Review of the Research:
Nine Components of Effective Professional Development

Prepared For

Texas Instruments' Educational and Productivity Solutions Division

by

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EXECUTIVE SUMMARY

The Professional Development Services group of Texas Instruments' (TI's) Educational and Productivity Solutions (E & PS) Division offers a variety of professional development services to teachers and districts, including face-to-face institutes as well as on-line courses. Professional development supported by scientifically based research (SBR) is of particular interest to TI's E & PS Division as state and local entities make decisions about which products and services to adopt or purchase based on the No Child Left Behind (NCLB) legislation which emphasizes that effective professional development should (1) improve teachers' knowledge in their content area; (2) be on-going, hands-on, and of high quality; and (3) give teachers the knowledge and skills they need to improve their instructional practices such that student achievement will be impacted.

The review of the research literature was organized around nine components of effective professional development. These components were identified through document reviews, particularly the three sources listed below, and interviews with key staff from TI's E & PS Division (see Institute for the Advancement of Research in Education, 2004). The nine components represent the elements of professional development that held constant across the sources and were in common with TI's approach to professional development.

1. *Providing Professional Development for Effective Technology Use*, a critical issue Web site produced by the North Central Regional Educational Laboratory (http://www.ncrel.org/sdrs/areas/issues/methods/technlgy/te1000.htm). On this site, the North Central Regional Educational Laboratory (NCREL) identifies 14 essential components of effective professional development.

2. Eight principles of effective professional development—identified from research as well as literature and best practice—on the Knowledge Loom Web site (http://www.knowledgeloom.org/pd/).

3. The National Staff Development Council's (NSDC) 12 standards for staff development, revised in 2001.

The nine components of professional development around which this literature review is based are that it: (1) addresses student-learning needs, (2) incorporates hands-on technology use, (3) is job-embedded, (4) has application to specific curricula, (5) addresses knowledge, skills, and beliefs, (6) occurs over time, (7) occurs with colleagues, (8) provides technical assistance and support to teachers, and (9) incorporates evaluation.

For this review, the best available evidence in each of the nine areas was identified and obtained. Each piece of evidence was evaluated in terms of the extent to which it aligned with the principles of SBR, as defined by Section 9101 of NCLB (2002) and by the National Research Council (Shavelson & Towne, 2002). Initially, a total of 92 abstracts, issue reports, journal articles, policy briefs, project reports, research reports,

technical reports, and textbooks were reviewed. Of these 92, 14 met minimal SBR standards: two could be deemed experimental studies and twelve were some type of quasi-experimental study (e.g., non-equivalent control group, time series).

In short, evidence supporting the nine components as characteristics of professional develop was found, though there was more evidence supporting the importance of some of the components than others. These findings are summarized in Table 1 below.

Table 1. Number of the 14 studies reviewed with supporting evidence for each of the nine components of effective professional development.

Components of Effective Professional Development	Experimental Studies with Supporting Evidence	Quasi-experimental Studies with Supporting Evidence
Addresses Student-Learning Needs	2	12
Incorporates Hands-on Technology Use	0	2
Is Job-Embedded	2	12
Has Application to Specific Curricula	2	12
Addresses Knowledge, Skills, and Beliefs	2	11
Occurs Over Time	0	3
Occurs with Colleagues	0	2
Provides Technical Assistance & Support to Teachers	1	2
Incorporates Evaluation	2	10

Based on the review of the available research literature regarding the components of effective professional development, the following recommendations are made. TI's E & PS Division should:

- Continue in its efforts to address the nine components of effective professional development when delivering either in-person or on-line professional development. While the circumstances associated with a particular professional development experience may dictate that one or more of the components may not be present, at present the available evidence does not provide sufficient guidance as to which, if any, of the components is more or less important than another.

- Make every effort to evaluate the effectiveness of the professional development services they offer through a comprehensive evaluation of student learning outcomes, participants' use of new knowledge, organization support and change, participants' learning, as well as participants' reactions. This evaluation should be focused on the four attributes of evaluation developed by the Joint Committee on Standards for Educational Evaluation: (1) utility, (2) feasibility, (3) propriety, and (4) accuracy.

- Consider conducting randomized controlled trials that randomly assign individuals to experimental and control groups in order to empirically ascertain the effectiveness of the professional development they provide.

INTRODUCTION

Texas Instruments' (TI's) Educational and Productivity Solutions (E & PS) Division contracted with the Institute for the Advancement of Research in Education (IARE) in February 2004 to review the research literature regarding best available evidence relative to effective professional development. The review was organized around nine components of effective professional development. These components were identified through document reviews and interviews with key staff from TI's E & PS Division (see Institute for the Advancement of Research in Education, 2004) and synthesized from the following three main sources:

1.   *Providing Professional Development for Effective Technology Use*, a critical issue Web site produced by the North Central Regional Educational Laboratory (http://www.ncrel.org/sdrs/areas/issues/methods/technlgy/te1000.htm). On this site, the North Central Regional Educational Laboratory (NCREL) identifies 14 essential components of effective professional development.

2.   Eight principles of effective professional development—identified from research as well as literature and best practice—on the Knowledge Loom Web site (http://www.knowledgeloom.org/pd/).

3.   The National Staff Development Council's (NSDC) 12 standards for staff development, revised in 2001.

The nine components of effective professional development identified were that it: (1) addresses student-learning needs, (2) incorporates hands-on technology use, (3) is job-embedded, (4) has application to specific curricula, (5) addresses knowledge, skills, and beliefs, (6) occurs over time, (7) occurs with colleagues, (8) provides technical assistance and support to teachers, and (9) incorporates evaluation.

Texas Instruments' Educational and Productivity Solutions Division

The Professional Development Services group of TI's E & PS Division offers a variety of professional development services to teachers and districts, including face-to-face institutes as well as on-line courses. All instructors for professional development offered by E & PS are current or former classroom teachers, who have used TI products (e.g. TI-73, TI-83+, Navigator, Voyager 200, TI-89) with students in classrooms. Professional development practices supported by scientifically based research (SBR) are of particular interest to TI's E & PS Division as state and local entities make decisions about which products and services to adopt or purchase because of the No Child Left Behind (NCLB) legislation places new demands on educators at all levels. But perhaps no group will be more affected than staff development leaders. The accountability requirements under this federal program drastically reshape their roles. More notably, the legislation compels staff development leaders to refocus their perspectives and, in some

cases, to revise completely their efforts in the educational improvement process (Guskey, 2003).

Literature Review Purpose

Throughout NCLB there is a strong emphasis on ensuring that funds are used to support educational practices that are "based on scientific research." As part of an educational technology company, TI's E & PS Division would like to have the ability to support its claims that the professional development it offer is supported by SBR. At the outset, it is important to note that research designs typically employed to assess the impact of professional development on student learning have been qualitative or quasi-experimental in nature rather than experimental.

Criteria for Selection of Studies

In the beginning stages of this review of research pertaining to the nine components of effective professional development, a total of 92 abstracts, issue reports, journal articles, policy briefs, project reports, research reports, technical reports, and textbooks were reviewed from listings in ERIC, FirstSearch, and EBSCO. Of these items, further selection criteria dictated the elimination of sources that did not apply rigorous, systematic, and objective procedures to obtain reliable and valid knowledge relevant to education activities and programs. After all the eliminations, 14 studies remained that met the above criteria. Two of these were experimental studies while the remaining twelve were quasi-experimental studies. Refer to Table 2 below.

