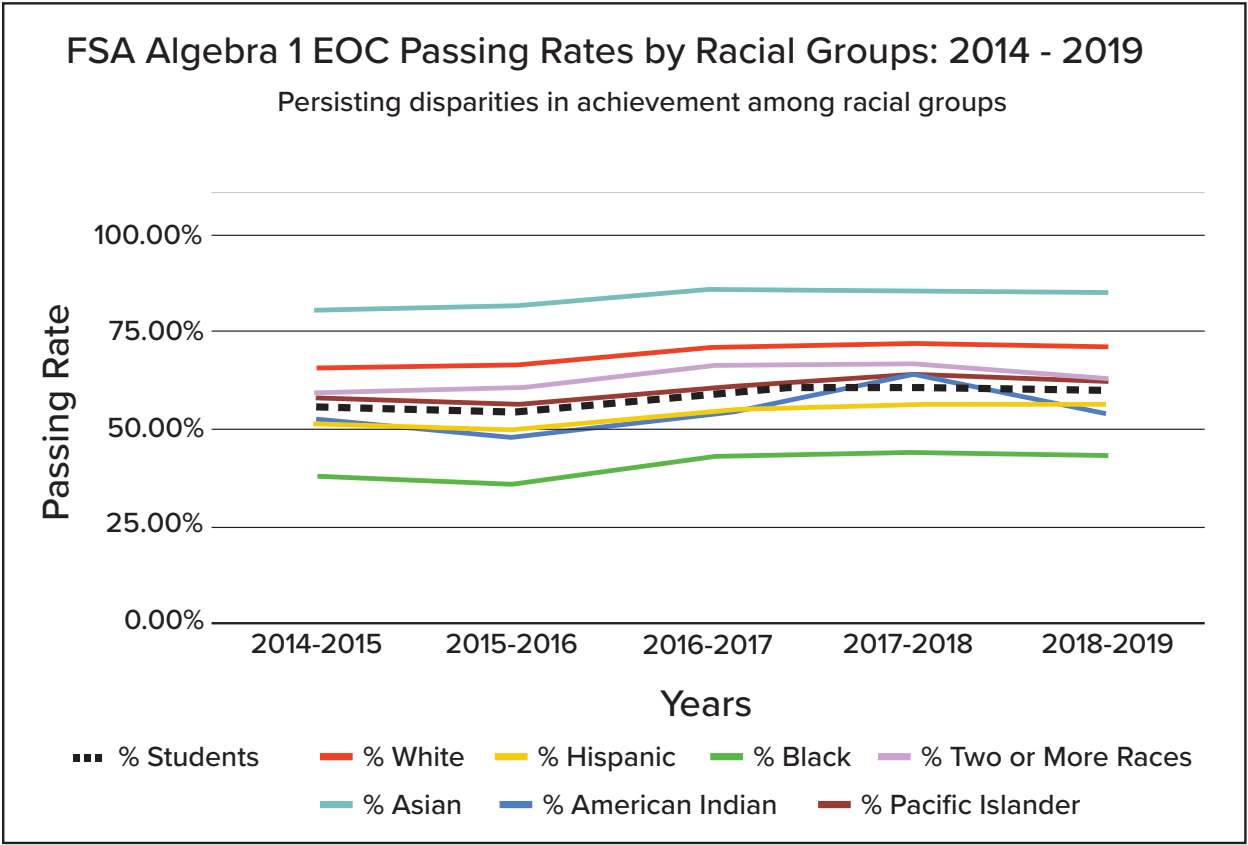


Figure 3. FSA Algebra 1 EOC Average Passing Rates (Level 3 and Above) by Racial Groups: 2014-2019

MATHEMATICS ACHIEVEMENT FOR OTHER GROUPS

Disparities in mathematics achievement are not just found among racial groups; severe achievement gaps also exist based on socioeconomic, English Language Learner (ELL) and disabilities status. Figures 4 and 5 show significant gaps between economic and non-economic disadvantaged students, ELL and non-ELL students, and students with and without disabilities. Students who are not economically disadvantaged, in an ELL group, or identified as disabled consistently perform above average in the FSA exams. Their counterparts perform below average, with ELL students and students with disabilities performing the lowest.

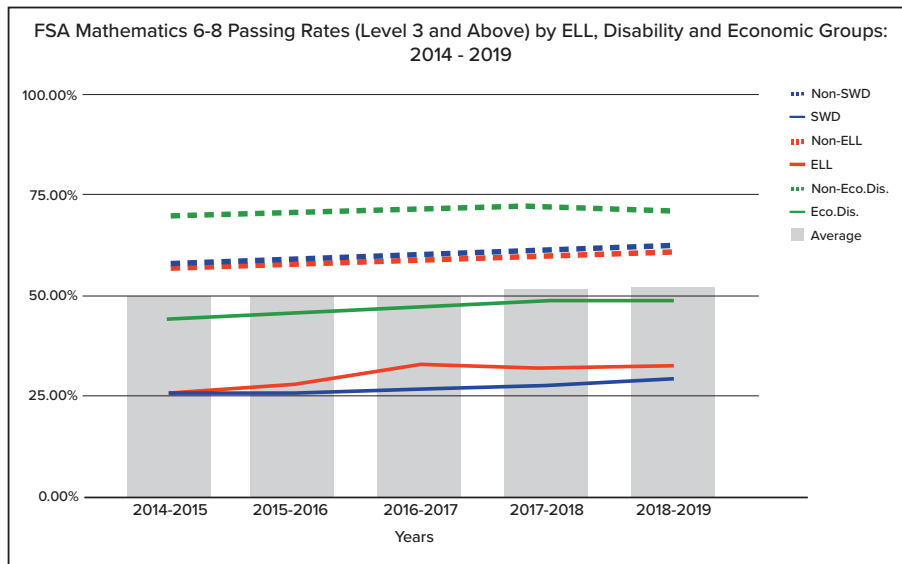


Figure 4. FSA Mathematics Passing Rates (Level 3 and Above) for Grades 6-8 by ELL, Disability and Economic Groups: 2014-2019

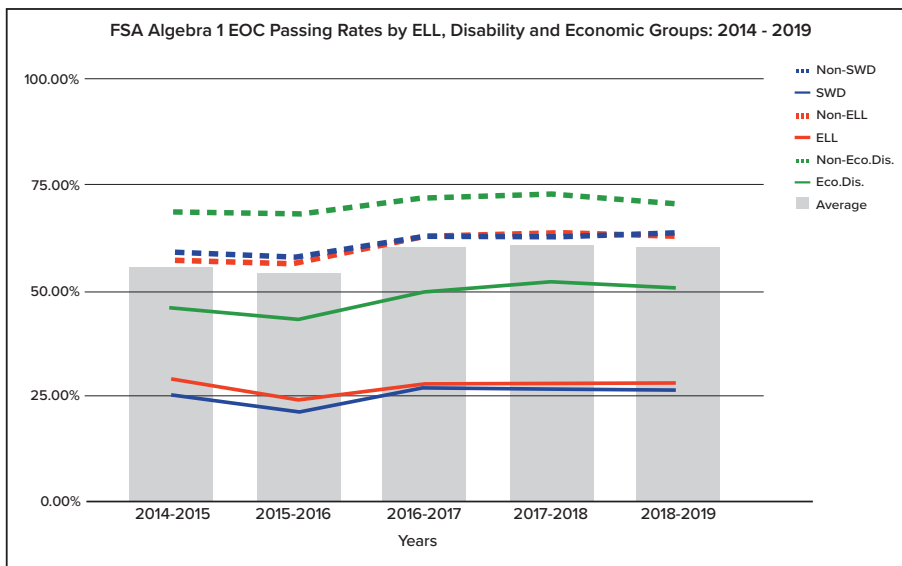


Figure 5. FSA Algebra 1 EOC Average Passing Rates (Level 3 and Above) by ELL, Disability and Economic Groups: 2014-2019

MATHEMATICS ACHIEVEMENT BY REGION

Student achievement disparities among groups are also reflected geographically, further demonstrating the compounding impact of racial, socioeconomic, and learning disadvantages. As shown in Figure 6, there are significant differences in passing rates for both the Algebra 1 EOC and the combined FSA Mathematics 6-8. Regions with high concentrations of students of color and students with low SES status performed lower on FSAs compared with counties with significantly higher White populations and SES status.

