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e-Learning for Educators

Effects of On-Line Professional Development on Teachers and their Students:

Executive Summary of Four Randomized Trials

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http://www.bc.edu/research/intasc/researchprojects/eLearning/efe.shtml

Introduction

Over the past decade, there has been growing interest in on-line delivery of professional development (OPD). This interest is driven largely by a desire to improve access to and convenience of professional development, as well as improve cost-efficiency. Despite this increased interest in OPD, there is a dearth of scientifically-based research exploring the effects of OPD on teacher and student outcomes. To address this lack of evidence, researchers at Boston College conducted a set of four randomized controlled trials that examined the effect of OPD on teacher knowledge, teacher practices, and student achievement. For two trials, the effect of teachers' participation on student practices was also examined.

The four studies summarized in this executive brief are part of a larger project known as the *e-Learning for Educators (efe) Project*. The efe Project is a ten-state initiative designed to expand each state's capacity to deliver high-quality OPD that addresses teacher quality and student achievement needs. As part of the initiative, four randomized controlled trials were conducted with teachers from multiple states to evaluate the effects of OPD on teachers' knowledge and instructional practices, and on students' content knowledge and practices. The four independent trials employed the same research design, but focused on a single grade level and subject area: fourth grade English language arts (ELA), fifth grade mathematics, seventh grade ELA, and eighth grade mathematics. This executive brief summarizes findings from each of the four trials.

Study Design

Each trial was conducted across multiple states between January 2007 and June 2009 and included three rounds of data collection, each spanning three school semesters. The trials compared changes in teachers' content knowledge and instructional practices, and student achievement between participants assigned to either a control or treatment group. For the two ELA trials, effects on student practices were also examined. For each trial, teachers who volunteered to participate were randomly assigned to the treatment or control group; students were grouped based on the assignment of their teacher.

All teachers completed a pre-survey in the spring semester of their first year of participation. Teachers in the treatment group then participated in a series of three OPD workshops: the first in the spring semester of their first year of participation, the second in the fall semester of their second year of participation, and the third in the spring semester of their second year of participation. Each workshop was sustained over seven weeks and required approximately 4–6 hours of participation per week from teachers. Therefore, teachers in the treatment group participated in approximately 100 hours of OPD related to best practices for teaching specific topics within mathematics or ELA. Teachers in the control group were not restricted from participating in their normal professional development activities (online or face-to-face). All teachers completed a post-survey at the end of the spring semester of their second year of participation.

Although the teachers participated in the study for three school semesters, the student participants were drawn from only two school semesters- the fall and spring semesters of the teachers' second year of participation. These students completed a pre-test as close as possible to the beginning of the school year and a post-test as close as possible to the end of the school year.

For each trial, the OPD workshops were developed by the Education Development Center (EDC) through a collaborative process among various stakeholders in the efe initiative. The workshops were designed to include both theoretical information as well as pedagogical techniques that could be immediately applied in the classroom. The OPD workshops implemented a learning community model, which combined independent activities and activities to be completed with students in the classroom, and placed a strong emphasis on facilitated peer-to-peer discussions. Each workshop consisted of one orientation session and six sessions of content. Each of the six content sessions involved three components: readings, activities, and discussions. The readings were drawn from articles, book chapters, or reports. The activities often required teachers to view online videos or work with existing classroom materials. For the discussion component, each teacher participant was asked to respond to one or more questions related to the readings and activities via the workshop discussion board. In addition to completing the readings, activities, and discussions of the six content sessions, the teacher participants were required to create a final product, which involved developing an action plan or lesson plan based on the workshop content.

Table 1 shows the numbers of teachers and students who participated in each of the four trials:

Table 1: Number of Teacher and Student Participants

		Control Group	Treatment Group	Total
4th Grade EL A Trial	Number of Teachers	61	49	110
	Number of Students	922	766	1,688
7th Grade ELA Trial	Number of Teachers	45	35	80
	Number of Students	1,225	831	2,056
5th Grade Mathematics Trial	Number of Teachers	45	34	79
	Number of Students	790	648	1,438
8th Grade Mathematics Trial	Number of Teachers	43	28	71
	Number of Students	1,062	799	1,889

Data analyses were conducted to estimate treatment effects for teachers and students. Analysis of Covariance (ANCOVA) was used to estimate the treatment effects for the teacher outcomes, and hierarchical linear modeling (HLM) was used to estimate the treatment effect for student outcomes.