Table 2. Summary of Reviewed Research*

Components of Effective Professional Development	Experimental Studies with Supporting Evidence	Quasi-experimental Studies with Supporting Evidence
Addresses Student-Learning Needs	2	12
Incorporates Hands-on Technology Use	0	2
Is Job-Embedded	2	12
Has Application to Specific Curricula	2	12
Addresses Knowledge, Skills, and Beliefs	2	11
Occurs Over Time	0	3
Occurs with Colleagues	0	2
Provides Technical Assistance & Support to Teachers	1	2
Incorporates Evaluation	2	10

*Any one particular study may, and does, address multiple professional development components

Methodology

Using academic databases such as ERIC, FirstSearch, and EBSCO, IARE conducted key-word searches to locate research on the nine components of effective professional that were identified as being used by TI's E & PS Division. NCLB's definition of SBR draws particular attention to experimental and quasi-experimental designs. Both experimental and quasi-experimental designs employ experimental and comparison groups. The primary difference between experiments and quasi-experiments relationships (Redfield, Sivin-Kachala, & Schneiderman, 2003) is that in experiments, study participants are randomly selected from the population to which results of the study are to be generalized (an external validity issue) and/or randomly assigned to experimental and comparison groups (an internal validity issue and one of the important keys to the determination of cause-effect).

FINDINGS

Effective Professional Development Addresses Student-Learning Needs

All fourteen studies selected for review provide evidence that effective professional development addresses student-learning needs. In each instance, the professional development program or experience being studied was targeted to particular desired learning outcomes. Both the experimental studies (Killion, 1999; MacIver, Plank, Balfanz, 1997; Project Legal, 2004) documented pre-test/post-test knowledge and achievement performance gains. In one instance (Killion, 1999; Project Legal, 2004), knowledge, comprehension, and problem solving skills related to law of students who had received instruction from especially trained teachers was significantly better than that of students who had received more traditional social studies instruction. In the case of the quasi-experimental studies, they have all reported using pre-/post-test measures of student achievement usually with some type of comparison group being employed to provide a context within which to judge gains (losses). Most of the quasi-experimental studies located have focused on professional development regarding math and science instruction. Table 3 below summarizes the profession development program being evaluated and its associated content focus for each of the twelve quasi-experimental studies included in this review.

Table 3. Summary of the quasi-experimental studies reporting the effects of professional develop on student learning needs.

Content Focus	Professional Development Program	Reference(s)
Math (2nd – 5th Grade)	Generalized professional development	Cohen & Hill (1998)
Math (algebra)	Hawaii Algebra Learning Project (HALP)	Young, Dougherty, Lai, & Matsumoto (1998); Killion (1999)

Content Focus	Professional Development Program	Reference(s)
Math (6th & 8th grade – algebra)	Peoria Urban Mathematics Program (PUMP) for Algebra	Swafford & Thornton (1998); Killion (1999)
Math (middle school)	Middle Grade Mathematics Renaissance	Acquarelli & Mumme (1996); Killion (1999)
Math (general)	University of Illinois at Chicago All Learn Mathematics	All Learn Mathematics Annual Report (1997); Killion (1999)
Math (algebra)	Algebra Initiative	Schweingruber, Papakonstantiou, Herbert & Rohr (1998 & 1999); Killion (2002b)
Math/Science	Generalized professional development	(USDE, 2000)
Science	Iowa Chautauqua	Dass & Yager (1997); Killion (1999)
Science	Student Watershed Research Project	Student Watershed Research Project (1997); Killion (1999)
Science (4th & 6th grades)	Science Education Enhancing the Development of Skills (SEEDS)	Killion (2002a)
Reading Readiness	Early Literacy and Learning Model (ELLM)	Wehry (2001); Killion (2002a)
General	Project CRISS: Reading, Writing, & Studying Strategies for Literature and Content	Santa (2004); Killion (1999)

In sum, professional development that is based on analysis of student learning helps teachers close the gap between actual student performance and goals for student learning (Cohen & Hill, 1998; Killion, 2002a; Killion, 2002b).

Effective Professional Development Incorporates Hands-on Technology Use

Only two of the studies selected for review addressed the professional development component dealing with the incorporation of hands-on technology use; both were quasi-experimental studies (Killion 2002a; Student Watershed Project, 1997).

For Student Watershed Research Project students demonstrated knowledge of data collection and analysis by having their test results compared to duplicate samples analyzed by professional laboratories rather than being required to demonstrate increased performance on a standardized assessment of science knowledge. Student Watershed Research Project staff combined professional laboratory results with the students' data, provided feedback on the data for both the student and teachers, and audited student data. In addition, students wrote their group findings and then presented them to a panel of

their classroom peers. Annual summits allowed students to display their data on poster-board and give oral presentations where quality and content of presentations are judged by various watershed health professionals. Students also have had opportunities to provide information to regulatory agencies regarding the watershed they monitor (Killion 2002a; Student Watershed Project, 1997).

The second study that addressed hands-on technology use was the Science Education Enhancing the Development of Skills or SEEDS program (Killion, 2002a). In this program, teachers regularly used hands-on science activities in addition to cooperative learning groups, discussion, and open-ended questions. As a result of the SEEDS professional development, teachers reported increased pedagogical preparedness for using performance-based assessments, hands-on science, informal assessments; for helping students take responsibility for their own learning; and for using students' prior knowledge in planning lessons. Annual student performance on the state science proficiency assessment in grades 4 and 6 indicated steady growth and consistently higher performance.

Thus, the two studies cited above would suggest that incorporating hands-on technology in the professional development process helps teachers develop confidence in their skills. When teachers develop confidence in their skills, they are then able to improve their teaching practices, which, in turn, should impact student achievement.

Effective Professional Development is Job-Embedded

All fourteen of the experimental and quasi-experimental studies included in the review reported that the professional development program or process being examined in each study was job embedded. In both of the experimental studies (Killion, 1999; MacIver, Plank, Balfanz, 1997; Project Legal, 2004), the staff development component provided the teachers sustained on-the-job professional development where they had ongoing support from other teachers and/or staff development professionals. The same was found to be true for the quasi-experimental studies though the nature of the job-embeddedness varied from situation to situation. For example, on-site "coaches" might be used such as with ELLM (Killion, 2002a; Wehry, 2001) while another approach were teachers assume multiple roles might have been used in another program (e.g., leader, trainer, curriculum developer) such as is done in SEEDS (Killion, 2002a). It seems that the particular strategy is not as important as is using one that produces sustained involvement with whatever the professional development focus is. Job-embedded professional development appears to improve teacher practices by promoting practical learning. In addition, it takes less time away from the classroom and generally costs less (Acquearelli & Mumme, 1996; All Learn Mathematics Annual Report, 1997; Cohen & Hill, 1998; Dass & Yager, 1997; Killion, 1999; Killion, 2002b; MacIver, Plank, Balfanz, 1997; Project Legal, 2004; Santa, 2004; Schweingruber, Papakonstantiou, Herbert, & Rohr, 1998 & 1999; Student Watershed Research Project, 1997; Swafford & Thornton, 1998; USDE, 2000; Wehry, 2001; Young, Dougherty, Lai, & Matsumoto, 1998).