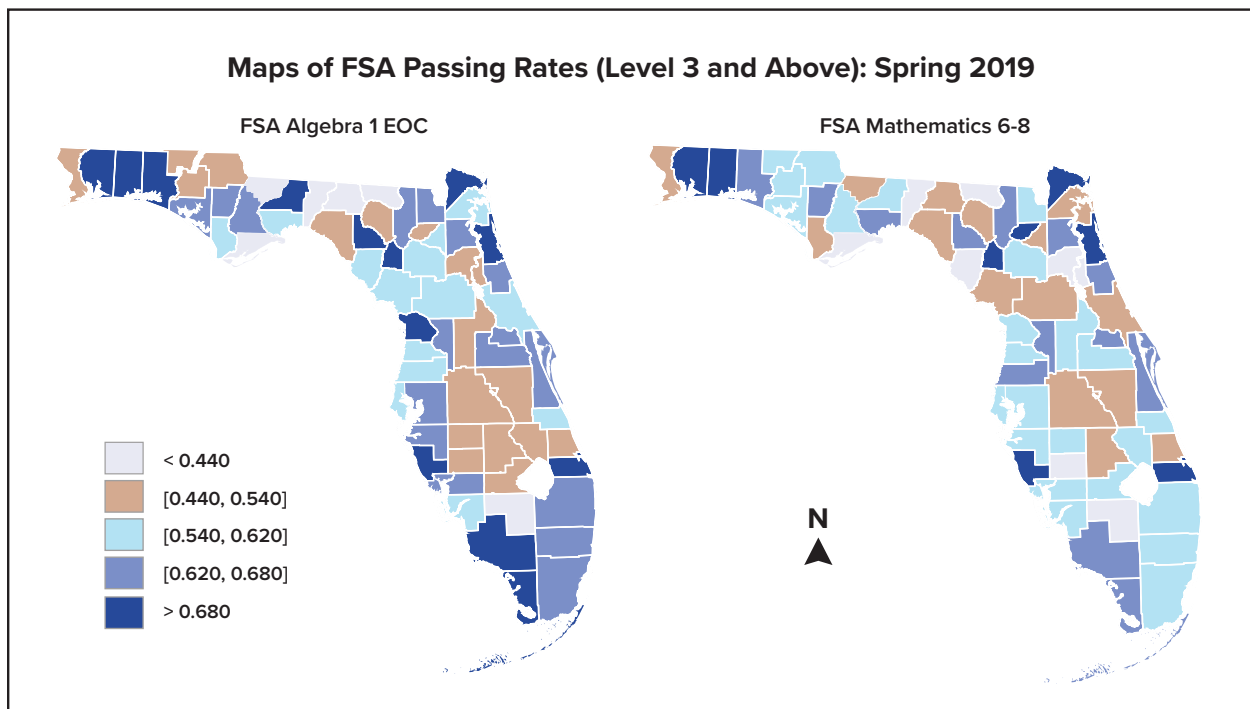


Figure 6. FSA Grades 6-8 and Algebra 1 EOC Passing Rates (Level 3 and Above) in Florida by County: Spring 2019

For example, Gadsden county is located in the panhandle with a population comprised of 55.8% Black and 10.5% Hispanic residents and a 23.6% of poverty rate (\$40,992 median household income). The 2019 combined 6-8 grades FSA and Algebra 1 EOC passing rates were 49.5% and 33.9%, respectively. By contrast, St. Johns County is comprised of 82.3 percent White residents, with only 6.6 percent living in poverty and a median household income of \$77,323, the highest among all counties in the state. The passing rates for combined 6-8 grades FSA and Algebra 1 EOC passing rates were 79.3% and 79.7%, respectively.

IMPLICATIONS

The data suggest that students falling into one or more of these 'disadvantaged' categories are not receiving equitable access to quality resources and instructional support needed to ensure academic success.

Research shows that disadvantaged students (by income, race, and academic struggles) typically are taught by the least experienced and/or qualified teachers with access to the least number of resources and opportunities (Goldhaber et al., 2015).

COVID-19 has increased the likelihood of students being behind in mathematics as well as the variability in their academic performance (Kuhfeld *et al.*, 2020). COVID-19 worsens the existing and persisting achievement disparities across different socioeconomic levels and between White students and students of color (DiPietro et al., 2020; Dorn et al., 2020). Academically, students from disadvantaged backgrounds do not have the same access to relevant learning digital resources, do not have the same support at home, and are already underserved (DiPietro et al., 2020). Besides academics, COVID-19 disproportionately affects disadvantaged and vulnerable groups as those people are more likely to get infected, to receive subpar (or have no access to) medical attention, and have their employment affected by reduced hours or layoffs (Perry & Aronson, 2021). The achievement gap already has monetary and social costs to the United States. If the gap worsens, those costs will increase (Dorn et al., 2020).

Despite the empirical evidence of the relevance of math education, the U.S. (and thus Florida), has embraced the idea that being mathematically “illiterate” is socially and culturally acceptable (Rogers, 2017). Both reading and mathematical literacies are important and not mutually exclusive, as math and reading proficiency are not only good predictors of the skills that lead to socioeconomic growth (Hanushek et al., 2013), but they are correlated with the proficiency of one affecting the other and vice versa (Haarlar et al., 2012).

Continuing to accept the narrative that certain students are simply not mathematically inclined, thus resulting in a drastic number of children not achieving basic proficiency in the subject, has incredibly broad ramifications. For individuals, higher education translates into higher incomes; for national prosperity, higher educational achievement increases economic growth (Hanushek & Peterson, 2014). Therefore, failing to improve the education system may be costly to a local, regional, and national economy.

Effective Mathematics Professional Development: A Lever for Change

TEACHERS AS AGENTS OF CHANGE

Teachers are ideally positioned to make a significant impact on their students' academic achievement, as research shows that effective teachers matter more to student achievement than any other aspect of schooling (Oppen, 2019). It is well documented that students perform better when served by highly effective teachers with high levels of experience and content expertise, and a wide variety of effective and differentiated pedagogical skill sets (Mobra & Hamlin, 2020; Podolsky et al., 2019). Further, teacher certification, subject matter knowledge, pedagogical knowledge, and teaching experience have been identified as significantly associated with higher student achievement (Akiba et al., 2007; Darling-Hammond & Youngs, 2002; Rice, 2003; Wayne & Youngs, 2003). The proven transformative power that highly effective teachers have on students can extend beyond their K-12 journey, positively impacting college attendance rates and even future median income (Chetty et al., 2014; Tucker & Stronge, 2005).



FLORIDA'S MATHEMATICS TEACHER WORKFORCE

Compounded by a number of factors, the teaching workforce in Florida, as in many other states, has drastically changed over the past decade, resulting in a less prepared, and thus less skilled, population.

Florida's education workforce is now comprised of nearly 30% of teachers who did not complete a traditional teacher preparation program.

(Teachers of Tomorrow, 2018; Oppen, 2019)

In comparison, about 18% of mathematics educators in the United States entered the teaching profession through an alternative route (Garcia & Weiss, 2019; National Science Board, 2019).