Summary of Findings

Collectively, the four trials provide strong evidence that participation in a coordinated series of three OPD workshops has positive effects on teachers' instructional practices and content knowledge. Compared to the control group teachers, larger changes in instructional practices occurred in each trial for teachers in the treatment group. In many cases, the effect of the OPD workshops on instructional practices was large. Across all four trials, larger changes in teacher content knowledge also occurred for teachers in the treatment group. In most cases, the size of the effect was medium or large.

In addition, the results of the trials provide evidence that teachers' participation in a coordinated set of three OPD workshops can have positive effects on their students. Although these effects are smaller and occur less consistently across all the sub-domains targeted by the courses, in each trial, a statistically significant effect was found for at least one student measure.

Table 2 (next page) provides a summary of the findings within each trial.

Table 2: Summary of Statistically Significant Findings

	4th ELA	7th ELA	5th Math	8th Math
TEACHER				
Instructional Practices	Writing †[3]	Writing †[2]	Algebraic Thinking †[3]	Proportional Reasoning †[3]
	Vocabulary †[3]	Vocabulary †[2]	Fractions †[3]	Geometric Measurement †[2]
	Reading Comprehension †[2]	Reading Comprehension	Measurement †[3]	Functions †[3]
Knowledge	Writing †[3]	—	Algebraic Thinking †[2]	Proportional Reasoning[1]
	Vocabulary †[1]	Vocabulary †[1]	Fractions[1]	Geometric Measurement[1]
	Reading Comprehension †[3]	Reading Comprehension[1]	Measurement †[3]	Functions[1]
	Composite ELA †[3]	Composite ELA †[2]	Composite Math †[3]	Composite Math †[2]
STUDENT				
Knowledge	Writing[1]	Writing[1]	Algebraic Thinking[1]	Proportional Reasoning[1]
	Vocabulary †[1]	Vocabulary[1]	Fractions[1]	Geometric Measurement †[1]
	Reading Comprehension[1]	Reading Comprehension[1]	Measurement[1]	Functions †[1]
	Composite ELA †[1]	Composite ELA[1]	Composite Math †[1]	Composite Math †[1]
Practice	Writing †[1]	Writing[1]	—	—
	Reading Comprehension[1]	Reading Comprehension †[1]	—	—

† indicates statistically significant effect.
[1] indicates a small effect size.
[2] indicates a moderate effect size.
[3] indicates a large effect size.

As shown in Table 2, findings from the fourth grade ELA trial indicate that teachers in the treatment group had, on average, higher scores on the measures of instructional practices for writing, vocabulary, and reading comprehension than the teachers in the control group. The size of the effects was large for writing and vocabulary, and medium for reading comprehension. Analyses also indicate that teachers in the treatment group had higher scores on the measures of content knowledge for writing, vocabulary, reading comprehension, and overall ELA than the teachers in the control group. These effects were large for teachers' reading comprehension scores, writing knowledge scores, and overall ELA knowledge scores, and small for vocabulary knowledge scores. Analysis of student data indicates that there were changes in student practices related to both

reading comprehension and writing for students whose teachers were assigned to the treatment group and participated in the OPD courses. These differences, however, were relatively small and were statistically significant for writing, but not reading comprehension. Larger changes in student knowledge scores were also found for students whose teachers were assigned to the treatment group. Again, these differences were small, and were statistically significant for the overall ELA score and vocabulary, but not for reading comprehension and writing.