Effective Professional Development Does Have Application to Specific Curricula

All of the studies reviewed indicated that effective professional development that was grounded in teaching specific content helped teachers become more deeply immersed in subject matter and teaching methods (Acquearelli & Mumme, 1996; All Learn Mathematics Annual Report, 1997; Cohen & Hill, 1998; Dass & Yager, 1997; Killion, 1999; Killion, 2002b; MacIver, Plank, Balfanz, 1997; Project Legal, 2004; Santa, 2004; Schweingruber, Papakonstantiou, Herbert, & Rohr, 1998 & 1999; Student Watershed Research Project, 1997; Swafford & Thornton, 1998; USDE, 2000; Wehry, 2001; Young, Dougherty, Lai, & Matsumoto, 1998). Most of the studies reviewed had mathematics as their focus (Acquarelli & Mumme, 1996; All Learn Mathematics Annual Report, 1997; Cohen & Hill, 1998; Killion, 1999; Swafford & Thornton, 1998; Schweingruber, Papakonstantiou, Herbert, & Rohr, 1999). A few of the studies focused on science (Dass & Yager, 1997; Killion, 1999; Killion, 2002b; Student Watershed Research Project, 1997) or both mathematics and science (USDE, 2000). Only one of the studies reviewed (Killion, 1999; Santa, 2004) had a general education focus.

Effective Professional Development Does Address Knowledge, Skills, and Beliefs

All but one of the fourteen studies reviewed support the idea that professional development should provide opportunities to engage in creation of a theoretical understanding of the knowledge and skills to be learned (Acquearelli & Mumme, 1996; All Learn Mathematics Annual Report, 1997; Dass & Yager, 1997; Killion, 1999; Killion, 2002b; MacIver, Plank, Balfanz, 1997; Project Legal, 2004; Santa, 2004; Schweingruber, Papakonstantiou, Herbert, & Rohr, 1998 & 1999; Student Watershed Research Project, 1997; Swafford & Thornton, 1998; USDE, 2000; Wehry, 2001; Young, Dougherty, Lai, & Matsumoto, 1998). Teacher thinking and classroom behavior are influenced by teachers' knowledge and beliefs; therefore, an important component of their professional development needs to be the expansion of their professional knowledge base. Improving teacher knowledge and skills is a factor in raising student performance and ensuring their success.

Effective Professional Development Does Occur Over Time

Three of the quasi-experimental studies addressed professional development occurring over time. The findings of these studies reveal that high-quality professional development occurs over time and should be seen as an on-going process (Cohen & Hill, 1998; Killion, 1999; Santa, 2004; USDE, 2000). By participating in on-going professional development, teachers are made aware of changing expectations and new teaching methods. The evidence clearly suggests that one-time workshops or short duration professional development does not produce sustained improvement of teaching practices. Therefore, the potential to impact student achievement increases when professional development occurs over time.

Effective Professional Development Does Occur with Colleagues

Two of the quasi-experimental studies reviewed reported data related to professional development occurring with colleagues. The evidence from these two studies clearly point to the notion that the most effective professional development sessions are those that allow teachers time to collaborate with one another and to discuss their professional development experience (Cohen & Hill, 1998; USDE, 2000). These two studies indicate that when teachers collaborate with colleagues, there is a positive impact on instructional practices and, therefore, student achievement.

Effective Professional Development Does Provide Technical Assistance and Support to Teachers

Three studies reviewed, one experimental and two quasi-experimental, reported findings that addressed the provision of technical assistance and support to teachers (Acquarelli & Mumme, 1996; Killion, 1999; Project Legal, 2004; USDE, 2000). The evidence from these three studies indicates that without continuous technical assistance and support effective, long lasting professional development will not result. Teachers indicated being more successful in implementing new instructional strategies and techniques when they received ongoing technical assistance and support after receiving professional development.

Effective Professional Development Does Incorporate Evaluation

The pressure has intensified on schools to show that the professional development being provided to teachers is effective and showing positive results. This issue is not whether teachers were satisfied with a particular professional development experience—but rather what effect professional development has had on student achievement (Guskey, 2000). Both of the experimental studies reviewed and ten of the twelve quasi-experimental studies examined reported findings related to assess student performance changes as a result of the professional development that the students' teacher had experienced (Acquearelli & Mumme, 1996; All Learn Mathematics Annual Report, 1997; Dass & Yager, 1997; Killion, 1999; Killion, 2002b; MacIver, Plank, Balfanz, 1997; Project Legal, 2004; Santa, 2004; Schweingruber, Papakonstantiou, Herbert, & Rohr, 1998 & 1999; Student Watershed Research Project, 1997; Swafford & Thornton, 1998; Wehry, 2001; Young, Dougherty, Lai, & Matsumoto, 1998). See Table 4 below.

Table 4. Summary of evaluation components

Professional Development Program	Student Performance Evaluation Tool (Area)	Reference
Project CRISS: Reading, Writing, & Studying Strategies for Literature and Content	Standardized Free-recall (General)	Santa (2004); Killion (1999)

Professional Development Program	Student Performance Evaluation Tool (Area)	Reference
Early Literacy and Learning Model (ELLM)	Tera – 2 (Reading Readiness)	Wehry (2001); Killion (2002a)
Science Education Enhancing the Development of Skills (SEEDS)	Ohio state science proficiency tests (Science – 4th & 6th grades)	Killion (2002a)
Student Team Literature Program	Stanford 9 Achievement Test (Reading Comprehension)	MacIver, Plank, Balfanz (1997); Killion (1999)
Project Legal	Criterion-referenced tests	Project Legal (2004); Killion (1999)
Algebra Initiative	Algebra I End-of-Course Exam (Math – algebra)	Schweingruber, Papakonstantiou, Herbert, & Rohr (1998 & 1999); Killion (2002b)
University of Illinois at Chicago All Learn Mathematics	Iowa Test of Basic Skills (Math – general)	All Learn Mathematics Annual Report (1997); Killion (1999)
Hawaii Algebra Learning Project (HALP)	GOALS: A Performance-Based Measure of Achievement (Math – algebra)	Young, Dougherty, Lai, & Matsumoto (1998); Killion (1999)
Iowa Chautauqua	Multiple-choice tests (Science)	Dass & Yager (1997); Killion (1999)
Peoria Urban Mathematics Program (PUMP) for Algebra	Illinois Goal Assessment Program (Math)	Swafford & Thornton (1998); Killion (1999)
Middle Grade Mathematics Renaissance	New Standards Reference Exam (Math – middle school)	Acquarelli & Mumme (1996); Killion (1999)
Student Watershed Research Project	Student data samples (Science)	Student Watershed Research Project (1997); Killion (1999)

Summary

NCLB places a premium on professional development that (1) improves teachers' knowledge of the subjects they teach; (2) is an integral part of schoolwide educational improvement plans; (3) gives teachers and other school personnel the knowledge and skills they need to help students meet challenging standards; (4) is high-quality, sustained, intensive, and classroom-focused to have a positive and lasting effect on classroom instruction and teachers' performance in the classroom; and (5) advances teachers' understanding of effective instructional strategies that are based on

scientifically based research and align with and are directly related to academic content standards, academic achievement standards, and assessments. The best evidence available points to the fact that the Professional Development Services group TI's E & PS Division and provide effective professional development if nine components identified in the literature are present. It has not been empirically established if all nine components must be present or if only a particular subset is crucial. It is only through continued rigorous research that this will be established.

RECOMMENDATIONS FOR NEXT STEPS

The Professional Development Services group of TI's E & PS Division offers a variety of professional development services to teachers and districts. NCLB emphasizes that effective professional development should (1) improve teachers' knowledge in their content area; (2) be on-going, hands-on, and of high quality; and (3) give teachers the knowledge and skills they need to improve their instructional practices such that student achievement will be impacted. In order to address these issues, TI's E & PS Division should:

- Continue in its efforts to address the nine components of effective professional development when delivering either in-person or on-line professional development. While the circumstances associated with a particular professional development experience may dictate that one or more of the components may not be feasible, at present the available evidence does not provide sufficient guidance as to which, if any, of the components is more or less important than another.