Mathematics is considered to be a subject area in Florida with a critical teacher shortage, ranked third across all PK-12 subjects based on percentage of courses taught by non-certificated teachers, projected vacancies, and college graduates with the appropriate degree. In 2018-2019, 17,457 teachers held mathematics certifications, accounting for only 4% of all certifications. Nearly 7% of mathematics courses in Florida were taught by teachers without mathematics certificates in that year. COVID-19 has heightened the teacher shortage problem; consequently, the number of non-traditional teachers is projected to continue the increasing trend.

As a result, many non-traditional teachers enter the classroom with little or no mathematical studies beyond their own K-12 mathematics education, or with a more advanced mathematical experience (e.g. engineering, advanced mathematics) that makes it difficult to scaffold back and understand the basics to be able to teach it. Alternative certification programs help non-traditional teachers obtain the required training and credentials to earn a professional certificate. These programs cover a wide breadth of education-focused content, typically focused on more general topics. As a result, alternatively certified teachers are more likely to need additional content and instructional training to improve their professional learning and knowledge. Professional development and continuous training opportunities improve the learning climate among educators and positively influence teacher retention and recruitment (Garcia & Weiss, 2019).

SUPPORTING MATHEMATICS EDUCATORS AND ENHANCING STUDENT LEARNING THROUGH EFFECTIVE PROFESSIONAL DEVELOPMENT

Florida's current math education workforce composition of a relatively large number of novice and out-of-field teachers has a significant impact on student achievement. Research has shown that professional development is a crucial entity in equipping teachers with skills and tools to improve instruction and increase student learning (Ball & Cohen, 1999; Jacob & McGovern, 2015). Professional development involves activities or processes intended to help shape or improve teachers' beliefs, attitudes, knowledge and instructional practice (Clarke & Hollingsworth, 2002).

The National Council of Teachers of Mathematics (NCTM) states that "the ultimate goal of professional development is improving students' learning, through the mechanism of improving instruction" (Doerr et al., 2010, p. 1). Ongoing professional development programs have been shown to improve student performance in mathematics courses such as Algebra 1 and 2 (Bishop, 2016). Thus, mathematics professional development should have the improvement of all students' learning of mathematics as the driving force behind the development of its structure, duration, and activities (Eisenhower National Clearinghouse for Mathematics and Science Education [ENC], 1998; Loucks-Horsley et al., 2010).

Both teachers who completed a traditional teacher prep program and those who entered the profession via alternative routes benefit from high-quality professional development opportunities. Through such experiences, they build mathematical content knowledge as well as specialized knowledge on how to best teach mathematics to students with individual and unique needs. In addition, post-certification professional support has been shown to improve teachers' likelihood to stay in the classroom (Redding & Smith, 2016; Zhang & Zeller, 2016).

COVID-19 has accelerated the need for teachers to be able to access high quality and highly effective professional development in order to effectively instruct in various educational settings, particularly virtual environments. König and colleagues (2020) state that the key components of an efficient and productive transition and adaptation to online teaching during COVID-19 include information and communication technologies tools, particularly training teachers in digital competence and effective instruction in a digital environment. This is a huge opportunity for the professional development market. Beyond that, it is an opportunity for the flexibilization of the supply and accessibility of professional development.



CRITICAL COMPONENTS OF EFFECTIVE PROFESSIONAL DEVELOPMENT

Although mathematics professional development can vary depending on the scope and purpose, there are several key characteristics that have been found through research to improve teacher learning of both content and pedagogical knowledge.

Darling-Hammond, Hylar, and Gardner (2017) suggest that professional development should be content-focused; provide participants with modeling and tangible examples, and opportunities for active learning and collaboration; provide coaching and expert support, as well as opportunities for feedback and reflection; and it should be coherent, ongoing and sustainable (Figure 10). These criteria are consistent with Desimone's (2009) five-featured conceptual framework for professional development: content focus, active learning, coherence, duration and collective participation. Using these, we propose the following framework for effective teacher professional development (Figure 7).

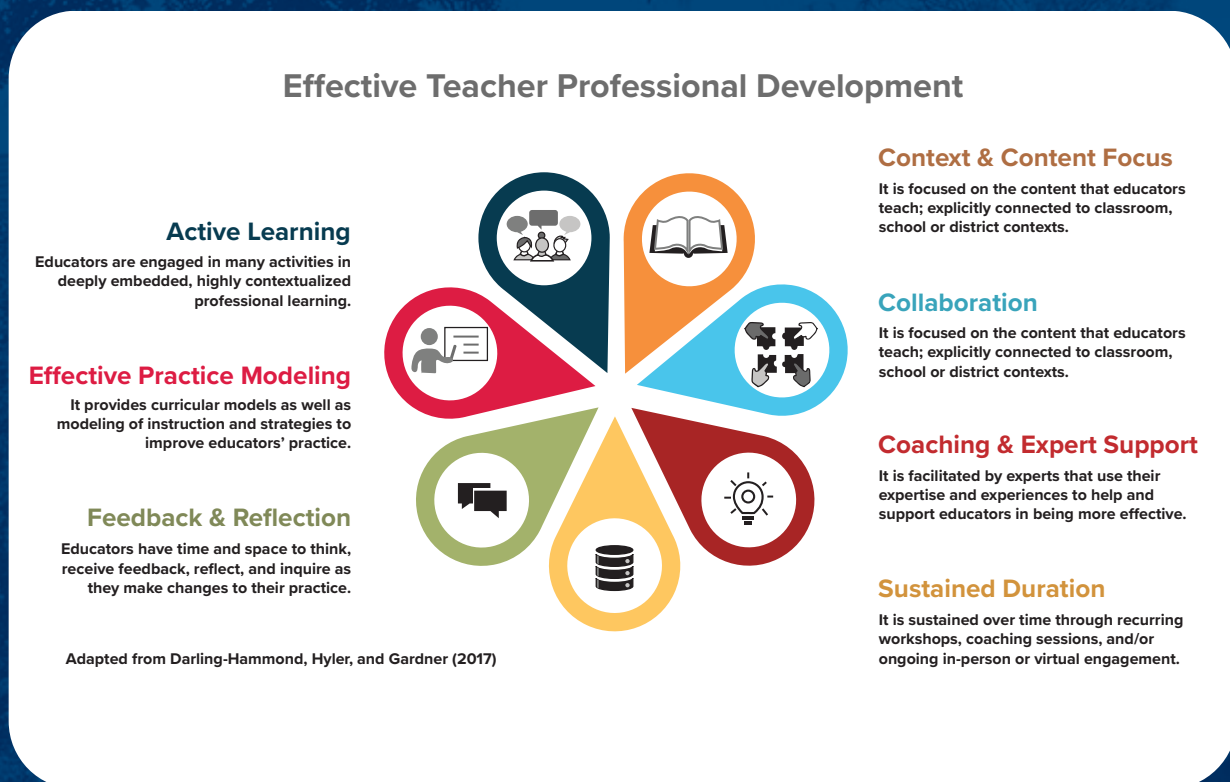


Figure 7. Criteria for Effective Professional Development



CONTEXT AND CONTENT FOCUS

Job-embedded professional development is designed to be integrated into a teacher's workday, where they spend time "assessing and finding solutions for authentic and immediate problems of practice as part of a cycle of continuous improvement" (Croft et al., 2010, p. 2). This professional development structure aims to link teacher learning with application through inquiry-based learning, ensuring that their work is aligned with state standards as well as local school goals. Job-embedded learning opportunities can take place in the classroom or school, with or without students, alone or with colleagues, but regardless of such variations, has the same focus on issues of actual practice. Various types of professional development can occur within the job-embedded structure, including action research, lesson study, mentoring, coaching, and examining student work (Croft et al., 2010; Loucks-Horsley et al., 2010).

