Designing professional development

Effective professional development requires ongoing reflection, decision making, and adjustments.

Professional developers face a number of decisions and dilemmas as they design and carry out learning opportunities for teachers. Professional development that aims to transform teaching and build substantial knowledge of science and mathematics content is not a simple task of "plan and implement." Rather, it involves staying alert to the changing context in which one works, the stages of development teachers move through as they develop new knowledge and skills, and a host of other dynamics at work.

National Institute for Science Education (NISE) researchers Susan Mundry and Susan Loucks-Horsley examined four cases of professional development. The case studies underscore the importance for those who plan and implement teacher learning activities to assess their progress at many points along the way, to acknowledge the dilemmas and decisions that emerge for them, and to communicate decisions and rationale with others to build and maintain commitment.

Teacher professional development is an important, and often controversial, part of systemwide education reform. Part of the research here at WCER focuses on how to make professional development more meaningful for teachers and, by extension, more beneficial to students.

NISE researchers Susan Mundry, Susan Loucks-Horsley, and Mary Kennedy have made important contributions to how the enormous investment in teacher professional development could be targeted on more effective practices. Mundry and Loucks-Horsley report that successful professional development programs balance pragmatic vs. philosophical concerns, are sufficiently flexible to reach all teachers in the school, and guide teachers in whether to use existing curriculum materials or to develop new materials. Kennedy has found that professional development programs that focus on subject matter knowledge and on student learning of particular subject matter affect student learning more than do programs that focus mainly on teaching practices.

What's the best way to reward effective teaching? New research from WCER's Consortium for Policy Research in Education has important implications for school-based performance award programs. (SBPA programs pay teachers bonuses when their schools meet performance improvement goals.) Although some programs in place are weak in their motivational power, they can be improved to make their effects worth the effort.

For more information about WCER research, visit our Web site at *http://www.wcer.wisc.edu.*

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One study analyzed districtwide professional development at the planning stage. Two of the case studies were retrospective analyses of schools involved in a completed multiyear reform project. The fourth case study examined professional development design in the middle of a five-year reform initiative. Here are some dilemmas faced by professional developers:

Focus: philosophical or pragmatic?

One dilemma professional development programs face is whether to focus on philosophical issues, such as changing teachers' views of learning, or to focus on more pragmatic issues, such as the use of specific instructional approaches and curriculum materials and how the focus shifts over time for teachers and professional developers. One case study suggests that a program guided solely by practical issues lacks a vision for program improvement. On the other hand, a program guided solely by philosophical issues ignores the realities of

teachers' lives. It's important, therefore, to maintain a balance between a practical and philosophical perspective, with the understanding that at different times in the process professional development might focus more on one or the other, but that neither is sufficient alone.

Audience: fewer teachers in depth, or every teacher?

Should staff developers try to design an intervention to reach all teachers, or one that works in more depth with fewer teachers? The case studies reviewed here suggest that professional development programs need special features to reach all teachers. It is not simply a matter of providing everyone with the same experience. The strong influence of context in all the cases suggests that learning experiences vary greatly from teacher to teacher and setting to setting.

For professional developers to reach all teachers they need both a material infrastructure and a human infrastructure in the context in which they are working. The material infrastructure is the articulated foundation of what the requested change entails, such as clear direction, a reform curriculum, and vision. The human infrastructure is the culture for learning and reform that is established in the school or district that encourages a community of practice to develop.

The case studies suggest that:

▶ Working successfully with all teachers requires that the schools or districts have an articulated culture for change and available resources, including knowledge and expertise and time for teacher learning.

▶ Professional developers need to hold high standards for teacher learning and to be clear about the goals. They must work to build a shared commitment among teachers to reach the high standards. Watering down standards or allowing wide variety in approach in order to include all teachers results in uneven implementation and unclear practices.

▶ A process for rolling admission to professional development initiatives is necessary to involve new or reassigned teachers, especially in urban settings where turnover is high.

Curriculum: develop or adopt?

A critical decision in the design of professional development is whether to engage teachers in curriculum development or help them learn to use existing curriculum materials.

Professional developers must weigh carefully the costs and benefits of curriculum development

Students benefit when professional development balances philosophical issues with pragmatic concerns.

opment is complex, combines different elements and strategies at different times, and is continuously evolving and changing. There are no exact models that can be taken and applied from place to place. Instead, there are design elements that must be considered as one plans and provides professional development for different contexts.