- Make every effort to evaluate the effectiveness of the professional development services they offer through a comprehensive evaluation of student learning outcomes, participants' use of new knowledge, organization support and change, participants' learning, as well as participants' reactions. This evaluation should be focused on the four attributes of evaluation developed by the Joint Committee on Standards for Educational Evaluation: (1) utility, (2) feasibility, (3) propriety, and (4) accuracy.

- Consider conducting randomized controlled trials that randomly assign individuals to experimental and control groups in order to empirically ascertain the effectiveness of the professional development they provide.

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APPENDIX

Literature Checklist

Author(s):   Santa, C. M.

Title: *Project CRISS: Evidence of effectiveness*

Source: Retrieved from http://www.nsdc.org/midbook/index.cfm

Publication Date: 2004   **Volume:**   **Issue #:**

Peer Reviewed? Yes

Type of Study: Quasi-experimental (a non-equivalent control group design)

Data Collected: Data were collected through a standardized free-recall approach using text appropriate to the reading level of the students.

Population: The evaluation of Project CRISS was conducted in 1991-1992 with eight pre- and post-comparison groups at the development site and two replication sites (Montana, Florida, and Virginia). In subsequent studies in 1994-1995, similar results occurred in two other sites (Colorado and Washington).

Professional Development Component(s):

Component	Addressed
Addresses Student-Learning Needs	*
Incorporates Hands-on Technology Use	
Is Job-Embedded	*
Has Application to Specific Curricula	*
Addresses Knowledge, Skills, and Beliefs	*
Occurs Over Time	*
Occurs with Colleagues	
Provides Technical Assistance & Support to Teachers	
Incorporates Evaluation	*

Findings

Students who were taught Project CRISS strategies demonstrated significantly greater gains (p < .001) in the retention of subject-specific information than comparable students who did not participate in the program. The evaluation of Project CRISS was conducted in 1991-92 with eight pre- and post-comparison groups at the development site and two replication sites (Montana, Florida, and Virginia) using intact classroom groups of students in grades 4, 6, 8, and 11. Teachers, rather than students, were randomly assigned to the treatment and comparison groups.

Information retention was assessed through a standardized free-recall approach using text appropriate to the reading level of the students. Both pre- and post-test data were collected using procedures that closely resembled actual classroom and learning situations. Measures to ensure reliability of the process were employed. Data were then analyzed using statistical processes to explore differing effects of the implementation of Project CRISS across both the pre- and post-tests. Students at all three sites outperformed the nontreatment group at significant levels even when accounting for naturally occurring gains of students. In subsequent studies in 1994-95, similar results were found in two other sites (Colorado and Washington).

Conclusions

Students of teachers who participated in Project CRISS training, which was sustained and job-embedded, outperformed the non-treatment group at significant levels even when accounting for naturally occurring gains of students at all three evaluation sites. At the middle school level, students in the treatment group recalled more than twice as much content-area knowledge as their comparison groups. For teachers of all the content areas this program was deemed beneficial. When teacher interdisciplinary teams used similar learning strategies across content areas, students' application of the skills was reinforced and their learning increases.

Related Resource

Killion, J. (1999). *What works in the middle school: Results-based staff development.* Oxford, OH: National Staff Development Council. Retrieved March 22, 2003 from http://www.nsdc.org/midbook/index.cfm

Literature Checklist

Author(s): Wehry, S.

Title: *The early literacy and learning model (ELLM) initiative: Making a difference 1999/2000 & 2000/2001*

Source: Florida Institute of Education at the University of North Florida

Publication Date: 2001 **Volume:** **Issue #:**

Peer Reviewed? Yes

Type of Study: Quasi-experimental (a non-equivalent group design)

Data Collected: Data were collected via reading readiness tests, program-developed tests, and teacher interviews.

Population: The Early Literacy and Learning Model (ELLM) was used in five Northeast Florida Counties, including Jacksonville, with children from predominantly high poverty, low-achieving urban schools and centers that served mostly African-American students and their families. The program was implemented in 89 sites including faith-based childcare, Head Start, subsidized pre-kindergarten early intervention, pre-kindergarten handicapped special education and bilingual, kindergarten, and 1st-grade classrooms.

Professional Development Component(s):

Component	Addressed
Addresses Student-Learning Needs	*
Incorporates Hands-on Technology Use	
Is Job-Embedded	*
Has Application to Specific Curricula	*
Addresses Knowledge, Skills, and Beliefs	*
Occurs Over Time	
Occurs with Colleagues	
Provides Technical Assistance & Support to Teachers	
Incorporates Evaluation	*

Findings

ELLM contributed to the improvement of children's reading readiness. Using non-random but equivalent group pre- and post-test design with a control setting, ELLM has enabled children to demonstrate significant gains in reading readiness when compared to both national norms and the control site on the TERA - 2 and an alphabet recognition

test. These results occurred for three cohort groups consisting of 4- and 5-year-olds in childcare; 5- and 6-year-olds in kindergarten; and 6- and 7-year-olds in 1st grade. Furthermore, the ELLM students represented high-needs urban students, and they performed in the national "average" category as defined by TERA - 2.

ELLM students in the 4- to 5-year-old and 5- to 6 - year-old cohorts demonstrated significant improvement in the alphabet recognition assessment, outperforming the national sample of kindergarteners tested as a part of America's Kindergarteners: Early Childhood Longitudinal Study (ECLS). Of ECLS students, 66% demonstrated reading proficiency while 81% of the ELLM kindergarten students and 56% of the ELLM pre-kindergarten demonstrated proficiency.

Teachers seemed to view themselves as learners and reported increased confidence in their own reading skills, deeper understanding of reading instruction, more knowledge about reading resources, and greater appreciation for the strategies they were using.

Conclusions

ELLM provides the foundation for successful readers. Addressing the specific needs of high-poverty, low-achieving students, this program offered teachers intensive, on-going support to provide literacy instruction. The staff development model depended largely on literacy coaches who worked directly with teachers in their classrooms as they applied what they were learning and made adaptations to address the varied learning needs of their students.

Related Resource

Killion, J. (2002). *What works in the elementary school: Results-based staff development.* Oxford, OH: National Staff Development Council. Retrieved March 22, 2003 from http://www.nsdc.org/connect/projects/elwhatworks.pdf

Literature Checklist

Author(s):   Killion, J.

Title: *Science education enhancing the development of skills*

Source: *What works in elementary school: Results-based staff development*,
                         National Staff Development Council

Publication Date: 2002   **Volume:**   **Issue #:**

Peer Reviewed?   Yes

Type of Study: Quasi-experimental (a non-equivalent control group design)

Data Collected: Data were collected from the Ohio state science proficiency tests,
                        program-specific teacher surveys, and classroom observations.

Population: Over 1,000 teachers from rural, urban, and suburban communities
                        in six towns and three private schools in Stark County, Ohio were
                        involved in this project.