Similarly, professional development is often criticized as not being set in a context that relates to a teacher's practical teaching experience. Designing professional development that "attend to teachers' unique circumstances" and connect multicultural education with mathematics will provide teachers with tangible approaches to "enhance student learning opportunities" (Sowder, 2007, p. 166-167). This is well aligned to the NCTM's Equity Principle: "Excellence in mathematics education requires equity – high expectations and strong support for all students" (NCTM, 2000, p. 11).

Thus, effective professional development must take into consideration the current context and climate of teachers and their students in order to create a sense of relevancy and coherence (ENC, 1998; Garet et al., 2001; Loucks-Horsely et al., 2010). This occurs by connecting activities and experiences with equity practices, as well as with other professional development experiences, aligning the content with standards and assessments, and fostering professional communication (Garet et al., 2001). When teachers believe that a professional development opportunity is aligned with their equity principles and with local as well state standards and/or initiatives, they are more likely to invest their time and effort into the engagement (Doerr et al., 2010).

Content-focused professional development refers to training on teaching strategies associated with a specific curriculum or set of benchmarks, standards, or processes (Darling-Hammond et al., 2017; Desimone, 2009). Content knowledge has been recognized as a significant component of effective teaching (Shah et al., 2019). Research indicates that the level of teachers' mathematical content knowledge positively impacts aspects of instructional practices (Bishop, 2016; Garet et al, 2016) and impacts students' gains in mathematics (Hill et al., 2005; Jacobs et al., 2007). Further, research suggests that professional development focused on improving teachers' knowledge of mathematics is more effective than professional development only focused on pedagogical knowledge (Garet et al., 2001; Heck et al., 2008).



ACTIVE LEARNING

In order for teachers to best learn about new strategies that will improve their content and pedagogical content knowledge, professional development designers should create activities that mirror what students will experience in the mathematics classroom (Darling-Hammond et al., 2017; Desimone, 2009; ENC, 1998; Garet et al., 2001). As such, teachers become the students and engage in challenging mathematics problems that are deeply embedded in the teachers' and students' contexts (Darling-Hammond et al., 2017). These authentic and interactive activities designed for students, using teachers' feedback and context, should encourage collaboration, dialogue, and analysis, thus leading to the development of a deeper understanding of the discipline itself (Loucks-Horsley et al., 2010). Nonetheless, teachers should not sit passively through lectures. Rather, they should participate not only in their own learning but in the planning process of those professional development opportunities (Darling-Hammond et al., 2017; Desimone, 2009). Situating professional development in realistic contexts also allows teachers to engage in examination, analysis, and reflection of their own teaching practice through the use of artifacts, particularly videos (Ball & Cohen, 1999; Borko et al., 2008; Clarke & Hollingsworth, 2002).



COLLABORATION

One of the best practices of teachers' professional learning is to learn from one another (Desimone, 2009). Teachers from the same school, grade, or department should collectively participate in professional development opportunities and engage collaboratively with the content and tasks, such as lesson planning and analysis of student work (Darling-Hammond et al., 2017). There is significant potential for rich interaction and discourse and collaboration serves as a powerful form of continuous job-embedded professional learning (Adams, Poekert, and Cugini, 2018).

A Community of Practice is one example of a collaborative structure that is used to organize educators into productive groups (Wenger, 2000). Communities of Practice are defined as "groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly" (Wenger, 2011, p. 1). These are groups comprised of members with a shared domain of interest and level of competence and contain three elements: members share an understanding of what their community is about and hold one another accountable; members interact with one another, and through this interaction develop norms and relationships; and members collectively develop a repertoire of resources, including language, artifacts, tools, and routines. Participants engage in various activities and protocols that help them to enhance their work as practitioners, such as problem-solving, coordinating efforts, visiting other members, and requesting information.

Another similar structure is the professional learning community, a collaboration of teachers with the purpose of examining issues in teaching and learning (Loucks-Horsley

et al., 2010). The group determines the focus and collects data that they can analyze and then identify areas of student learning needs. Once these areas have been identified and prioritized, the group sets up a plan of action that includes strategies they believe will help to resolve the problem. Collectively, the teachers implement the plan and then evaluate whether they met their goal and solved the issue at hand. Success of this collaboration rests partly upon the support received from administration; study groups need sufficient time to meet and identify issues, analyze data, develop an action plan, and evaluate the results. Additionally, all members of the group must be committed to the process and willing to engage in critical examination and reflection of their classroom practices.



EFFECTIVE PRACTICE MODELING

Teachers engage and learn better when they interact firsthand with lessons and relate with, critique, and reflect on scenarios (Desimone, 2009). Thus, professional development should provide educators with opportunities to utilize models and experience a wide variety of sample items. It is not just about learning what to teach, but also about how to teach it and having many strategies, activities and instructional ideas at the teachers' disposal. Examples include video or written cases of teaching, demonstration lessons, unit or lesson plans, observations of peers, and curriculum materials including sample assessments and student work samples (Darling-Hammond et al., 2017, p.11). These "curricular and instructional models and modeling of instruction help teachers to have a vision of practice on which to anchor their own learning and growth" (p. 11). Teachers benefit when coaches and subject-area experts share and model effective practices and offer opportunities for teachers to reflect on those practices and improve it upon feedback. This "involves the sharing of expertise about content and evidence-based practices, focused directly on teachers' individual needs" (Darling-Hammond et al., 2017; p. vi).



COACHING AND EXPERT SUPPORT

Teachers appreciate and engage more in professional development opportunities when they receive coaching and expert support, including cycles of feedback and reflection with these experts. These experts add value to teachers' professional learning experiences by sharing expertise and modeling evidence-based strategies that focus directly on the unique individual needs of the teachers and their teaching contexts (Darling-Hammond et al., 2017).

Although they are often an overlooked component of effective professional development, facilitators play a vital role in the success of any such program (Borko et al., 2014; Sowder, 2007). They must intentionally create an environment that is built on trust and respect, one that is safe for teachers to share information and critically reflect upon their own beliefs and practices (Borko et al., 2008; Loucks-Horsley et al., 2010).

Facilitators must also have excellent “interpersonal and group-processing skills” in order to effectively manage group dynamics (Croft, Coggshall, Dolan, & Powers, 2010, p. 9). Therefore, when the facilitator has coaching experience or the facilitator is an expert on a content area or curriculum, the right learning environment is easier to create.

FEEDBACK AND REFLECTION

High-quality professional learning includes intentional time and space for educators to engage in meaningful feedback cycles and subsequent reflection. From these activities, teachers should be provided the opportunity to make adjustments to their practice, share positive and negative impacts, and then continue to make changes. As Darling-Hammond and colleagues (2017) clearly and assertively state, “feedback and reflection both help teachers to thoughtfully move toward the expert visions of practice” (p. vi). When these feedback and reflection cycles are supported by coaches and experts, learning is maximized.

The learning experience is enhanced when teachers submit artifacts of their practice, receive feedback, reflect on that feedback, and adjust their practices afterwards. These artifacts could be formative or summative assessments, student work, lesson plans, activities, or videos from a lesson. Through a powerful feedback and reflection cycle, teachers can see the connection between teacher practice and student engagement and mastery (Darling-Hammond et al., 2017). Having these opportunities to share both positive and constructive reactions to authentic instances of teacher practice enhances the professional learning experience for the teachers.

