LEARNING POLICY CENTER

UNIVERSITY OF PITTSBURGH
LEARNING POLICY BRIEF
Volume 1 | Issue 5 | December 2008
www.learningpolicycenter.org

The purpose of this Learning Policy Center brief is to inform districts and schools about the necessity of implementing high quality professional development alongside changes in curriculum in order to see improvements to teaching and learning.

KEY FINDINGS

Smart Use of District Resources: Curriculum Change Must Be Coupled with Quality Professional Development for Teachers

by Christian Schunn

Curriculum change is an omnipresent feature of school district life: every year, a significant number of teachers teach using curricular materials they have not used before. Administrators frequently ask teachers to make these changes without providing professional development. This kind of change hurts student learning. The research described in this brief suggests that districts would make more effective use of their resources by implementing curriculum change only when high quality supporting professional development accompanies that curriculum change.

Why is curriculum change so common? Regular changes in what curricular materials teachers use come from a wide variety of sources: calls for changing teaching methods from external research, change in adopted curricula with change of school or district administration, and changing external pressures. It is relatively easy to raise money for new textbooks or hands-on materials because they appear to give very salient, direct benefits to students. In addition, there is a constant flow of new teachers to the district or old teachers to new teaching roles, and thus even the same curriculum in a district can represent curriculum change to many teachers.

Why does using new curricular materials require professional development? There is a common belief that textbooks supply all the content and teachers can just use the same general teaching strategies regardless of material. However, each new set of curricular materials comes with new challenges for the teacher. There may be new underlying content with which the teacher is unfamiliar, especially when the teacher is a generalist (as in the typical case of elementary instruction), or when the teacher is teaching out of area (as is commonly the case in science instruction). For example, sometimes chemistry teachers are asked to teach biology or environmental science. But new content can even be an issue for teachers using a new book for a course they have taught before. When teachers do not deeply understand the underlying content being taught, they can reinforce rather than correct student misconceptions, be unable to answer student questions, or do a poor job of deciding which content to emphasize and which content to skim or skip entirely.

Another common challenge of new curriculum materials is that they often require a different teaching method than that to which many teachers are accustomed. Recent reforms in reading, mathematics, and science have produced new

curricula that can be extremely effective, but require teachers to shift from a teacher-centered lecturing approach to an interactive, student-centered teaching style (e.g., whole class discussion, project-based learning, teamwork). Applying more conventional pedagogical methods to reform materials is common, but far from ideal: the new curricula critically depend upon the teacher adopting new roles in the classroom, such as scaffolding student attempts to solve problems rather than directly demonstrating procedures. When students are asked to do more cognitively demanding tasks (such as those found in the newer curriculum), they need more help—and a different kind of help—not less. Teachers who are unprepared to teach those difficult tasks cannot provide the kind of help that students need.

I argue that intensive, content- and curriculum-oriented professional development (PD) is needed for teachers to use these newer curricula effectively. Such PD must include: 1) sufficient hours to support the teacher, and 2) attention to the disciplinary content and specific activities found in the curriculum materials. In this brief, I will discuss our findings from multiple projects that explored how teachers most effectively implement a new inquiry-based science curriculum.[1] Teachers who received quality PD reaped great benefits in terms of their own instruction and student achievement. However, teachers that did not receive the same PD actually experienced large decreases in student achievement compared with teachers who stayed with the traditional curriculum. I consider what these findings mean for school districts and how they can make the best use of their resources in regard to PD that matters for teaching and learning.

Teachers who received quality PD reaped great benefits in terms of their own instruction and student achievement. However, teachers that did not receive the same PD actually experienced large decreases in student achievement compared with teachers who stayed with the traditional curriculum.

Effects of PD on Teaching and Learning with Reform-Based Curriculum

Students derive many benefits when their teachers attend quality professional development workshops in conjunction with curriculum change:

- *Students learn significantly more content*. In our work, students using the new materials with teachers that attended the professional development saw a twofold increase in learning basic science knowledge compared to students using older, traditional curricular materials. In contrast, when teachers changed curriculum and did not attend PD, their students showed an actual decrease in content learning relative to learning under the old curriculum. Achievement of students in multiple sub-groups reflected the benefit of the new curriculum materials with teacher PD, but the students from traditionally underserved minorities saw a six-fold benefit. Thus, students at the lowest levels of prior achievement received the greatest benefit when taught the new curriculum by teachers who attended the professional development.
- *Students become more interested in the subject matter*. When teachers attended quality PD, their students showed significant growth of interest in pursuing science in later coursework and in pursuing careers in engineering. It is likely that the changes in student interest and the gap-closing results are linked: successfully implemented curricular materials gave students a clear motivation to learn science.