Professional Development Component(s):

Component	Addressed
Addresses Student-Learning Needs	*
Incorporates Hands-on Technology Use	*
Is Job-Embedded	*
Has Application to Specific Curricula	*
Addresses Knowledge, Skills, and Beliefs	*
Occurs Over Time	
Occurs with Colleagues	
Provides Technical Assistance & Support to Teachers	
Incorporates Evaluation	*

Findings

Annual student performance on the Ohio state science proficiency assessment in grades 4
and 6 indicated steady growth and consistently higher performance by Stark County
students than the state. The test required higher-level thinking more than factual recall of
data and assessed the strands of nature of science, physical science, earth and space
science, and life science. From the beginning of the project in 1995, 4th grade student
achievement has rose from 44 percent of the student passing the state assessment to 76
percent of the students passing in 2002. The 6th grade passing rate has risen from 47

percent to 71 percent. In all cases, the state's average scores were lower, and sometimes by as much as 10 percent.

In addition to performance on state assessments, teacher classroom practices changed. Teachers more regularly used hands-on science activities, cooperative learning groups, discussion, and open-ended questions. Teachers reported increased pedagogical preparedness for using performance-based assessments, hands-on science, informal assessments, helping students take responsibility for their own learning, and using students' prior knowledge in planning lessons.

Conclusions

The combination of strong curriculum and intensive, sustained professional development as was evident in Science Education Enhancing the Development of Skills improved students' performance and teachers' classroom practices. The opportunity for teachers to assume multiple roles as leaders, trainers, coaches, curriculum developers, and facilitators was a strength of the staff development design for this program. Teachers deepened their understanding of science, science pedagogy, and leadership through the project's professional development. Another strong feature of the project was the countrywide collaboration.

Literature Checklist

Author(s):   MacIver, D. J., Plank, S. B., and Balfanz, R.

Title: *Working together to become proficient readers: Early impact of the talent development middle school's student team literature program.* (Report No. 15).

Source: Center for Research on the Education of Students Placed At Risk

Publication Date: 1997   **Volume:**   **Issue #:**

Peer Reviewed?   Yes

Type of Study: Experimental (a matched control group, pre-test/post-test design)

Data Collected: Data were collected from the Stanford 9 Achievement Test.

Population: The project was implemented in 1995-1996 in 21 classrooms in sixth through eighth grades at Central East Middle School in Philadelphia. Over 85 percent of the students were from low-income families and the student population at Central East Middle School included a large percentage of second language learners and minority students. (pre-post with randomly assigned control/comparison and treatment groups – random assignment of teacher and/or classes)

Professional Development Component(s):

Component	Addressed
Addresses Student-Learning Needs	*
Incorporates Hands-on Technology Use	
Is Job-Embedded	*
Has Application to Specific Curricula	*
Addresses Knowledge, Skills, and Beliefs	*
Occurs Over Time	
Occurs with Colleagues	
Provides Technical Assistance & Support to Teachers	
Incorporates Evaluation	*

Findings

A matched control group, pre-test/post-test design was used to evaluate effects of Student Team Literature (STL) on students' end-of-the-year reading comprehension scale scores on the Stanford 9. Researchers used hierarchical linear models to estimate the differences

between experimental classrooms (21) and control classrooms (25) in reading comprehension, while controlling for prior achievement and current grade level. Additional measures were used to estimate the difference in the effectiveness of peer assistance in increasing reading comprehension in experimental and control classrooms.

While the results from the Student Team Literature were based on one school's use, earlier research on the Student Team Reading (the first version of the Student Team Literature) was extensive. It demonstrated significant improvement (p<.05) in the California Achievement Test Total Reading for 1,223 urban sixth-grade students in six middle schools when compared to control classrooms where traditional reading instruction was provided using basal and isolated skill instruction. In addition, a second study of the Student Team Reading Program paired with the Student Team Writing Program in sixth-, seventh-, and eighth-grade classrooms with 3,986 students in the Baltimore City Schools, resulted in significant improvements (at least p<.05) in reading comprehension, vocabulary, language mechanics, and language expression on the California Achievement Test when compared to match control schools. These results were obtained even when the control schools had significantly higher pre-test scores (p<.01) in Total Reading and Total Language.

Conclusions

Teachers involved in this staff development program received comprehensive, sustained professional development throughout the school year. Additionally, these same teachers worked in collaborative groups throughout the school year. Students in the Student Team Literature (STL) classrooms displayed significantly better reading comprehension after the first year of implementation (effect size .51) than did students in the comparison group. The increase in reading comprehension occurred across all levels of prior ability; students with the strongest prior reading skills benefited the most. Peer assistance was found to be more productive and frequent in STL classrooms than in the control classrooms.

Related Resource

Killion, J. (1999). *What works in the middle school: Results-based staff development.* Oxford, OH: National Staff Development Council. Retrieved March 22, 2003 from http://www.nsdc.org/midbook/index.cfm

Literature Checklist

Author(s):

Title: *Law-related education: Goals for American leadership*

Source: Project Legal Website

Publication Date: 2004   **Volume:**   **Issue #:**

Peer Reviewed?   Yes

Type of Study: Experimental

Data Collected: Data were collected through criterion-referenced tests of knowledge and comprehension of legal issues and problem-solving skills related to legal issues.

Population: The original study in 1979 involved 1,718 students in the state of New York in diverse school settings whose teachers were randomly assigned to implement either Project Legal or traditional instructional approaches. (pre-post test with randomly assigned control/comparison and treatment groups – random assignment of teacher and/or classes)

Professional Development Component(s):

Component	Addressed
Addresses Student-Learning Needs	*
Incorporates Hands-on Technology Use	
Is Job-Embedded	*
Has Application to Specific Curricula	*
Addresses Knowledge, Skills, and Beliefs	*
Occurs Over Time	
Occurs with Colleagues	
Provides Technical Assistance & Support to Teachers	*
Incorporates Evaluation	*

Findings

Project Legal's first evaluation was conducted during the 1978-1979 school year, and subsequent evaluations have supported the initial findings. The original study used a pre- and post-test control and treatment group design. Students who participated in Project Legal classrooms performed significantly better than those who had more traditional social studies curriculum and instruction.

Criterion-referenced assessments of students' law-related knowledge and comprehension (KCL) and problem-solving skills in law (PSL) were designed by the program developers to measure the program's effectiveness. The original study involved 1,718 students in New York state in diverse school settings whose teachers were randomly assigned to implement either Project Legal or traditional instructional approaches. The random assignment of teachers and classrooms to treatment and control groups strengthens the findings of the program evaluation.

Conclusions

The staff development component of this project immersed teachers in sustained professional development where they had ongoing support and consultation with project staff and other teachers who were implementing the program. Students in Project Legal classrooms in grades 5, 8, and 11 significantly improved their knowledge and comprehension of law-related curriculum and their problem-solving skills related to functioning in the U.S. legal/judicial system when compared to students in traditional U.S. history classrooms.

Related Resource

Killion, J. (1999). *What works in the middle school: Results-based staff development.* Oxford, OH: National Staff Development Council. Retrieved March 22, 2003 from http://www.nsdc.org/midbook/index.cfm

Literature Checklist

Author(s):   Schweingruber, H., Papakonstantiou, A., Herbert, E., & Rohr, M.

Title: *High school algebra initiative: Year one report*
            High school algebra initiative: Year two report

Source: Rice University School Mathematics Project

Publication Date: 1998 and 1999   **Volume:**   **Issue #:**

Peer Reviewed?   Yes

Type of Study: Quasi-experimental (a post-test only with nonequivalent group)

Data Collected: Data were collected from Algebra I End-of Course Exams,
            classroom observations, project-specific teacher surveys, and
            project-specific principal surveys.

