

Math for All Research Base

Preliminary Empirical Evidence of the Feasibility, Usability, and Potential Impact of the MFA PD Program. The MFA program has been piloted and field-tested in multiple districts over the past 8 years. The purpose of this research was to establish the feasibility and usability of the program and to obtain some initial evidence of its impact on teachers and students. In collaboration with researchers from the Center for Technology and School Change at Teachers College, Columbia University (Meier et al., 2008), we conducted field tests in 10 urban, suburban, and rural school districts from four states (AR, CT, ND, NY) during the 2006-2007 school year. The school districts incorporated the MFA program into their existing PD offerings and provided teachers with release time so that they could attend workshop sessions during the school day. Formative feedback collected from participating general and special education teachers and district administrators collected through surveys and interviews indicated that they found the PD valuable and that it fit well within their school districts' contexts and priorities.

To explore the potential impact of the MFA program on teacher outcomes, this study utilized a quasi-experimental design, with 88 general and special education teachers participating in the MFA PD, and a set of 22 general and special education teachers who served in a "business-as-usual" comparison group. While the control group teachers volunteered to be in the study and thus were not randomly selected, a Levene's Test for Equality of Variances confirmed homogeneity between the control and treatment groups before an independent samples t-test and a one-way analysis of variance were used to compare related pre-post differences in means on the established constructs. Instruments included a questionnaire that documented teacher-reported changes in participants' classroom and lesson planning practices and a performance-based assessment task that documented changes in participants' understanding of and skill in observing students and matching instructional strategies to students' needs and strengths (Meier et al., 2008)¹. This study found that teachers in the treatment group were significantly more likely than the control teachers to show an increase in their perceived efficacy for teaching students with disabilities from before to after the PD ($t=3.22, p<.05$). An analysis of variance also found significant differences between MFA and control teachers' responses to a performance-based assessment task that asked teachers to describe one of their students whose understanding of mathematics they questioned and to describe instructional strategies that work well for the child. MFA teachers were more likely than control teachers to describe the child's growth as a math learner, to mention strengths in their description of the child, to use the neurodevelopment framework to guide their observation of the student, to use a broad range of instructional strategies and classroom structures, and to note instructional strategies that were aligned to the students' strengths and needs, ($F=41.370, p<.001$). Classroom observations confirmed that teachers who participated in the MFA PD were observing individual children, adapting math lessons to better meet students' strengths and needs, and incorporating a range of instructional strategies into their classroom practice. Results from this study thus provided initial evidence of the feasibility and usability of the MFA program in a variety of settings, as well as its impact on teachers' knowledge, skills, and teaching practices that prior research has associated with improved learning outcomes for students with and without disabilities².

¹ The proposed study will incorporate the use of refined versions of these instruments.

² Several teacher characteristics are related to positive student achievement. Darling-Hammond and Ball (1998) found that, in addition to the amount of content knowledge, teachers' understanding of teaching and learning processes significantly predicted student achievement. Teacher practices also are related to student achievement. For example, effective teachers adjust their teaching to fit the needs of different students and the demands of different instructional goals, topics, and methods (Doyle, 1985; Hanushek, 1971). Assessing students' current knowledge and progress is also a critical skill for improving the achievement of students with learning disabilities. Formative evaluation has been identified as a research-supported practice for improving the learning of students with learning disabilities (Espin, Shin, & Busch, 2000; Fuchs & Fuchs, 2002; Raver, 2004; UMass Donahue Institute Research and Evaluation Group, 2004).

As part of a second, larger study (Moeller, Brodesky, Goldsmith, 2011) we have investigated how staff developers other than the program developers implement and adapt the program with teachers in their local contexts when relying solely on facilitator guides as supports. The study included five pairs of staff developers who used MFA with a total of approximately 100 teachers from four school districts. This project allowed us to collect additional evidence about the impact of the MFA program. We found that the program still had a significant effect on teachers' knowledge and classroom practices when it was implemented by facilitators other than the program developers, a finding that attests to the scalability of the program. These outcomes were measured using refined versions of the instruments developed for our field tests, described above. Across sites, t-tests revealed significant increases in nine constructs that were identified through a factor analysis of teacher questionnaire items. These constructs included teachers' preparedness and comfort with understanding students' strengths and weaknesses (preparedness $t=6.77$, $p<.000$; comfort $t=7.33$, $p<.000$), understanding mathematics concepts (preparedness $t=3.67$, $p<.000$; comfort $t=4.95$, $p<.000$), choosing and using instructional strategies (preparedness $t=9.66$, $p<.000$; comfort $t=8.37$, $p<.000$), and planning lessons collaboratively (preparedness $t=5.83$, $p<.000$; comfort $t=4.13$, $p<.000$). We also found a significant increase in the frequency with which teachers reported using accessible instructional practices related to teaching math to students with disabilities ($t=2.20$, $p<.05$).

While our research was not specifically designed to assess the impact of the MFA program on student learning outcomes, it allowed us to gather some initial data to explore this question. Informal assessments of individual students with disabilities submitted by teachers after the completion of the PD indicate that 26% of these students showed improvements in learning math or in neurodevelopmental functions such as memory or language use. For remaining students, teachers were able to describe strategies that helped students do better in math (32%), and to identify areas of specific strengths (18%) or needs (24%), information which guided them in their instructional planning for these students. We also explored the potential impact that the MFA program had on students' performance on standardized math tests. For this purpose, we sampled 4th- and 5th-grade-level cohorts of students at those schools in which many or most of the teachers at a given grade level participated in the PD. There were nine such cohorts in our data set. For these cohorts we examined the rates at which students scored at or above proficiency in the years prior to and after they were taught by teachers who participated in the PD. For all cohorts included in the analysis, the percentage of students who scored at or above the proficiency level increased after being taught by teachers who participated in the PD, with an average increase of 8.7%. For seven of the nine cohorts, this increase was greater than the average change in proficiency rates for the 4th- and 5th-grade levels within their state, which ranged from 3.5% to 5%.

While our preliminary data do not allow for causal inference, our findings provide initial evidence of the promise of MFA for improving teacher and student outcomes. MFA has yet to be rigorously tested against a counterfactual using an RCT design. Indeed, this makes MFA a strong candidate for an RCT, as this represents a natural next step within our program of research.