Context-sensitive professional development requires professional developers to have different skills and abilities than they have needed in the past. These include being able to:

▶ assess the context within which they are working

▶ draw upon the knowledge base on standards-based learning and teaching of science and mathematics, professional development, and educational change

▶ work with local clients to design and/or tailor the professional development program, and

▶ gather data, reflect on results, and make program improvements.

The Professional Development Design Framework (Loucks-Horsley et al.) suggests that planning and implementing effective professional development for science and mathematics teachers requires ongoing reflection, decision making, and adjustments. Effective professional development programs are ones that are designed specifically to address a number of elements, including goals and purposes, knowledge bases, and the context within which professional development will take place. Successful professional developers consider these elements as important "inputs" to the professional development design. Further, they plan for the design to change over time to keep pace with changes in the environment and teachers' learning goals.

Loucks-Horsley, S., Hewson, P. W., Love, N., & Stiles, K. (1998). *Designing professional development for teachers of science and mathematics.* Thousand Oaks, CA: Corwin.

For more information visit the NISE Web site at *http://www.wcer.wisc.edu/NISE.*

Loucks-Horsley: "Professional development must remain alert to the changing context."

over curriculum adoption or adaptation. Professional developers can provide a service by helping educators choose quality curricula, and by planning how to direct the available resources to effective curriculum implementation rather than curriculum development.

The case studies suggest:

▶ When curriculum implementation is a goal, professional developers should help teachers review and select curriculum materials that are a good fit for their context, instead of engaging teachers in curriculum development.

▶ If full-scale curriculum adoption is not possible but revised curriculum is desired, professional developers should create opportunities for teachers to engage in their own learning of science and mathematics through specific supplementary activities and/or curriculum replacement units.

▶ If professional developers engage in curriculum development or adaptation, make sure that teachers have the content knowledge needed to translate reform ideas into specific and coherent curriculum, and that they have ample time to develop, test, and refine the curriculum materials.

A framework for planning and analyzing

The case studies also support other findings from the NISE. In their study of effective professional development for science and mathematics teachers, Loucks-Horsley, Hewson, Love, and Stiles (1998) learned that outstanding professional devel-

Inservice teacher education: Form vs. substance

How could inservice professional development programs be made more effective for teachers of mathematics and science? In other words, how could inservice programs be modified to better influence student achievement?

By focusing more on teachers' subject matter knowledge and on *how students learn* particular subject matter, rather than on discussing the format of the programs or on teachers' pedagogical strategies.

NISE researcher Mary Kennedy recently examined literature on the effectiveness of several

visitations, and so forth. Much less has been said about what the *content* of such programs should be.

Kennedy focused exclusively on studies that examine the effects of programs on student learning, a surprisingly small literature. Her review suggests that the differences among programs that mattered most were differences in the *content* that was actually provided to teachers, not differences in program form or structure.

By *content* Kennedy means not necessarily the school subject-matter content, but rather the topics that are dealt with in a professional development program. Inservice teacher education content might include, for instance, classroom management and discipline techniques, techniques for working with parents, legal definitions of sexual harassment, knowledge about specific school subject matter, knowledge about how students learn specific school subject matter, or knowledge of how to teach specific school subject matter. "When I say that reformers fail to discuss the content of inservice teacher education, I mean that they do not discuss which of these topics are most important for teachers," Kennedy says. "Instead, they discuss the length of time that should be devoted to inservice programs, the schedule of the programs, the way in which teachers are engaged in the programs, or other features that are unrelated to the content actually taught to teachers."

Other findings

Kennedy's analysis found evidence that contradicts many assumptions about the effectiveness of inservice teacher professional development programs.

▶ Contact time: The total contact time with teachers in these programs was not the most important predictor of effects on student achievement. All of the very brief mathematics inservice programs in one group studied demonstrated greater influences on student learning than did one very time-intensive program. A study by WCER researchers Thomas P. Carpenter, Elizabeth Fennema, and others, *Using knowledge of children's mathematics thinking in classroom teaching* (1989), used less contact time than some other studies, with equally positive effects on student learning.

▶ Concentrated or distributed contact hours: While the science studies provided some evidence for an advantage to distributed time, the studies in mathematics did not support this

Teachers benefit when professional developers emphasize the content of professional development over its format.

teacher professional development programs in mathematics and science. The widespread distaste for one-shot workshops in teacher professional development has led to many proposals for alternative approaches to inservice teacher education, Kennedy says. Surprisingly, none of these proposals addresses the *content* of inservice teacher education. Instead, most emphasize structural or organizational arrangements, for example, total contact hours, distribution of contact hours, and whether the program includes in-class visits and coaching.