Population: Project was implemented in all high schools in Houston
            Independent School District that served approximately 210,000
            students from ethnically and economically diverse backgrounds

Professional Development Component(s):

Component	Addressed
Addresses Student-Learning Needs	*
Incorporates Hands-on Technology Use	
Is Job-Embedded	*
Has Application to Specific Curricula	*
Addresses Knowledge, Skills, and Beliefs	*
Occurs Over Time	
Occurs with Colleagues	
Provides Technical Assistance & Support to Teachers	
Incorporates Evaluation	*

Findings

Over the three years of the Initiative, students' scores on the statewide Algebra I End-of-Course Exam increased from 23 percent passing to 42 percent passing. Most encouragingly, after three years of the Initiative, passing rates for African American and Hispanic students in Houston Independent School District were higher than in the state as a whole. Likewise, passing rates for economically disadvantaged students were higher than statewide rates.

In addition to scores on state end-of-course tests, teachers and administrators reported positive responses to the Initiative. Other benefits of the Initiative included changes in instruction and corresponding impact on student motivation and attitude; increased collaboration among teachers and strengthened ability to work together; tighter alignment between curriculum and instruction; and more focused discussion of mathematics instruction and content.

Conclusions

This sustained professional development program for Algebra I teachers changed teacher practices, impacted student achievement, increased collaboration among teachers, and increased alignment between curriculum and instruction.

Related Resource

Killion, J. (2002). *What works in the high school: Results-based staff development.* Oxford, OH: National Staff Development Council. Retrieved March 22, 2003 from http://www.nsdc.org/connect/projects/hswhatworks.pdf

Literature Checklist

Author(s):   University of Illinois at Chicago

Title: *All learn mathematics annual report 1996-97*

Source: University of Illinois at Chicago

Publication Date: 1997   **Volume:**   **Issue #:**

Peer Reviewed?   Yes

Type of Study: Quasi-experimental (a non-equivalent control group)

Data Collected: Data were collected from the Iowa Test of Basic Skills, project-specific teacher surveys, teacher interviews, and classroom observations.

Population: 600 teachers in over 44 schools (selection process unknown)

Professional Development Component(s):

Component	Addressed
Addresses Student-Learning Needs	*
Incorporates Hands-on Technology Use	
Is Job-Embedded	*
Has Application to Specific Curricula	*
Addresses Knowledge, Skills, and Beliefs	*
Occurs Over Time	
Occurs with Colleagues	
Provides Technical Assistance & Support to Teachers	
Incorporates Evaluation	*

Findings

For the schools participating in the both the first and second cadre, all improved their mathematics scores. The degree of improvement varied by schools with increases occurring at the lowest-performing as well as at the highest-performing schools. Differences in the number of student performing at or above the national norm at five of the six schools in the first cadre were statistically significant when compared to the control group. In the second cadre, the difference in the number of students performing at or above the national norm at seven of the 18 schools was statistically significant, when compared to the control group. The lowest performance of students in the second cadre is most likely due to the length of implementation. Changes in teachers' practices were also attributed to All Learn Mathematics. Interview and survey results indicate that, as a result of participating in staff development programs, teachers' attitudes about

mathematics improved; classroom instructional practices shifted from lecture or teacher-centered to student-centered and students working in cooperation with each other; and teachers' preparedness to teach mathematics, including their own understanding of mathematics concepts improved. Teachers felt well-prepared to have students work in cooperative works, practice computational skills, and engage students in inquiry-oriented activities. They also felt competent to use performance-based assessment and informal questioning, lead a class of students on investigative strategies, and manage students engaged in hands-on or project-based work.

Conclusions

Not only did the University of Illinois at Chicago—All Learn Mathematics (ALM) program increase student achievement in mathematics at all participating schools, it increased teachers' understanding of mathematics and use of appropriate instructional strategies to create student-centered classrooms. As a result of ALM, significant changes in mathematics education were made, and a greater accountability for schools, students, teachers, and administrators has been initiated.

Related Resource

Killion, J. (1999). *What works in the middle school: Results-based staff development.* Oxford, OH: National Staff Development Council. Retrieved March 22, 2003 from http://www.nsdc.org/midbook/index.cfm

Literature Checklist

Author(s): Cohen, D. K., & Hill, H. C.

Title: *State policy and classroom performance: Mathematics reform in California*

Source: Consortium for Policy Research in Education

Publication Date: January 1998 **Volume:**   **Issue #:**

Peer Reviewed? Yes

Type of Study: Quasi-experimental (a time series design)

Data Collected: Data were collected from the California Learning Assessment System state achievement tests, a one-time project-specific teacher survey, a review of state and district documents, school visits, and interviews of state and district administrators and reformers.

Population: Survey participants included 1,000 teachers, sampled to represent the population of second through fifth grade elementary school teachers in California. School visits were conducted at elementary schools and classrooms in three California school districts. The same districts, schools, and classroom teachers were followed for four to five years.

Professional Development Component(s):

Component	Addressed
Addresses Student-Learning Needs	*
Incorporates Hands-on Technology Use	
Is Job-Embedded	*
Has Application to Specific Curricula	*
Addresses Knowledge, Skills, and Beliefs	
Occurs Over Time	*
Occurs with Colleagues	*
Provides Technical Assistance & Support to Teachers	
Incorporates Evaluation	

Findings

Two-thirds of teachers responding to the survey reported participating in at least one of the five mathematics-related professional development in the year prior to the survey. The breadth of these professional development opportunities, however, was not matched in their depth. Most teachers reported spending only nominal amounts of time in

professional development activities. Of the teachers who reported attending one of the workshops in the past year, roughly half indicated they spent one day or less than one day in the mathematics-related activity. Approximately 35 percent reported spending between two and six days. A smaller fraction of those who attended the workshops, and a very small fraction of the entire sample, attended workshops lasting one week or longer. Few California teachers found rich learning opportunities.

Survey results suggest that teachers' learning opportunities may need to go one level deeper than subject specificity. Providing teachers with concrete, topic-specific learning opportunities appears to help them change mathematics teaching practices which impacts student learning.

Conclusions

The 1994 survey of California elementary school teachers indicated to the researchers that professional development that was not grounded in academic content was less likely to have constructive effects. Professional development that was fragmented, that was not focused on curriculum for students, that did not afford teachers additional learning opportunities, and that did not involve collaborative activities had less of an impact on teachers.

Literature Checklist

Author(s):   Young, D. B., Dougherty, B., Lai, M. K., & Matsumoto, A.

Title: *Addressing equity through curriculum development and program evaluation*

Source: Journal of Women and Minorities in Science and Engineering

Publication Date: 1998   **Volume:**   4   **Issue #:**

Peer Reviewed?   Yes

Type of Study: Quasi-experimental (a post-test only with nonequivalent group)

Data Collected: Data were collected from GOALS: A Performance-Based Measure of Achievement and classroom observations.

Population: The tests were administered in fall 1995 and spring 1996 to students at three sites. Two sites were in Mississippi and one was in Hawaii. The sites represented a wide diversity of socio-economic and achievement levels.

Professional Development Component(s):

Component	Addressed
Addresses Student-Learning Needs	*
Incorporates Hands-on Technology Use	
Is Job-Embedded	*
Has Application to Specific Curricula	*
Addresses Knowledge, Skills, and Beliefs	*
Occurs Over Time	
Occurs with Colleagues	
Provides Technical Assistance & Support to Teachers	
Incorporates Evaluation	*

Findings

In 1995-1996, an evaluation using a pre-test, post-test, norm-referenced design was conducted of the Hawaii Algebra Learning Project. GOALS: A Performance-Based Measure of Achievement was used because the items cover topics beyond first-year algebra, including geometry, probability, and statistics. The test's open-ended format matched the format of the project's classroom instruction. GOALS emphasizes justification and explanation of answers, so students can demonstrate their thinking and reasoning. Although, not a true control group, the national norming group provided an acceptable comparison group for statistical analysis.