Teachers derive many benefits from attending quality teacher professional development workshops:

- *PD workshops can fill gaps in teachers' content knowledge related to the*

[1] In the brief, I only describe the specific details of one representative study in one district. However, the recommendations in this brief are based on my experiences implementing reform science curricula in urban districts across five states distributed across all four continental time zones. The districts varied in size from hundreds of thousands of children to only a few thousand children.

Learning Policy Center | 5807 WWPH 230 South Bouquet Street | Pittsburgh, PA 15260-5189 | P: 412.624.7050 | F: 412.624.2662

curriculum being taught. Because reform-based curricula require the teacher to be adaptive to the needs of their particular students, these curricula critically depend upon the teacher deeply understanding the content being taught and thus being able to answer important questions about the lessons in the curriculum: What are the big ideas, how do they relate to one another, and what evidence/reasoning underlies those big ideas? PD creates the opportunities for teachers to develop this deeper understanding of what they are teaching.

- *Teachers can learn ways to effectively implement the new teaching methods connected with a reform-based curriculum*. Many reform curricula require new teaching methods (e.g., group-work, project-work, extended class discussions), and these new methods can be implemented poorly without support. For example, rather than viewing student presentations as simply a method to assess each student's overall performance (i.e., assign a grade), teachers in our workshops learned how to use student presentations as a way to diagnose and repair student confusions about content and build understanding across the whole class.
- *Teachers can learn the implementation tricks of a new curriculum*. In addition to learning new pedagogical approaches, teachers need to learn many little tricks and strategies to teach a curriculum effectively and efficiently. Reform-based curricula often have hands-on activities that critically depend upon the materials working just right. Teacher PD helps to quickly pass this knowledge on, rather than requiring each teacher to learn it through trial and error.

School districts typically have the right to mandate curricular material changes, and schools districts have a policy of providing new curricular materials to teachers regardless of whether they attend supporting professional development workshops. Given our findings, this policy can result in considerable waste of limited district resources and weak overall improvements in student learning.

Because of common agreements with teacher unions, school districts often have trouble in mandating teacher participation in particular professional development workshops. At the same time school districts typically have the right to mandate curricular material changes, and schools districts have a policy of providing new curricular materials to teachers regardless of whether they attend supporting professional development workshops. Given our findings, this policy can result in considerable waste of limited district resources and weak overall improvements in student learning. In addition, teachers who are in the most need of PD for successful implementation (e.g., have the lowest performing students, are themselves relatively new to teaching, have had the least amount prior PD experiences) are the ones least likely to attend voluntary PD opportunities (Porter et al., 2003).

In our study, the approximate cost to the district for the professional development was $500 per teacher. By contrast, the approximate cost to the district of purchasing the new materials was approximately $1000 per teacher. In sum, many thousands of dollars were wasted on purchasing materials for teachers who used them ineffectively due to lack of supporting professional development. In this case, distributing new materials to only those teachers choosing to attend professional development would have provided sufficient savings to pay for professional development for twice as many teachers.

Recommendation: *Mandate PD for teachers who are adopting a new reform-based curriculum.* If a school or district cannot mandate attendance in quality professional development that supports new curricular materials adoptions, then they should make distribution of new materials contingent upon attending supporting professional development.

Organizing Professional Development

In very large school districts, it is often not possible to organize high quality professional development workshops for all of the relevant teachers of the given curriculum in a given year. For example, there may be too many

Learning Policy Center | 5807 WWPH 230 South Bouquet Street | Pittsburgh, PA 15260-5189 | P: 412.624.7050 | F: 412.624.2662

Methodology Highlights

This study[2] examined the effects of new science curricular materials with and without supporting teacher professional development on student learning of core science content in a mid-sized urban public school district. The new curricular materials altered the method of instruction and learning from what the established, more traditional curriculum offered, although the physical materials used for the lessons remained similar across the two curricula.

- The established curriculum consisted of hands-on scripted inquiry in which students conducted and interpreted experiments according to tight scripts. The teacher's primary role was to setup each experiment and lecture on the canonical interpretation at the end.
- The reform curriculum consisted of design-based learning in which students designed an alarm system to meet a need in their lives. In designing the system, students followed a systematic engineering method for design, learning science concepts through design. The teacher's role shifted from lecturer to facilitator, pushing students to formalize their understandings of how electronics materials work and share it with the class.