SUSTAINED DURATION

Because teachers often do not fully change their beliefs or practice until they have experienced student success with a certain strategy, which may take significant time, it can take teachers several years to fully implement a new practice or program (Ball & Cohen, 1999; Loucks-Horsley et al., 2010). Therefore, professional development should also be ongoing and sustainable. Teachers need enough time to learn, practice, implement, measure, and reflect upon new techniques and strategies that spur growth in their practice (Darling-Hammond et al., 2017). Furthermore, Janssen et al. (2015) recommend a modular structure that allows for flexible, customizable options for progressing through the professional development content.

Heck et al. (2008) found that there was a significant increase in teachers’ use of investigative classroom practices when they engaged in up to 100 hours of professional development. Hill and Ball (2004) also noted that gains in teachers’ knowledge increased as the amount of time in training increased. Garet et al. (2001) argue that professional development should be embedded within a teacher’s work day in order to allow for more authentic connections to be made with the practices and ease in sustaining them over

time. This means that professional development must not be a one-time occurrence, but provide follow-up opportunities for teachers to attend to discuss their success and failures along the way.

DELIVERING HIGH-QUALITY PROFESSIONAL DEVELOPMENT

In order to offer professional learning experiences that incorporate these criteria while also meeting the needs and constraints of educators, it is vital to include virtual, synchronous or asynchronous components when designing and delivering professional development. Online professional development opportunities are increasing in popularity as more tech-savvy teachers enter the field and the need for flexible learning experiences grows (Loucks-Horsley et al., 2010). There are a variety of online professional development options with differing purposes. In order to be effective, they should have certain key elements. The number of participants should be aligned with the format; high-quality technology and interactive tools should be used; facilitators should be experienced with online professional development formats; content should be connected with practice; and opportunities for reflection should be embedded. One example of an online professional development format used by professional organizations is the webinar, an online seminar that can be accessed by a large population.

Fully online or blended learning programs can help expand access and allow for a truly practice-based approach when teachers can engage throughout the school year and share the outcomes from integrating new ideas and practices into their teaching. For example, Lane and Ní Ríordáin (2019) offer evidence that classroom-based action research projects or classroom-based learning is an important part of effective professional development for out-of-field teachers.

Given the large variation in teachers' backgrounds and pathways into the profession, online professional development programs can offer a more customizable approach to meeting the needs of teachers. Furthermore, it can remove many barriers that teachers experience related to participating in professional development. There are a myriad of challenges related to economics, time, and educational limitations that many teachers face in accessing high-quality professional development (UF Lastinger Center, 2016). Time challenges are generated by the competing demands of work, family, and professional development needs. Many teachers have family and children, making accessing professional development in the evenings or on weekends challenging and, in cases when child care is needed, expensive (Badri et al., 2016; Krille, 2020; UF Lastinger Center, 2016). Teachers have high workloads. Many opportunities for professional development conflict with their teaching appointments. Additionally, it is hard for many of them to organize substitutes for their classes (Krille, 2020). On top of time challenges, teachers have to face the costs of transportation to access certain professional development opportunities (UF Lastinger Center, 2016). Having the flexibility to access online resources removes the barrier of time availability and costs of transportation.

Online professional development can also offer teachers repeated access to the program content and an opportunity to set their own pace and progression. This is particularly important given that Goldsmith et al., (2014) found that teacher learning occurs incrementally and iteratively. However, they assessed that professional development programs rarely offer an iterative approach to teacher learning. Due to the nature of the profession, teachers need time to try new approaches and strategies, one by one. They need to test whether or not these new things work before switching to or adding new ones. Besides, teachers need time and space to learn and understand what they are learning before implementing it with their students. Having the opportunities to access professional learning resources 24/7 from the comfort of their own home, workplace, or any other setting allows them to work at their own pace.



Mathematics Professional Development in Florida

STRUCTURE OF FLORIDA'S PROFESSIONAL DEVELOPMENT SYSTEM

Section 1012.98, Florida Statutes, School Community Professional Development Act, establishes that “the purpose of the professional development system is to increase student achievement, enhance classroom instructional strategies that promote rigor and relevance throughout the curriculum, and prepare students for continuing education and the workforce” (Florida Legislature, 2020). The Statute also states that “the Department of Education, public postsecondary educational institutions, public school districts, public schools, state education foundations, consortia, and professional organizations in this state shall work collaboratively to establish a coordinated system of professional development” (Florida Legislature, 2020). In addition, the system of professional development must align to the standards adopted by the state and support the framework for standards adopted by the National Staff Development Council, now known as Learning Forward.

The State Professional Learning Catalog (Rule: 6A-5.071) fulfills the requirements of Florida Statutes 1011.22, 1012.98, and 1011.62 and Board of Education Rule 6A-5071 by detailing a Professional Development System that includes:

- **Alignment with student and personnel needs**, determined through multiple data sources;
- Professional development activities that focus on professional growth and analysis of student achievement data; ongoing formal and informal **assessments** of student achievement; identification and use of enhanced and **differentiated instructional strategies**; rigor, relevance, and reading in the content areas; enhancement of **subject content expertise**; integrated use of classroom technology that enhances teaching and learning; classroom management; parent involvement; and school safety;
- Professional development **activities for school administrative personnel** that address skills for effective school management and instructional leadership; and
- **Professional Improvement Plans** and Professional Growth Plans based on effectiveness and/or student performance measures.

Florida has a coordinated system of professional development to address the professional growth needs of the educators, the college credits or in-service points for recertification, and any area where educators need to improve (FLDOE, 2020c). Although there is specific focus on areas such as literacy (Chapter 1002.59), reading (Chapter 1001.215), early learning (Chapter 1002.995), and middle grades (Chapter 1012.98), there is little mention of mathematics.

PROFESSIONAL DEVELOPMENT PROVIDERS IN FLORIDA

The state provides schools districts with significant autonomy in creating professional development plans based on their unique needs, with approximately 75% of districts doing so through a designated professional development department. Focus areas for these systems include: analysis of student achievement data; student needs; personnel needs; instructional strategies and methods that support rigorous, relevant, and challenging curricula; school discipline data; school environment surveys; assessments; performance appraisals for teachers and personnel; school improvement plans; school in-service plans; and other performance indicators to identify needs. Additionally, schools can also develop an individual professional development plan that aligns to Section 1012.98, Florida Statute.

In addition to the professional development offered by school districts, there are a large number of external vendors from the local, state, and national levels that deliver professional development to Florida's educators. More than 80 providers have been identified as supporting Florida's 76 school districts (Figure 8). The needs of the market (school district, teachers, and administrators) are largely driven by compliance on grades, assessments, certification and teaching standards (B.E.S.T. and professional development system standards). While large providers, such as publishers, are focused on research-based lifecycle services (planning to implementation), small vendors focus on selling niche (custom workshop onsite training) services to their customers. Professional development providers in Florida can be organized into the following categories: higher education institutions, Department of Education and school districts; education consortia and nonprofit entities, private firms, and book publishers.



Florida Mathematics Professional Development Vendor Landscape View



Figure 8. Florida Mathematics Professional Development Landscape View

DEPARTMENT OF EDUCATION

Through the Department of Education, Florida offers professional learning programs and grants to state and local educational agencies to support effective instructions, using Title II, Part A funds from the Every Student Succeeds Act ESSA section 2001 (FLDOE, 2020c). These funds are strictly to access professional development and training to increase student achievement through improving quality and effectiveness of teachers, principals, and other school leaders. Examples of approved pathways that are funded by the state and provided at no cost to educators are the Literacy Matrix through the UF Lastinger Center, Teacher Induction, New Teacher Mentoring and Mentor Training program, Clinical Education Facilitator Academy, Dr. Brian Dassler Leadership Academy, and the William Cecil Golden School Leadership Development Program, among others.