The tests were administered in fall 1995 and spring 1996 to students at three sites. Two sites were in Mississippi and one was in Hawaii. To compare the scores, the mean of the raw scores were converted to their corresponding scaled scores. These scaled scores each corresponded to a percentile whose value depended on whether the test was administered in the fall or spring. Students who participated in the project performed significantly better than the comparison group.

At all sites, large gains beyond expectations were found. All pre-post-percentile scores were statistically significant at the $p < 0.001$ level. Even though there were large differences in pre-test means at the three sites, the gains shown at each site were very similar in magnitude, indicating a significance value-added component. Percentile gains ranged from 15 to 21 points.

All teachers involved were either directly observed or videotaped during the year to assure that the quality of instruction was aligned with the goals of the program, that teachers covered the expected amount of course material and concepts, and that they used a variety of instructional strategies consistent with the program and designed to meet student learning needs.

Conclusions

The Hawaii Algebra Learning Project is a combined curriculum and staff development effort. The use of teacher resources, student texts, and assessments, coupled with intensive, sustained professional development program, led to significant improvements in student achievement in mathematics with students of diverse backgrounds.

Related Resource

Killion, J. (1999). *What works in the middle school: Results-based staff development.* Oxford, OH: National Staff Development Council. Retrieved March 22, 2003 from http://www.nsdc.org/midbook/index.cfm

Literature Checklist

Author(s):   Dass, P., & Yager, R.

Title: *Iowa chautauqua program final performance report*

Source: University of Iowa

Publication Date: 1997   **Volume:**   **Issue #:**

Peer Reviewed?   Yes

Type of Study: Quasi-experimental (a non-equivalent control group design)

Data Collected: Data were collected from project-specific multiple-choice tests and National Assessment of Educational Progress attitude survey.

Population: The project has been implemented in five of Iowa's 15 Area Education Agencies and in 10 other states. Students in grades 4-9 were included in the assessment

Professional Development Component(s):

Component	Addressed
Addresses Student-Learning Needs	*
Incorporates Hands-on Technology Use	
Is Job-Embedded	*
Has Application to Specific Curricula	*
Addresses Knowledge, Skills, and Beliefs	*
Occurs Over Time	
Occurs with Colleagues	
Provides Technical Assistance & Support to Teachers	
Incorporates Evaluation	*

Findings

Multiple measures of student performance and changes in teacher practice indicate that the Iowa Chautauqua Program has produced positive results for students. For example, researchers have used project-specific, multiple choice tests to measure the concept, process, application, and creativity domains. The attitude domain was assessed using a Likert-type five point scale with items from the National Assessment of Educational Progress, Third Assessment of Science. Pre- and post-tests were administered to all students of 15 lead teachers in 1989-1990. In total, 723 students were assessed. The 15 lead teachers were selected from a pool of 50 Lead Teachers for the formal assessment. Lead teachers taught two or more sections, one serving as a control group with

conventional instructional procedures and one serving as the experimental group with Science-Technology-Society approaches to instruction. Data were also collected from at least one section of the 250 new teachers in the program. No contrasting data were available for those classrooms. Researchers state that the sample of teachers and students are representative of the larger population of teachers and students.

Results indicate that students in the control and experimental groups had similar conceptual knowledge about science on the post-test (effect size –0.03). Student participating in the Iowa Chautauqua Program had significantly higher gains in the process (effect size 2.20), application (effect size 3.21), creativity (effect size 2.12), and attitude (effect size 1.62) domains.

Conclusions

The Iowa Chautauqua Program increases teacher confidence in teaching science and increases teacher understanding and use of basic features of science. Lead teachers involved in the program had students who master more scientific concepts, better understand the basic processes of science, apply concepts and processes to new situations, develop more creativity skills, and had more positive attitudes about science, their science teachers, the usefulness of science, and science careers when compared to students in other classrooms. This programs replication throughout 11 states is evidence of the program's widespread success as a staff development program that increases student achievement.

Related Resource

Killion, J. (1999). *What works in the middle school: Results-based staff development.* Oxford, OH: National Staff Development Council. Retrieved March 22, 2003 from http://www.nsdc.org/midbook/index.cfm

Literature Checklist

Author(s):   Planning and Evaluation Service

Title: *Does professional development change teaching practice? Results from a three-year study*

Source: U.S. Department of Education, Office of the Under Secretary

Publication Date: 2000   **Volume:**   **Issue #:**

Peer Reviewed?   No

Type of Study: Quasi-experimental (a time series design)

Data Collected: Data from the National Profile, the Case Studies, and the Longitudinal Study of Teacher Change were examined in this study.

Population: Using a purposefully selected sample of teachers in 30 schools, in 10 districts, in 5 states, the researchers examined the quality of teachers' professional development in Eisenhower and other professional development activities and its effects on changing teaching practice in mathematics and science from 1996-1999.

Professional Development Component(s):

Component	Addressed
Addresses Student-Learning Needs	*
Incorporates Hands-on Technology Use	
Is Job-Embedded	*
Has Application to Specific Curricula	*
Addresses Knowledge, Skills, and Beliefs	*
Occurs Over Time	*
Occurs with Colleagues	*
Provides Technical Assistance & Support to Teachers	*
Incorporates Evaluation	

Findings

Data from this study suggest that discussing professional development experiences with colleagues and participating in follow-up activities made the experience more meaningful for participating teachers. Results from the study provide evidence of the link between focusing on specific teaching strategies in professional development and having teachers use those specific strategies in the classroom. Specifically, professional development

focused on specific, higher-order teaching strategies increases teachers' use of those strategies in the classroom. Professional development is also much more effective in changing teachers' classroom practice when it has specific features of high quality, such as the collective participation of teachers from the same school or grade. Results suggest there is great variation in the quality of teachers' professional development experiences. Findings also indicate that the average teacher's professional development experiences do not add up to a long-term, coherent, high-quality program. High-quality professional development that focuses on specific teaching strategies does affect teacher practice. In sum, the findings show that the most effective professional development is focused on specific higher-order teaching strategies and has features of high quality such as addressing student-learning needs, has application to specific curricula, occurs over time, and occurs with colleagues.

Conclusions

The researchers concluded that six key features of professional development are effective in improving teaching practice: three structural features (characteristics of the structure of the activity)—reform type, duration, and collective participation—and three core features (characteristics of the substance of the activity)—active learning, coherence, and content focus.

Literature Checklist

Author(s):   Swafford, J., & Thornton, C.

Title: *The PUMP algebra project*

Source: Retrieved from
                    http://www.nsdc.org/library/authors/NSDCPlan.cfm

Publication Date: 1998   **Volume:**   **Issue #:**

Peer Reviewed?   Yes

Type of Study: Quasi-experimental (pre-post test with no control group)

Data Collected: Data were collected from the Illinois Goal Assessment Program
                        (state mathematics test), Mathematics Learning and Teaching
                        Survey, algebra enrollment at middle and high school, and
                        minority student enrollment in algebra.

Population: Peoria Public Schools serves approximately 17,000 students and
                        all middle school mathematics teachers participated in project.