Five, 4-hour teacher professional development workshops supported successful implementation in a number of ways:

- teachers tried the materials as learners, which enabled them to find and repair gaps in their own science content knowledge
- teachers discussed various roles of a teacher in supporting student learning in a design-based curriculum
- teachers shared tricks for implementing particular activities in the new curriculum

There were three groups of teachers and students that were statistically equated by both teacher and student backgrounds:

- **Established curriculum.** Five teachers (with 405 students) who continued to use the old curricular materials and had already received professional development workshops for the use of those materials
- **Reform curriculum with PD.** Thirteen teachers (with 977 students) who switched to the new materials and attended the PD workshops focused on implementing the new materials
- **Reform curriculum without PD.** Five teachers (with 274 students) who switched to the new materials but did not attend the PD workshops focused on implementing the new materials

Student learning was measured using pre and post-tests of basic electricity concepts, and statistical analyses compared the relative learning gains across the three conditions.

Effects on teachers were found through extensive classroom observations prior to, during, and after PD workshops as well as through pre-post measures of content knowledge gains.

[2] These methodological details refer to the main study referenced in this brief (Mehalik et al., 2008). However, the findings regarding student interest in pursuing science/engineering careers and different effects of reform curriculum change on different subgroups of students are based on other studies we have conducted on these reform curricula (Doppelt et al., 2008; Ellefson et al., 2008; Reynolds et al., in press).

Learning Policy Center | 5807 WWPH 230 South Bouquet Street | Pittsburgh, PA 15260-5189 | P: 412.624.7050 | F: 412.624.2662

teachers (i.e., more than 30) with which to engage at once in an interactive workshop format that is required for high quality learning experiences. Or competing scheduling constraints may prevent many teachers from attending in a given year. Either way, the district is likely to have to create waves of professional development across multiple years. Thus, the tying of materials distribution to PD attendance could result in a slight delay of materials distribution.

Many thousands of dollars were wasted on purchasing materials for teachers who used them ineffectively due to lack of supporting professional development. In this case, distributing new materials to only those teachers choosing to attend professional development would have provided sufficient savings to pay for professional development for twice as many teachers.

In smaller school districts or schools selecting their own curricular materials, having multiple rounds of professional development may not be possible within the district. These schools or districts may profit from partnerships with nearby districts in curricular material selection, material refurbishment, and teacher professional development.

The Necessity of High-Quality Professional Development

In-depth professional development can be expensive and difficult to provide. As all things worth doing, teacher professional development can be done poorly, and often is. In fact, the typical low quality of teacher professional development has made many teachers jaded towards all teacher PD, which in turn reduces attendance at even the worthwhile ones. We observed a number of features of professional development that are critically important.

PD cannot be crammed. When new curricular materials are distributed to large numbers of teachers, it is difficult to find sufficient time and monetary resources to schedule high quality professional development for all teachers. One temptation is to have a short overview session during a single district in-service day. Another temptation is to have a multiple-day workshop just prior to start of the school year. Neither of these approaches is likely to be successful, especially when the curricular materials change involves substantial changes of practice on the part of the teacher, which is commonly the case for curricular changes worth doing.

Significant curricular material changes require teacher professional development that is much longer than just a few hours. Some research suggests that at least 20 hours are required to see any significant benefits (Garet et al., 2001). Such an amount of professional development allows for some attention to the content of the new materials, new methods of teaching that they require, and details of successful implementation of particular lessons.

PD must overlap with classroom implementation. Teacher professional de-

Summary Policy Recommendations

1. To ensure improvements in student achievement and instruction, it is essential that districts provide teachers with intensive professional development to support the adoption of the new curriculum material.

2. Districts should strive to distribute new curriculum materials only to those teachers who attend the professional development associated with those materials.

3. In order to be effective, teacher professional development accompanying curriculum change should be extensive (20 hours or more), sustained (occurring over the time of classroom implementation), and address the specific disciplinary content and activities found in the curriculum.

Learning Policy Center | 5807 WWPH 230 South Bouquet Street | Pittsburgh, PA 15260-5189 | P: 412.624.7050 | F: 412.624.2662

velopment should also be distributed over the time of classroom implementation, in the form of site-based coaching or distributed workshops. Multiple day workshops at the beginning of the year are likely to be wasted dollars because of limits to how much information can be retained prior to opportunities to practice what was learned.

Workshops entirely before implementation suffer a host of other problems, regardless of how many days they include:

- Teachers often forget critical information by the time they need the information in their classrooms if there is a long delay between workshop and classroom implementation, as there likely is from summer workshops. In addition, for teachers, as with students, information acquired in a massed session is especially prone to rapid decay (in contrast to information acquired over sessions spread out in time).
- Many questions do not arise in the teachers' minds until faced with actual students and their reactions to new teaching methods. As a result, without follow-up after implementation workshops, teachers often abandon new curricular materials very early into initial use because they lose confidence in a successful implementation.