HIGHER EDUCATION INSTITUTIONS

Postsecondary educational institutions, including the Florida College System, the State University System of Florida, and out-of-state institutions such as the Charles A. Dana Center at The University of Texas at Austin offer various professional development and career advancement opportunities to educators, including degrees, certifications, and more informal trainings, institutes, and workshops.

NON-PROFIT ORGANIZATIONS AND EDUCATION CONSORTIA

Non-profit organizations and education consortia also offer state-approved professional development opportunities to educators, particularly those located within smaller districts that do not have the resources available to develop and/or implement their own. These include National Council of Teachers of Mathematics and the Florida Council of Teachers of Mathematics, Council for Education Change, Florida Distance Learning Consortium, Heartland Educational Consortium, North East Florida Educational Consortium (NEFEC), and Panhandle Area Educational Consortium (PAEC), among others listed in Figure 11. Many of these programs offer a wide variety of resources such as leadership, teacher retention, and mentorship; content development; investigations of technology integration, assessment, content, standards, data, and instructional practice; and webinars, activities and standards-based trainings. However, access is limited by either cost, geography, or lack of a blended model where participants can either attend virtually or in person.

PRIVATE FIRMS

Private firms constitute an estimated 40% of providers active within the professional development market in Florida. These firms focus on specific services for schools, teachers, and/or students, such as support in implementing mathematics standards, digital learning and instructional technology, specific content areas, supporting lessons, and assessments. Thus, most services cover a select number of the criteria for effective professional development, but few include all within one experience. In addition, many of these firms also offer student learning resources and tools, and thus, their services are primarily oriented toward effective implementation of these products. Cost is a large barrier for accessibility to these professional development offerings for smaller districts and individual schools.

TEXTBOOK PUBLISHERS

Mathematics textbook and curriculum publishers such as Houghton Mifflin, McGraw Hill, and Pearson have the most significant service presence across the state, offering both online and onsite service delivery models. These trainings primarily focus on supporting teachers in effectively implementing the curriculum, offering instructional practices centered on their textbooks and supplementary materials. Many of their professional development sessions are centered on using their technology and online platform for formative and summative assessments, homework, resources such as interactive activities, and other services such as grading and differentiating. Participants can expect to engage in content-specific learning, active engagement strategies, teaching models, collaboration, and practical application of their instructional materials. Access to these professional development opportunities may be limited due to textbook adoption policies of the district or school and cost of the programs and services.

ALIGNMENT OF PROFESSIONAL DEVELOPMENT OFFERINGS TO EFFECTIVE CRITERIA

Researchers have engaged in a number of studies over the past 25 years to understand the state of Florida’s educational professional development system and identify opportunities for improvement that will translate in increased student learning outcomes. Joyce and Byrne (1997) conducted an evaluation of Florida’s professional development landscape and identified several key themes: a limited collaboration culture; lack of structured time to participate in professional development opportunities; and significant autonomy from teachers in choosing what and how many professional developments in which to engage (Adams, 2019; Joyce & Byrn, 1997).

In addition, professional development activities were introductory and dominated by generic teaching practices, “too brief and scattered,” with very few offering a diverse range of instructional strategies. In response, the Florida Legislature and the Department of Education developed Florida’s Protocol System to “to evaluate the quality and effectiveness of school district professional development systems (The Florida House of Representatives Schools & Learning Council, 2008, p. 1).”

The Florida House of Representatives Schools & Learning Council (2008) conducted a post-protocol evaluation of the professional development landscape in Florida.

THE REPORT CONCLUDED THAT:

- Teacher professional development systems, use of individual professional development plans, and progress in evaluation of professional development varied significantly by school district.
- Professional development systems were improved, with stronger linkage between professional development and student achievement, better efforts in collecting data, and more content-focused sessions, among other improvement areas.
- District-level coordination of professional development increased.
- School districts made some progress in follow-up to ensure classroom transfer.
- Rural school districts faced challenges in evaluating in-service needs.
- Teachers were still allotting limited work time for job-embedded professional development.
- There was a need for new instructional strategies.
- Protocol standards did not differentiate among grade levels.

MATHEMATICS PROFESSIONAL DEVELOPMENT PERSPECTIVES SURVEY

In order to better understand the current professional development landscape, with a specific focus on secondary mathematics, our research team conducted a survey between December 2020 and January 2021. Florida-based middle school and high school mathematics teachers, coaches, and specialists were invited to voluntarily complete the online survey. The survey was comprised of demographic questions and Likert Scale questions organized by the effective professional development criteria framework. Respondents indicated the extent of agreement to a set of five statements per criteria, with extreme descriptors of “strongly disagree” and “strongly agree.”

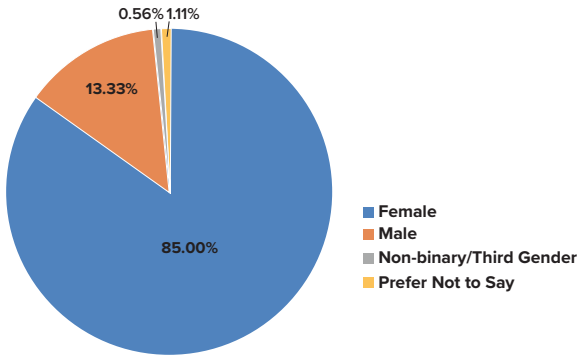
The survey was completed by 138 respondents, with demographic data indicated in Figure 9. Responses were provided by a diverse pool of educators across a representative geographic sample. 85% of respondents were female; 51% Caucasian, 22% African-American/Black, 16% Latino or Hispanics; 49% indicated teaching middle school mathematics and 40% indicated teaching high school mathematics; 47% of respondents hold a Bachelor’s degree, and 44% hold a Master’s degree.

Among the survey participants, 33% participated in 1-2 mathematics professional development opportunities in the past two years (or 24 months), 30% participated in three to five opportunities, 31% participated in more than five opportunities, and 6% indicated that they did not participate in any. Figure 10 summarizes the professional development experiences in which respondents engaged over the past two years based on their level of agreement with each question related to a specific criterium.

