FORMULATING A STATE APPROACH TO PROFESSIONAL DEVELOPMENT

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Abstract

When viewed from the perspective of an entire state's needs, the challenges of designing professional development to meet the requirements of the federal No Child Left Behind legislation of 2001 are daunting. In Oklahoma, the concerns about delivering to rural and urban populations which contain a variety of underserved populations are further complicated by the differences in the way science and mathematics are structured as disciplines. We describe two model programs, one in science and one in mathematics, which take much different approaches. However, the programs have three common elements that make them highly successful. Each program engages teachers strongly, seeks to change learning by altering both teachers' behavior and content knowledge, and is continuously reflective.

The Professional Development Challenge

The American educational landscape has become much more complex and challenging over the last decade. In mathematics and science, the higher education partners who work with school districts in professional development must provide standards-based training in areas subject to testing while not abandoning other areas of the curriculum. They must do this in ways that are accountable, and the training must address the needs of diverse student audiences.

This challenge can be met by developing a portfolio of programs that are diverse in the way they approach science and mathematics professional development, yet are based upon some common elements that make them effective. In this article, we describe strategies and two model programs we have implemented in Oklahoma, a state that has many traits in common with other states.

National Background

The Elementary and Secondary Education Act (ESEA), part of the nation's longstanding commitment to educational quality, became the federal No Child Left Behind (NCLB) legislation of 2001 when it was signed into law on January 8, 2002. This federal legislation made significant changes in education policy, such as new testing, accountability, and teacher quality provisions which impacted every school district in the country. These changes have altered the landscape of school reform and had a major effect on professional development delivered by higher education.

The No Child Left Behind (NCLB) legislation, with its requirements for highly qualified teachers, has increased national attention on state policies and practices regarding the teacher preparation, certification, and professional development. In 2001, the Carnegie Corporation of New York awarded a grant to State Higher Education Executive Officers (SHEEO) to work with Institutes of Higher Education (IHE) on teacher quality policy issues. The ultimate goal of this project was to improve the capacity of elementary and secondary school teachers by identifying key issues where higher education has a clear responsibility to improve teacher quality. The report suggested two important characteristics that should be part of NCLB professional development: 1) more visible and tangible collaborative efforts to improve teacher preparation among preK-12 and postsecondary education in the project states; and, 2) wider involvement of arts and science faculty in the education of prospective teachers and in the development of standards and curricula [1].

The Oklahoma Situation

The challenges of implementing the NCLB legislation at the higher education level in Oklahoma mirror those faced by many states. The Oklahoma State Regents for Higher Education (OSRHE), as the designated State Agency for Higher Education (SAHE), manages the higher education portion of Oklahoma funds used to address the NCLB targets. In their role, the Regents are charged to provide high quality, continuing professional education workshops for teachers or teams of teachers from individual schools and/or districts.

The Highly Qualified Teachers and Improving Teacher Quality State Grants program is one aspect of NCLB funding. A principal goal of the program is to ensure that all students have highly qualified teachers; that is, teachers with the subject matter knowledge and teaching skills necessary to help all students achieve high academic standards, regardless of individual learning styles or needs. State funding for it supports scientifically based practices that improve teaching so as to raise student achievement in core academic subjects.

In common with other states, Oklahoma faces a range of challenges in addressing these charges. First, differences in the State's population density make equitable delivery a challenge. About 64% of the population resides in higher density urban or suburban settings where needs are great, but the remaining 36% is spread throughout rural regions with sparse populations, where the distances make delivery of services more challenging [2]. Second, Oklahoma has substantial populations of underserved students who have historical achievement gaps. The African-American student population (10.8%) has important needs; there is a growing Hispanic population (9.6%); and, the Native American student population (19.2%) is among the nation's largest [3]. Overlaying these issues is a long history of local control which has resulted in 429 independent school districts (K-12) and 111 dependent school districts (K-8). The net result is that services must be provided in a range of locales, addressing the needs of a variety of students in ways that impact many individual districts.