Findings for the grade 7 ELA trial indicate that teachers who participated in the treatment group had, on average, higher scores on the measures of instructional practices for writing and vocabulary, but not reading comprehension, when compared to the teachers in the control group. The size of the effects was medium for writing and vocabulary, and negligible for reading comprehension. Analyses also indicate that, when compared to the control group, participation in the OPD courses had statistically significant effects on teachers' vocabulary and overall ELA knowledge scores, but did not have a significant effect on reading comprehension scores. Teachers' knowledge scores in writing were not reported due to unreliability in the writing knowledge scale. These effects were medium for teachers' overall ELA scores and small for both vocabulary and reading comprehension scores. Analysis of student data indicates that there were changes in student practices related to both reading comprehension and writing for students whose teachers were assigned to the treatment group. These differences, however, were relatively small and were statistically significant for reading comprehension, but not writing. Changes in student knowledge scores were also found for students whose teachers participated in the OPD courses. However, differences between the control and treatment groups were negligible and not statistically significant.

Findings from the grade 5 Mathematics trial indicate that teachers who participated in the treatment group had, on average, higher scores on the measures of instructional practices for algebraic thinking, fractions, and measurement than the teachers in the control group. The size of the effects was large for all three content areas. Analyses also indicate that, compared to the control group, participation in the OPD courses had statistically significant effects on teachers' algebraic thinking, measurement, and overall mathematics knowledge scores, but did not have a significant effect on fractions knowledge scores. These effects were large for teachers' overall knowledge of mathematics and measurement scores, medium for algebraic thinking scores, and small for knowledge of fractions. Analysis of student data indicates that there were changes in student content knowledge scores and that, compared to the control group, these changes were larger for students whose teachers participated in the OPD courses. These differences, however, were relatively small and were statistically significant for the overall mathematics scores, but not for the sub-scales.

Finally, findings from the grade 8 mathematics trial indicate that teachers who participated in the treatment group, on average, had higher scores on the measures of instructional practices for proportional reasoning, geometric measurement, and functions than the teachers in the control group. The size of the effects was large for proportional reasoning and functions, and moderate for geometric measurement. Analyses also indicate that, compared to the teachers in the control group, participation in the OPD courses had a larger effect on proportional reasoning, geometric measurement, and overall mathematics knowledge scores, and that the effect for the overall mathematics knowledge scores was statistically significant. The effect for overall mathematics score was moder-

ate, and small for proportional reasoning, geometric measurement, and function scores. Analysis of student data indicates that there were changes in student content knowledge scores and that these changes were larger for students whose teachers participated in the OPD courses. These differences were relatively small, and statistically significant for geometric measurement, functions, and overall mathematics scores, but not for proportional reasoning.

Summary

The series of four randomized controlled trials summarized here examined the effect that a series of three OPD courses had on teachers' knowledge and instructional practices, and subsequent effects on student achievement. Collectively, the four trials provide strong evidence that participation in a coordinated series of three OPD workshops has positive effects on teachers' instructional practices and content knowledge. Across all four trials, larger changes in teacher content knowledge also occurred for teachers in the treatment group. Each trial also provides evidence that participation in a coordinated set of three OPD workshops also has effects on students of the teachers in the workshops. Although these effects are smaller and occur less consistently across all the sub-domains targeted by the courses, in each trial, a statistically significant effect was found for at least one student measure. This is noteworthy given the timing of the collection of student outcome measures. For each trial, student measures were collected within weeks after teachers completed the final workshop. Moreover, two of the three workshops were completed during the same year in which student measures were collected. This timing provided very little time for teachers to alter their practices, become comfortable with these practices, and subsequently tailor these practices to their teaching style and the needs of their students. In addition, in some cases, students were likely exposed to content that was targeted by the workshops prior to the teacher's completion of the workshop.

Despite these shortcomings, the set of four randomized trials presented here provide a body of evidence that a series of online professional development courses that target specific student learning needs can have positive effects on teacher knowledge and instructional practices. Importantly, this study provides a body of evidence that teachers' participation in a coordinated series of OPD courses have effects that translate into improvements in targeted student outcomes. While further research is warranted to better understand the design features that maximize the effects of OPD and which explore the effects across a broader range of content areas and grade levels, the findings from this study support the continued implementation of online professional development similar to that developed and delivered in the e-Learning for Educators project.