Much of the reform rhetoric about professional development is geared toward the *form* that such development should take. This literature advocates collaboration among teachers, schoolwide participation in professional development, programs that extend over time and are interspersed with classroom practice, programs that include classroom

Many assumptions about professional development programs turn out to be unfounded, especially in mathematics and science classrooms.

How teachers benefit

In the studies Kennedy reviewed, programs that focused mainly on teachers' pedagogical strategies demonstrated smaller influences on student learning than did programs that focused on teachers' knowledge of the subject or on how students learn the subject. Moreover, the knowledge that these more successful programs provided tended *not* to be purely about subject matter—that is, they were not courses in mathematics—but instead were about *how students learn* that subject matter.

Kennedy suspects that this type of program content benefits teachers in two ways. First, to understand how students understand particular content, teachers also have to understand the content itself, so that subject-matter understanding is likely to be a byproduct of any program that focuses on how students understand subject matter. Second, by focusing on how students learn subject matter, inservice programs help teachers learn both what students should be learning and how to recognize signs of learning and signs of confusion. So teachers leave these programs with very specific ideas about what the subject matter they will teach consists of, what students should be learning about that subject matter, and how to tell whether students are learning or not. This content makes the greatest difference in student learning.

This research was jointly sponsored by the American Institutes for Research and the National Science Foundation. For more information about this research contact NISE at *http://www.wcer.wisc.edu/NISE* or contact Kennedy at mkennedy@msu.edu.

Carpenter, T. P., Fennema, E., Peterson, P. L., Chiang, C.-P., & Loef, M. (1989). Using knowledge of children's mathematics thinking in classroom teaching: An experimental study. *American Educational Research Journal, 26*, 499–531.

See also Porter, A. C. (1989). A curriculum out of balance: The case of elementary school mathematics. *Educational Researcher, 18*(5), 9–15.

Kennedy: "Professional development programs should emphasize how students learn."

hypothesis. The mathematics program with the most substantial influences on student learning, the Carpenter/Fennema study, consisted of a summer institute with no seminars distributed during the next academic year. Conversely, the program that demonstrated negative effects on student learning provided both seminars and in-class visitations throughout the school year.

▶ In-class visitations: Four of the programs included in Kennedy's review provided teachers with in-class visitations, yet none of these programs produced noticeably greater influences on student learning. In fact, one of these programs was least successful of all the programs included in this study. The effects that these programs demonstrated on student learning do not fall into a pattern that would justify in-class visitations as necessarily a key ingredient in inservice teacher education.

▶ Schoolwide or individual programs: Some researchers argue that inservice programs should be targeted toward a school's entire teaching staff rather than toward individual teachers. They reason that schoolwide programs have more likelihood of influencing a critical mass of teachers and that teachers thus influenced might be more likely to encourage one another toward new teaching practices. But the programs Kennedy studied that worked with whole schools demonstrated the smallest influences on student learning. Thus, providing services to whole schools may not be the most important feature of inservice teacher education.

School incentive programs deserve attention

Do school-based performance awards motivate teachers to teach students to higher performance levels?

WCER's Consortium for Policy Research in Education (CPRE) has conducted extensive research on the operation of school-based performance awards (SBPAs) and determined that such awards and their goals for student achievement have the potential to work. Although the ones in place are weak in their motivational power, such programs can be improved to make their effects worth the effort.

SBPA programs pay teachers bonuses when their schools meet performance improvement goals. They help channel teachers' work to the school system goals included in the performance measure, largely student achievement in core academic subjects. The CPRE research, which aimed to understand how these programs affected teacher motivation, was directed by UW–Madison Education Professor Allan Odden and conducted by Professors Carolyn Kelley and Herbert Heneman III and Researcher Anthony Milanowski. Their research focused on SBPA programs in Kentucky and Charlotte-Mecklenburg, NC, that pay teachers bonuses and one program in Maryland that provides the award to schools to use for activities and improvements.

Teachers found many of the outcomes of the SBPA programs valuable, showing that they are a potentially important element of a comprehensive strategy to improve student performance. Among the most valued outcomes were improved student achievement, teachers' personal satisfaction from increasing student achievement, professional recognition for doing a good job, and the monetary bonus. In some schools competing goals created some "noise"—for example, conflicts between the need to emphasize basic skills, the importance of instilling a "love of learning," or pursuing a different program emphasis, as at magnet schools. Still, the programs helped teachers understand that higher achievement in academic subjects should comprise core school goals.