Professional Development Component(s):

Component	Addressed
Addresses Student-Learning Needs	*
Incorporates Hands-on Technology Use	
Is Job-Embedded	*
Has Application to Specific Curricula	*
Addresses Knowledge, Skills, and Beliefs	*
Occurs Over Time	
Occurs with Colleagues	
Provides Technical Assistance & Support to Teachers	
Incorporates Evaluation	*

Findings

Peoria Urban Mathematics Plan for Algebra has impacted student achievement, teachers'
beliefs, and instructional practices. Pre-project scores and annual scores of student
achievement on the Illinois Goal Assessment Program (IGAP) were collected in March of
each year. The sixth-grade scores, while demonstrating an overall increase in the district
of 10 points, increased in seven of the 14 schools, decreased in six, and remained the
same in one after only two years of implementation. Differences in scores were
statistically significant. At the eighth grade, scores increased in 13 of the 14 middle
schools. The mean increase of 13.2 points across all schools was significant ($p<.05$).

While the results at the sixth grade and are not significant, possibly due to the brief implementation time and the low number of sixth-grade teachers in the project, the increase at half of the schools shows promise for continued improvement. The strong results at the eighth grade demonstrate that the program has the potential to dramatically improve student achievement.

Overall algebra enrollments at the middle school increased slightly, primarily s a function of increased minority population participation. At the high school level, the proportion of minority students in enrolled in algebra increased from 42.5 percent to 54.3 percent while the percentage of minority population actually enrolled in high school algebra increased from 15.7 to 22.6.

Survey results indicate that teachers reflect more on their teaching and are more likely to incorporate new instructional strategies into their practice. Statistically significant differences were found in instructional beliefs and practices in five of the eight clusters of the Mathematics Learning and Teaching Survey.

Conclusions

Peoria Urban Mathematics Plan for Algebra is a professional development program that focused on improving teacher performance: teachers' content knowledge, teachers' pedagogical and professional knowledge; and classroom-based support for the implementation of new knowledge into practice. This professional development program increased student achievement in algebra at the 8th grade, improved teacher practices, an increased minority-student participation and representation in high school algebra.

Related Resource

Killion, J. (1999). *What works in the middle school: Results-based staff development.* Oxford, OH: National Staff Development Council. Retrieved March 22, 2003 from http://www.nsdc.org/midbook/index.cfm

Literature Checklist

Author(s):   Acquarelli, K., & Mumme, J. A.

Title: *Renaissance in mathematics education reform*

Source: Phi Delta Kappan

Publication Date: 1996   **Volume:**   77   **Issue #:**

Peer Reviewed?   Yes

Type of Study: Quasi-experimental (a post-test only with nonequivalent group)

Data Collected: Data were collected from the1994 New Standards Reference Exam and case studies.

Population: During its five years as a component of California's State Systemic Initiative, more than 500 schools, including 2,500 math teachers, participated. This represents nearly 50 percent of the state's middle schools. Thirty-eight percent of schools in the project were involved for three or more years. Statewide, 74 percent of the project districts had 100 percent of their middle schools participating.

Professional Development Component(s):

Component	Addressed
Addresses Student-Learning Needs	*
Incorporates Hands-on Technology Use	
Is Job-Embedded	*
Has Application to Specific Curricula	*
Addresses Knowledge, Skills, and Beliefs	*
Occurs Over Time	
Occurs with Colleagues	
Provides Technical Assistance & Support to Teachers	*
Incorporates Evaluation	*

Findings

Mathematics Renaissance student performance was assessed in a subset of classrooms across the state of California. The 1994 New Standards Reference Exam was administered in the spring of 1995. Students in the Renaissance sample participated in two days of testing on a range of performance tasks of 5, 15, and 45 minutes in duration.

The exam was scored by Renaissance staff and teachers using New Standards scoring rubrics during a summer professional development session.

Analyses of the scores were performed by New Standards staff. In the analyses, Mathematics Renaissance students consistently scored significantly higher than the multi-state comparison group. Overall findings indicated that there is a strong, statistically significant evidence that students in the Renaissance sample performed at higher levels on all aspects of the New Standards exam, including skills, concepts, and problem-solving. This is especially noteworthy given the demographics of the Renaissance and multi-state comparison groups. The Renaissance sample schools were composed of more students from groups historically under-represented in mathematics classes.

The professional development resulted in significant changes in classroom practice, documented by case studies, school profiling, and survey data.

Conclusions

Teachers received intensive, sustained professional development in this project. They collaborated with one another and received in-class support. Mathematics Renaissance has positively impacted student achievement in mathematics and teacher instructional behaviors, and influenced district policy regarding curriculum and instructional materials.

Related Resource

Killion, J. (1999). *What works in the middle school: Results-based staff development.* Oxford, OH: National Staff Development Council. Retrieved March 22, 2003 from http://www.nsdc.org/midbook/index.cfm

Literature Checklist

Author(s):   Student Watershed Research Project

Title: *Fifth annual student watershed summit: Summary evaluation comments*

Source:

Publication Date: 1997   **Volume:**   **Issue #:**

Peer Reviewed?   Yes

Type of Study: Quasi-experimental (a post-test only with nonequivalent group)

Data Collected: Data were collected from student data samples, professional and peer review of student analysis reports, and student presentations and displays.

Population: This project originally trained 91 teachers who directly impacted over 6,000 students in grades 8-12 from 18 public and private school districts in the Portland/Vancouver metropolitan areas. (post-test only with non-equivalent/matched control/comparison and treatment group)

Professional Development Component(s):

Component	Addressed
Addresses Student-Learning Needs	*
Incorporates Hands-on Technology Use	*
Is Job-Embedded	*
Has Application to Specific Curricula	*
Addresses Knowledge, Skills, and Beliefs	*
Occurs Over Time	
Occurs with Colleagues	
Provides Technical Assistance & Support to Teachers	
Incorporates Evaluation	*

Findings

The evidence of student success for the Student Watershed Research Project (SWRP) is atypical. Rather than demonstrating increased performance on a standardized assessment of science knowledge, students demonstrate knowledge of data collection and analysis by having their test results compared to duplicate samples analyzed by professional

laboratories. SWRP staff combined professional laboratory results with the students'
data, provided feedback on the data for both the student and teachers, and audited student
data. SWRP standards for reliability of student-collected data were very high. SWRP
staff coordinated and supervised a rigorous quality assurance/quality control program.

The reliability of SWRP data allowed local agencies to use the data to make policy
decisions. The SWRP model has been recognized locally and nationally for the quality
of the data produced, which reflects the quality of student and teacher performance. Data
produced by students were used in a publication by Oregon's Department of
Environmental Quality in establishing surface water quality standards for dissolved
oxygen.

In addition, students wrote their group findings and then presented them to a panel of
their classroom peers. Students became specialists in the particular parameter they
measured, and each group presented both background and findings for their testing
during the presentations. Annual summits allowed students to display their data on
posterboard and give oral presentations, where the quality and content of presentations
were judged by various watershed health professionals. Students also had opportunities
to provide information to regulatory agencies regarding the watershed they monitor.

Conclusions

The Student Watershed Research Project developed teachers' understandings of
watershed research and provided an excellent model of authentic performance assessment
for students. Intensive training for teachers was followed by a wide range of ongoing
support to facilitate implementation of the learning in their classrooms. SWRP
contributed to students' understanding, appreciation, and practice of science as a result of
their teachers' participation in professional development models hands-on, practical
learning experiences.

Related Resource

Killion, J. (1999). *What works in the middle school: Results-based staff development.*
        Oxford, OH: National Staff Development Council. Retrieved March 22, 2003
        from http://www.nsdc.org/midbook/index.cfm