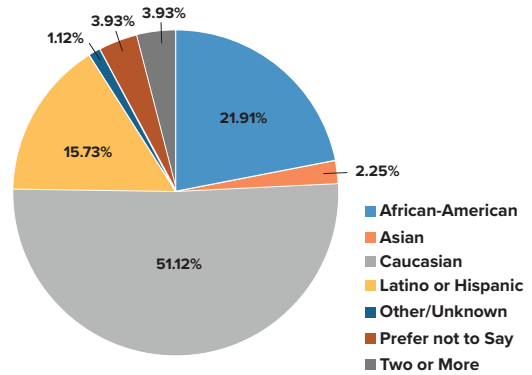


DEMOGRAPHICS OF SURVEY RESPONDENTS

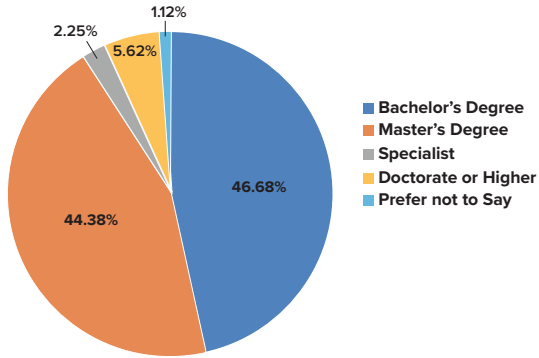
GENDER



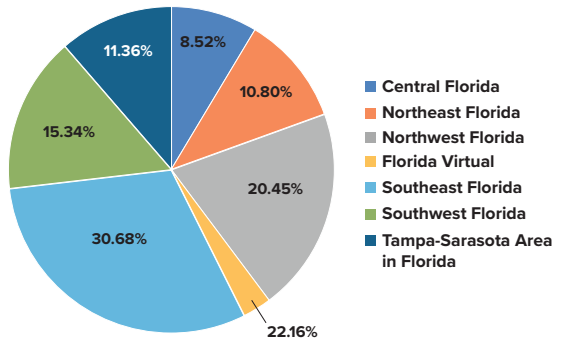
ETHNICITY



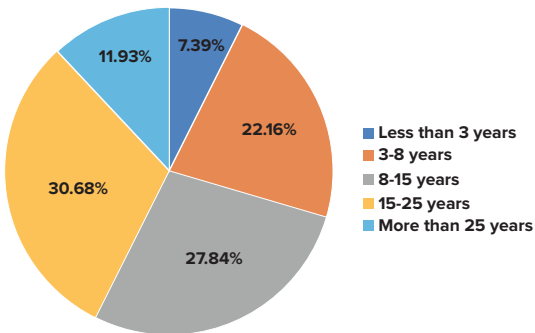
EDUCATION



TEACHING LOCATION



YEARS OF EXPERIENCE



EDUCATOR'S ROLE

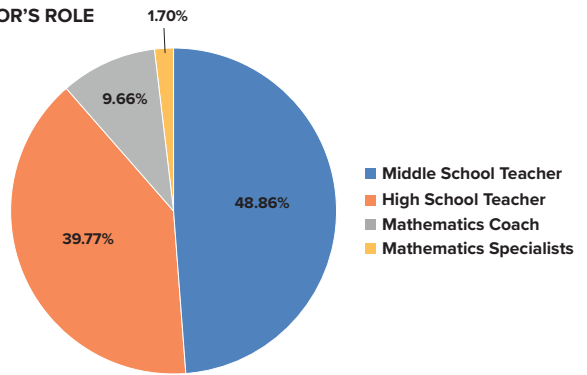


Figure 9. Demographics of Survey Respondents

Educators' Level of Agreement with their Professional Development Experiences Meeting the Effectiveness Criteria

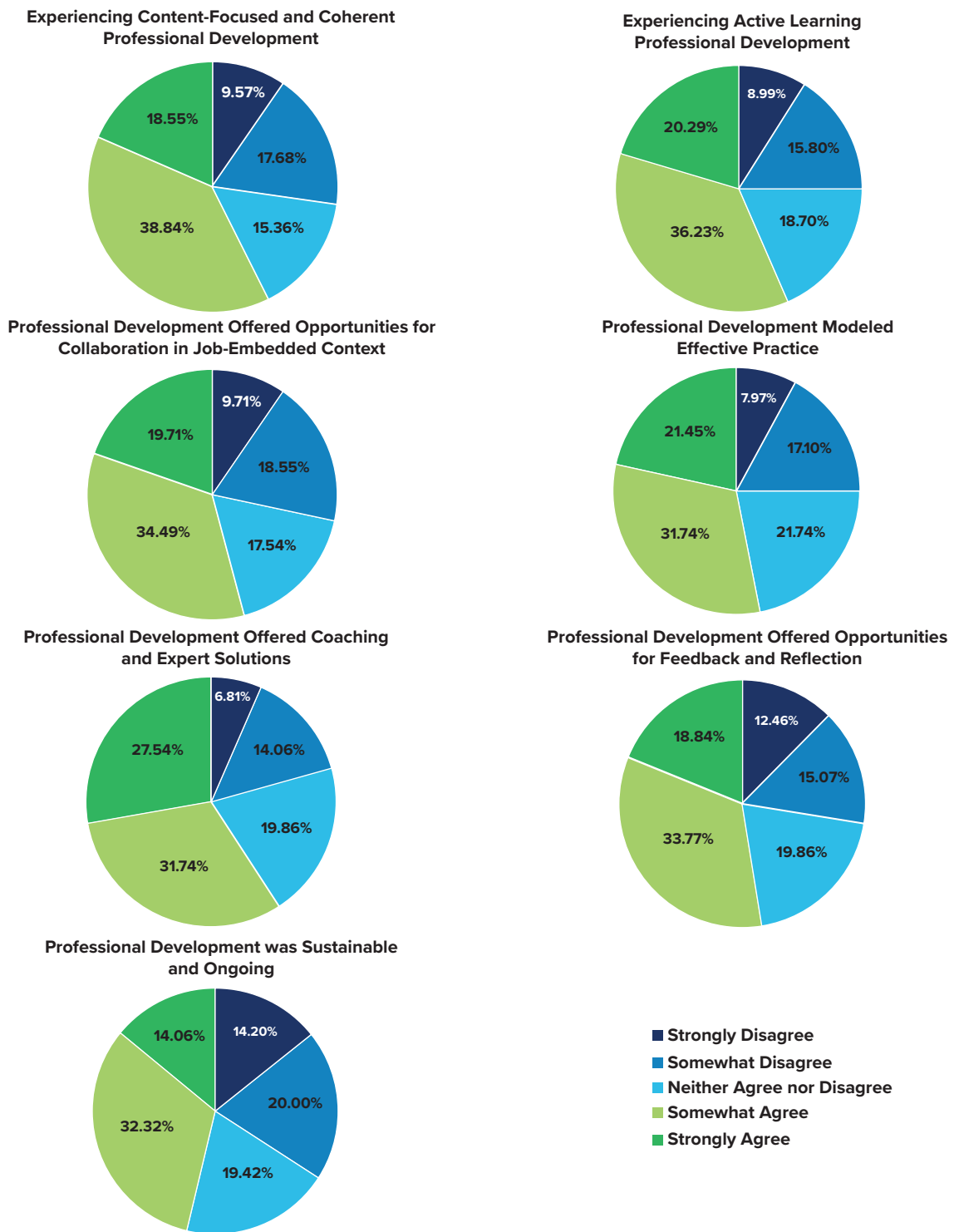


Figure 10. Educators' Level of Agreement with their Professional Development Experiences Meeting the Effectiveness Criteria



CONTEXT & CONTENT FOCUS

There was a 57% average agreement by survey respondents that their professional development experiences in the past two years have been coherent and content-focused. The highest level of agreement (70%) was with professional development being focused on the content that they explicitly taught and connected to their classroom contexts.

More than one third of respondents indicated that professional development did not include content focused on students' culture and language.

More than 30% also indicated that they did not have opportunities to study their students' work and test out new curriculum materials with students, or to study the sequencing of mathematics ideas and how they are linked to help students construct a coherent "story" that makes sense to them.



ACTIVE LEARNING

An average of 56% of respondents agreed that their professional development experiences in the past two years have involved active learning. 64% of respondents indicated having access to experiences that engaged them in the same learning activities that they were designing for their students.

64% also agreed with the statement that recent professional development sessions addressed the practices that they should learn, utilizing their experiences, interests and needs as resources for new learning opportunities that they were able to choose.

However, 43% of respondents indicated that they did not have opportunities to role-play and analyze student work and/or videotaped classroom lessons designed to foster high expectations of student learning.



COLLABORATION

Little more than half of respondents agreed that their professional development experiences in the past two years offered opportunities for collaboration in job-embedded context. 67% indicated that they were offered opportunities to problem-solve and learn with their colleagues with the aim of improving instruction. Around two-thirds agreed that teachers' collaboration was central to all activities during the professional development sessions they engaged with in the past two years. However, more than one-third of respondents indicated that professional development sessions were not designed and implemented in partnership with whole-grade levels, departments, schools, and/or districts. In addition, about 36% had not engaged in carefully structured, collaborative analysis of students' work, consistent with the findings in the area of context and content focus.