PD must connect to the materials being taught. PD can often be relatively generic (e.g., about a new teaching strategy in the abstract, or about general disciplinary content knowledge, but not connected to how that knowledge is taught in this particular curriculum). Making connections of teaching methods and content knowledge to the particular curriculum requires time. For more information regarding the effects of content-based PD, see Richard Correnti's recent Learning Policy Center brief, "Professional Development as a Lever for Changing Teacher Practice" (March 2008).

Recommendation: *Districts should not spend any money on PD that is insufficient in quantity to support high quality classroom implementation*. PD must be distributed over time and must overlap with classroom implementation. It is better to do high quality PD with fewer teachers than low quality PD with many teachers (Garet et al., 2001).

Summary

This brief argues that curricula change must be accompanied by professional development in order for school districts to see increases in student learning and quality teaching. In addition, it is important to highlight that the recommendation for tying new curricular materials to attendance at supporting professional development workshops does not apply to workshops that are poorly done. If insufficient resources exist to implement professional development that is distributed across time and with sufficient total time, then the new curricular materials should not be adopted at all, assuming that student learning was the main motivator for curricular change. Such curricular change can be likened to purchasing computers but installing no outlets to power them.

Further Reading:

Doppelt, Y., Mehalik, M. M., Schunn, C. D., & Krysinski, D. (2008). Engagement and achievements in design-based learning. *Journal of Technology Education, 19*(2), 21-38.

Ellefson, M., Brinker, R., Vernacchio, V., & Schunn, C. D. (2008). Design-based learning for biology: Genetic engineering experience improves understanding of gene expression. *Biochemistry and Molecular Biology Education, 36*(4), 292–298.

Garet, M. S., Porter, A. C., et al. (2001). What Makes Professional Development Effective? Results From a National Sample of Teachers. *American Educational Research Journal 38*(4), 915-945.

Guskey, T. R. (2002). Does it make a difference? Evaluating professional development. *Educational Leadership, 59*(6), 45-51.

Little, J. W. (1989). District Policy Choices and Teachers' Professional Development Opportunities. *Educational Evaluation and Policy Analysis, 11*(2), 165-179.

Loucks-Horsley, S., & Matsumoto, C. (1999). Research on professional development for teachers of mathematics and science: The state of the scene. *School Science and Mathematics, 99*(5), 258-271.

Mehalik, M. M., & Doppelt, Y., & Schunn, C. D. (2008). Middle-school science through design-based learning versus scripted inquiry: Better overall science concept learning and equity gap reduction. *Journal of Engineering Education, 97*(1), 71-85.

Porter, A. C., Garet, M. S., Desimone, L. M., & Birman, B. F. (2003). Providing effective professional development: Lessons from the Eisenhower Program. *Science Educator, 12*(1), 23–40.

Reynolds, B., Mehalik, M. M., Lovell, M. R., & Schunn, C. D. (in press). Increasing student awareness of and interest in engineering as a career option through design-based learning. *International Journal of Engineering Education*.

Supovitz, J. A., & Turner, H. M. (2000). The effects of professional development on science teaching practices and classroom culture. *Journal of Research in Science Teaching, 37*(9), 963-980.

Learning Policy Center | 5807 WWPH 230 South Bouquet Street | Pittsburgh, PA 15260-5189 | P: 412.624.7050 | F: 412.624.2662

The mission of the **Learning Policy Center** is to foster high quality learning environments for both students and professionals in public schools. Toward that end, we aim to infuse into policy decisions high quality, timely research on effective teaching and learning and on school, district, and policy conditions that support their improvement. **The Learning Policy Center** utilizes the rich talent pool of the University of Pittsburgh School of Education, the Learning Research and Development Center, the Institute for Learning and other regional assets to connect high quality learning research with education policy decision-makers.

Christian Schunn is an Associate Professor of Psychology, Intelligent Systems, and Learning Sciences and Policy at the University of Pittsburgh. You can contact him at: **schunn@pitt.edu**

The editorial board for this brief included Lindsay Clare Matsumura, Richard Correnti, Heather Bachman, Julia Kaufman, and Michael Siciliano.

Learning Policy Center | 5807 WWPH 230 South Bouquet Street | Pittsburgh, PA 15260-5189 | P: 412.624.7050 | F: 412.624.2662