When teachers learn to use technology, students benefit

WHAT THE STUDY SAYS

University faculty led a three-year teacher professional development initiative to integrate technology into instruction in two rural, high-poverty middle schools in the Southeast.

The study demonstrates that schoolwide professional development sustained over two to three years improves efficiency and effectiveness of instruction and produces significant increases in end-of-grade assessment scores, with the greatest gain after three years.

In addition, gains in student achievement as measured by standardized achievement tests in math and science are especially great for African-American students who have long-term exposure to teachers engaged in professional learning.

Study description

The study builds on past research about the relationships between teacher practice and beliefs, teacher practice

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At a glance

Teacher professional learning on technology integration improves efficiency and effectiveness of instruction and produces significant increases in end-of-grade assessment scores, particularly for African-American students in math and science.

THE STUDY

Blanchard, M., LePrevost, C., Tolin, A., & Gutierrez, K. (2016). Investigating technology-enhanced teacher professional development in rural, high-poverty middle schools. *Educational Researcher, 45*(3), 207-220.

WHAT THIS MEANS FOR PRACTITIONERS

Researchers provide evidence that sustained, content-specific professional learning aligned with student content standards and accompanied by resources to support implementation of learning does improve student learning.

Professional learning in this study aligned strongly with four of Learning Forward's Standards for Professional Learning (Learning Forward, 2011): **Resources, Learning Designs, Implementation,** and **Outcomes**. While other standards may have been integrated into the overall initiative, they were not discussed.

Over the three years of the study, each school received $81,000 for the purchase of technology tools, $39,000 for teacher stipends, and workshop materials (**Resources**). The professional learning employed multiple designs in authentic settings to support teacher learning and use of the technology (**Learning Designs**). The three-year initiative sustained implementation support with monthly online sessions and increased access to technology tools. Teachers reflected on their application lessons throughout the initiative (**Implementation**). Both teacher curricula and the application of the technology tools aligned with state content standards in math and science, and teachers had flexibility to apply the technologies to their own lessons (**Outcomes**).

As researchers noted, teacher professional learning "is more effective in increasing standardized assessment scores if it is done schoolwide and takes place over two to three years, with the most significant gains after three years" (p. 217). These gains are most effective, they say, when students have more years with teachers experiencing technology-enhanced professional development rather than more teachers over less time.

Researchers say that the study provides evidence that a long-term, schoolwide, technology-enhanced teacher professional learning program can impact teachers' beliefs about teaching and its effect on students, which can positively influence student achievement (p. 217).

The study highlights the effects of sustained experience with teachers who are learning and growing in their subject areas within well-designed, sustained, content-specific teacher professional learning on students who are most in need of substantive academic gains.

Reference

Learning Forward. (2011). *Standards for Professional Learning.* Oxford, OH: Author.

and student achievement, the nature of teacher professional development in technology use, the role of reflection in teacher professional development, and the availability of technology in schools with underrepresented or high-poverty students.

A university-based research team designed a professional development program to increase teachers' content knowledge, pedagogical content knowledge, and integration of technology into their classroom instruction.

The professional development program occurred over three years in two middle schools in neighboring districts. The program included 2,320 students in grades 6-8 and 20 teachers, mostly of math, science, and technology. Researchers used end-of-grade assessments in grades 6-8 math and grade 8 in science to measure changes in student achievement.

Questions

Researchers posed four research questions to guide their investigation.

1. Do teachers engaged in technology-enhanced professional development change their beliefs about teaching and their practice?
2. How do teachers reflect on the lessons they carry out before and during technology-enhanced professional development participation?
3. Do the mathematics and science assessment scores of students in classrooms where teachers participate in technology-enhanced professional development differ from students in nonparticipating teachers' classrooms? Does it matter how many technology-enhanced professional development teachers a student has?
4. Do the mathematics and science assessment scores of African-American students in classrooms of teachers participating in technology-enhanced professional development differ from those

of Caucasian students in those classrooms (p. 210)?

Methodology

The professional development program included three face-to-face summer institutes, each lasting three weeks, and three years of monthly online, synchronous collaboration sessions. Teacher curricula aligned with state content standards.

Teachers developed subject-area knowledge in math and science and subject-specific instructional practices and engaged in sustained practice within their subject areas with student-centered, inquiry-driven, hand-on investigations using handheld technology within time periods that represented the typical class length within the middle school.