EFFECTIVE PRACTICE MODELING

Around half of the respondents agreed that effective practice was modeled as part of their professional development experiences in the past two years. 65% indicated that their experiences provided curricular and instructional models as well as modeling of instruction. In addition, an average of 62% agreed that their recent professional development sessions helped them to develop a vision of practice on which to anchor their own learning and growth. However, about one-third disagreed that time and space were built for them and their colleagues to identify concepts they may find challenging to learn and examine the logic behind their own common misunderstandings of the content. About 30% of the participants also disagreed regarding having opportunities to analyze the roles of hands-on investigations, discourse, and inquiry in mathematics learning.



COACHING AND EXPERT SUPPORT

59% of respondents indicated receiving coaching and expert support to scaffold their professional development experiences during the past two years. About 75% of the participants agreed those experiences were facilitated by experts such as veteran teachers, coaches, district specialists, and/or curriculum writers.

Two-thirds of educators indicated receiving mentoring or coaching support outside of professional development experiences.

Further, 64% agreed that experts helped to guide and facilitate their learning in the context of their practice, and supported individual or group discussion and collaborative analysis of student work. However, more than one-third disagreed about benefiting from having an onsite or remote mentor, who helped them improve and excel in at least one aspect of their teaching.

FEEDBACK AND REFLECTION

A little more than half of respondents agreed that their professional development experiences in the past two years offered opportunities for feedback and reflection. 60% shared that reflection and inquiry were central to learning and development in those experiences. Nearly 40% of respondents indicated that they did not submit artifacts of practice (such as videos, assessments, rubrics), receive feedback, reflect on their teaching, and/or respond to questions from a coach regarding the relationship between teacher practice and student engagement.

SUSTAINED DURATION

Less than half of respondents agreed that their professional development experiences in the past two years were sustainable and ongoing.

Similarly, only 50% agreed that those experiences provided them with adequate time to learn, practice, implement, and reflect upon new strategies that facilitate change in their practice. 40% indicated that their professional development did not provide follow-up with applications in the classroom or additional development days or coaching sessions to extend and reinforce their learning. In addition, around 40% of respondents also indicated that professional development was time-limited, with limited ongoing engagement in learning.



▶ FOLLOW-UP FOCUS GROUP

Six survey respondents were randomly selected for a follow-up focus group to gather more detailed information regarding math educators' professional learning needs and available opportunities. The following key themes emerged from the focus group:

- Educators felt that content and coherence are the most important criteria of a professional development experience. Unpacking the standards and building up their **content and pedagogy knowledge** were themes that all participants brought up.
- Among the professional development criteria that participants have experienced, the least or not experienced at all were: **coaching** and extra support; **collaboration among teachers** to examine student work and common misconceptions; and opportunities for ongoing support, feedback, and reflection.
- Participants indicated that there are not enough opportunities to engage in various topics related to mathematics professional learning. Sessions tend to focus on the same select areas of focus.
- Participants would like to experience more **opportunities to learn from peers**, as everyone has different instructional strategies and approaches. They would like to watch each other deliver a lesson and facilitate a discussion. Participants also see value in examining student work as a team, sharing ideas, and identifying areas for improvement together.
- Participants would like to experience **sustainable and ongoing professional development** opportunities. They prefer shorter, more frequent sessions with a specific purpose and engaging in an active learning environment. They desire follow up, coaching, and extra support to ensure they are implementing what they learned and growing as professionals.
- Participants were concerned about the number of “outsiders” in charge of professional development, including those who do not have first-hand teaching experience or have not been in the classroom for a significant period of time. They shared that professional development should **reflect changes in instruction, students, and culture**.
- Participants were also concerned about the number of teachers leaving the field and the training and preparation of new teachers, particularly those coming from out of field.

Professional Development Considerations: Guidance for Implementation

Considering the current state of national and state student achievement in mathematics, the wide variety of existing professional development services and deliveries, and the known qualities of an effective and successful professional development experience, policymakers and practitioners have the necessary tools to make an impact. Policy can help support and incentivize the kind of professional development processes and structures described here; and furthermore, reduce the barriers that teachers often face when trying to engage in a professional development experience.

IN ORDER TO ACCOMPLISH THIS VISION, THERE ARE SEVERAL CONSIDERATIONS FOR KEY STAKEHOLDERS AND DECISION-MAKERS:

REVISE STATE PROFESSIONAL DEVELOPMENT STANDARDS TO BETTER ALIGN WITH THE RESEARCH ON EFFECTIVE PROFESSIONAL DEVELOPMENT.

Professional development opportunities should be developed and delivered so that the overall experience meets a majority, if not all, of the criteria established for effective PD: content and context; collaboration; active learning; effective practice modeling; feedback and reflection; coaching and expert supports; and sustained duration. Instead of one-size-fits-all experiences, offering more tailored and sequenced professional development will allow for deeper knowledge acquisition and integration into educators' daily practice (Adams, Poekert, & Cugini, 2018).

EMPHASIZE A COMPETENCY-BASED APPROACH TO PROFESSIONAL LEARNING TO ENSURE EDUCATORS ARE INTEGRATING THEIR NEW KNOWLEDGE IN WAYS THAT TRANSLATES TO CHANGED PRACTICE.

Educators must be provided opportunities to engage in job-embedded professional development that require a demonstration of their learning through submission of artifacts, such as videos and lessons. In addition, educators should receive meaningful feedback and ongoing coaching support to apply their learnings to the unique context of their classrooms.

LEVERAGE INTELLECTUAL CAPITAL WITH TECHNOLOGY TO CREATE MORE FLEXIBLE, TAILORED, AND COHESIVE LEARNING EXPERIENCES FOR MATHEMATICS EDUCATORS.

Given time constraints on educators, offering more flexible professional learning experiences that still provide opportunities for peer collaboration and reflection is crucial to meeting the needs of today's education workforce. More focused sessions sustained over a longer period of time will allow for opportunities to engage in feedback cycles and follow-up discussions that are proven to increase teacher knowledge and practice.

CREATE ENVIRONMENTS AND STRUCTURES THAT ALLOW FOR ONGOING COLLABORATION, COACHING, AND REFLECTION OPPORTUNITIES TO PROMOTE INTEGRATION OF LEARNING INTO PRACTICE.

A job-embedded approach to professional learning is critical to true transformation of teachers' beliefs and practice. Creating the appropriate conditions for educators to engage in meaningful, authentic collaboration, coaching, and reflection around context-specific content and activities has been proven to directly impact student learning and achievement outcomes.

There is a clear need for a coherent, statewide approach to mathematics professional development that includes research-based components proven to improve teacher knowledge and instruction. Florida mathematics educators desire professional development that offers opportunities to engage in more targeted, competency-based learning; collaborate with other colleagues; reflect on student learning and practice; receive coaching and meaningful feedback; and most importantly, engage in experiences that are sustained and ongoing.

Loucks-Horsley and colleagues (2010) liken professional development to the concept of a bridge; it is a "critical link where one is and where one wants to be" and although it works in one place, "it almost never works in another" (p. 5). Just as a bridge must carefully consider the destination, the users who will traverse it, and be sized to span the exact gap, professional development must also be designed and implemented in order to best serve its users, educators and students, and be focused on the problem that is trying to solve.

In order to close the mathematics opportunity and achievement gap for students, teachers must be fully supported to effectively drive that change. Having access to high-impact mathematics professional development is crucial to ensure that every mathematics teacher is equipped with the knowledge and skills necessary for success. Systematically enhancing teachers' skills will undoubtedly lead to significantly enhanced student achievement, and students will be more likely to develop the knowledge, skills, and competencies they need to thrive in today's, and future, economies.



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