The most likely limitation of the power of SBPAs to motivate is teachers' uncertainty that their effort will lead to goal attainment. On average, teachers' confidence that their own increased effort would lead to attaining student achievement goals was lower than expected, with wide variability due to several factors. If the school had previously met its goals and then received bonuses there was a higher perceived probability of success. Another factor was the perceived presence of system enablers—organizational characteristics such as principal leadership, professional development, and student achievement feedback and analysis—that help schools reach their goals. Kelley and colleagues have concluded that more attention needs to be focused on raising teacher expectancy through such enablers.

Teachers rate outcomes

Possible outcomes of SBPA programs may be grouped into four clusters. Teachers rated outcomes in the first two clusters as highly desirable and outcomes in the last two clusters as undesirable.

1. Goal Attainment (bonus pay, funds for school improvement, personal satisfaction from meeting the goals, public recognition)
2. Learning (having clear goals, professional development opportunities, working cooperatively with other teachers, having students learn new skills, satisfaction that student performance increased)
3. Stress (more pressure and job stress, working more hours, less freedom to teach things unrelated to the goals)
4. Sanctions (loss of pride, public criticism, loss of job security, intervention)

Heneman

Kelley

Milanowski

Odden

WCER researchers honored

Four WCER researchers have recently received recognition from campus and national organizations.

Senior Scientist Lynn McDonald was named in February to a 16-member President's Advisory Council on Youth Drug Use, a federal antinarcotics program. The Council will develop recommendations on drug abuse prevention, education, and treatment for the Clinton administration's national drug control strategy. McDonald founded a program called Families and Schools Together (FAST) that uses regular multifamily meetings to address the factors that often lead to alcohol and drug abuse among children. FAST is widely used across the U.S. and internationally.

Gloria Ladson-Billings received a $50,000 Romnes Fellowship, funded by the Wisconsin Alumni Research Foundation and awarded by the research committee of the UW–Madison Graduate School. The fellowship provides research support for recently tenured faculty who have already made an impact on their fields. Ladson-Billings, a professor of curriculum and instruction, is nationally noted for her work on successful teachers of African American children and on critical race theory in education.

Walter Secada, professor of curriculum and instruction and director of WCER's Comprehensive Regional Assistance Center Consortium—Region VI, and Jennifer O'Day, assistant professor of educational policy studies, were named co-chairs of the U.S. Department of Education's Bilingual Education Research Council on the Education of Limited English Proficient Students. The Council will advise the Department on its research agenda for the coming decade across a broad range of topics.

Kenneth Zeichner, Hoefs-Bascom professor of curriculum and instruction, has been elected to the Board of Directors of the National Society for the Study of Education and has been elected to the executive committee of the board of directors of the American Association of Colleges for Teacher Education. AACTE is a national voluntary association of colleges and universities with undergraduate and/or graduate programs that prepare professional educators.

McDonald

Zeichner

Secada

Ladson-Billings

School incentive programs

The most important determinant of goal attainment was teachers' beliefs that their own effort would lead to goal attainment. The greater the average expectancy of teachers in a school, the greater the likelihood that the school would meet its student achievement goals. This finding held true even after controlling for minority enrollment and socioeconomic status.

Teachers were very concerned about school-based performance award programs being administered fairly. Such fairness perceptions were shown in how motivated teachers said they were by the program and whether they would like to see it continue. In short, research to date on SBPA programs suggests that they have the potential to work, but that the ones in place are weaker than expected in their motivational power because of teacher doubts about efficacy and administrative follow-through.

The SBPA programs studied had the basic elements in place: They were school focused, functioned on the basis of improvement at each site, and provided monetary awards. But many teachers doubted that their efforts would be sufficient to accomplish the goals and that teachers would receive the award if their efforts were successful. While teachers valued the monetary bonus, small bonuses (about $1,000 per teacher) had a weak motivating effect. The CPRE study recommends that bonus levels should be larger, between $1500 and $3000 per teacher per year.

Education systems need to do everything possible to convince teachers that, if their schools meet the performance goals, the bonuses will be awarded. And, as always, fairness in administration of the program must be obvious to ensure a convincing, positive motivational effect on teachers.

Kelley says, "This research takes us beyond the rhetorical criticism made by people who are ideologically opposed to these programs, as well as beyond the notion that just hanging an incentive out there will improve performance. We know what the key design elements are for such programs, and our research affirms their motivational potential."