After the first year, researchers adapted the summer curriculum to allow for more customization by teachers within different content areas. Researchers introduced new technology each year to expand teachers' familiarity and use within their classrooms. To support new instructional practices, schools received funding to purchase classroom and school equipment.

Teachers experienced a mean amount of 103 hours of professional development over the three years, with the range between 57.5 and 134.25 hours. Teachers represented a cross-section of teachers within the two schools in years of experience, gender, and age.

Students of participating teachers served as the treatment group, and students of nonparticipating teachers were the comparison group. Two-thirds of the students in one school were African-American and received free or reduced-priced lunch, with the number of students in poverty over 80% in the other school.

Analysis

Researchers applied a mixed-method design to answer the study's questions. They examined six teacher constructs using a variety of pre- and post-participation data collection tools. Teachers completed four instruments pre- and post-participation: subject-specific self-efficacy beliefs survey, pedagogical discontentment, teaching beliefs, and comfort with technology.

Video lessons, coded by two raters using a protocol, captured teachers' reform-based teaching practice before and during each year of the study. Teacher reflections and observer notes for a pre- and post-video lesson, coded by two raters using three categories of technology use (transformation, amplification, and replacement), measured technology integration.

Scores on end-of-grade state standardized assessments for grades 6-8 in mathematics and in grade 8 for science measured student achievement.

Students were divided into six groups based on the number of participating teachers they had (from zero to five) during their school experience. Slightly less than a quarter of the students had either no participating teacher or only one, with about 30% of students having two participating teachers during three years.

Results

At the end of the initiative, teachers had significantly higher student-centered beliefs, with a stronger focus on teacher-student relationships, than they did before their participation, when their beliefs focused more on teacher decisions.

After the study, teachers had a significantly higher familiarity and comfort with technology, particularly those used during professional development, than before participation. Teachers' use of technology moved along the continuum from replacement to transformation.

One teacher used technology as replacement, without change in classroom practice, student learning, or goals. More than half of the teachers' use of technology was coded as amplification, using technology to be more efficient and effective with no actual change in the learning or teaching task. More than a third of the teachers used technology in transformational ways, altering the teacher role and instructional practice to change how students learn.

All teachers noted positive effects of their technology integration. No teacher noted negative effects. There were no significant pre-post differences in teachers' pedagogical discontentment, self-efficacy, or use of reform-based teaching practices.

Researchers applied linear regression analysis to 96% of the total student achievement scores from both schools. The number of participating teachers a student had made a significant impact on 8th-grade math and science scores. In short, the more participating teachers students had, the higher their scores. In math, the increase for all students was 0.07 in math and 0.08 in science. For African-American students, this increase was even more significant: 0.14 in math and 0.19 in science.

Parallel analyses to examine separate effects on Caucasian students or student gender yielded no significant effect. Researchers applied statistical analyses to examine the relationship between ethnicity and the number of participating teachers students had. They report a significant main effect for the years of participating teacher by ethnicity.

At the end of years one and two, Caucasian students scored significantly higher than African-American students. This held true if they experienced zero, one, or two years of participating teachers. At the end of year three, for students who experienced three years of participating teachers, there were no significant differences between the scores of African-American and Caucasian students.

Researchers discuss the paradoxical results. They acknowledge that teachers

did not make substantial changes in their instructional practices. This suggests that changes in teaching using technology may not be observable using the Reformed Teaching Observation Protocol (an instrument for measuring changes in teaching practices) or may occur without shifting to reform-based teaching practices.

Teachers did not experience pedagogical discontentment, yet their students benefited from increased use of technology. In fact, the benefits are cumulative.

Teacher reflections did reveal changes in teacher technology practices, although the observation protocol doesn't note those changes. While not measured, researchers noted student motivation and excitement about learning during observations and teacher reflections.

Limitations

Researchers noted several limitations. First is the specific context of the study — rural, high-poverty middle schools in the Southeast. The second is the small population of teachers and students.

Researchers also noted that four of the 20 teachers included in the study did not teach math or science. One taught language arts and three others taught technology. They acknowledged using a single measure of student achievement.

Another limitation, not mentioned by researchers, is the likely spillover effect of the treatment on other teachers within the school, especially given the size of the faculty within each math and science department and the schoolwide availability of technology for use by all teachers and students. ■