Needs in Mathematics and Science

The Oklahoma teaching standards, the Priority Access Student Skills (PASS), parallel the national standards in science and mathematics [4]. Testing on the mathematics standards in fifth grade is a key factor in determining a school's academic ranking and an important concern in the State. Based upon National Assessment of Educational Progress (NAEP) scores in the fourth grade, there has been improvement in mathematics success over the last decade. Oklahoma's NAEP score in mathematics was 237 in 2007, just under the national average of 239, and up from a score of 220 in 1992 and 229 in 2003 [5]. Although the mathematics scores have shown steady improvement since 1992, the achievement gaps of about 22 points for African-American students and 17 points for Hispanic students have remained consistent since 1992.

Oklahoma benefited from a Collaboratives for Excellence in Teacher Preparation (CETP) award from the National Science Foundation (NSF) which reformed the mathematics training of elementary teachers and was coupled with an increase in mathematics hours (to twelve) required for an undergraduate pre-service degree. Evaluation has shown that the program produced more standards-based instruction in mathematics and science instruction and some indications of enhanced student learning, but the enhancements in science may have been greater than those in mathematics [6-8]. New methods of instruction have had a positive effect on those who recently entered the profession, but much of the elementary teacher workforce is made up of teachers who have twelve to thirty years of experience and training that predates reform methods. In general, these teachers have a higher level of math anxiety and more of a tendency to teach in traditional ways.

In elementary science, the PASS standards also parallel national standards and emphasize inquiry-based instruction. However, because there is no state testing and no effect on a school's academic rating, there are a wide range of implementations. A few urban and suburban districts support kit-based instruction, using materials like *Science and Technology for Children* (*STC*), available through Carolina Biological [9]. Other districts offer some science that is structured in ways determined by the individual teachers. Still other schools and districts actively discourage science instruction in favor of additional instruction in reading and mathematics, areas subject to testing. This trend, one that has been cited nationally, has affected other core disciplines like social studies and fine arts [10-12].

Professional Development Response

Two projects, one in science and one in mathematics, illustrate how the State has responded and show how diverse strategies must be employed. At Southwestern Oklahoma State University, KESAM (Kindergarten-Eighth Scholars Appreciating Mathematics) was originally designed to serve the needs of rural teachers in western Oklahoma. In five years of operation, it has expanded to include coverage to both rural and urban areas across the State. It places special priority on recruiting teams of two teachers to build school culture and uses a word-of-mouth network, powerful in rural areas, in addition to normal recruitment to recruit teachers from rural areas with few professional development opportunities. University housing is provided and the teachers are encouraged to live on campus for the two-week program, opening participation to teachers from across the State.

The goal of KESAM is to communicate the fabric of K-8 mathematics in a way that reduces math anxiety and builds community. It uses an immersion approach to mathematics, and participants are involved in activities from 8:30 until 4:30, and informal groups work in the evening. Teachers do a range of activities in patterning, number sense, graphing, and estimation that build content knowledge. The activities are devised to build strong links between pedagogy and content, a principle shown to be important for effective standards-based instruction [13]. In addition, the teachers reflect upon vertical curriculum alignment, evaluation methods, and operational details like classroom management.

Building a professional community is an important element of the program. Much of the instruction in KESAM is done by master teachers and table leaders—teachers returning for a second year of participation, who work with small groups of first year participants. A Family Night during the program develops camaraderie and the teachers remain in touch during the

academic year using *Blackboard*® or Desire2Learn™.

At The University of Tulsa, "Sense-Sational Science" was begun in 2008 to address the needs of urban and suburban fourth and fifth grade teachers. Recruitment of teachers is done in partnership with two urban school districts and particularly targets teachers from schools that are underperforming or have high populations of underserved children. A central feature of the program is its partnership with five community groups: the Oklahoma Aquarium, Gilcrease Museum, Oxley Nature Center, the Oklahoma Air and Space Museum, and the Tulsa Zoo. The program includes two days of "authentic involvement" in science at each of these institutions during which the teachers engage in activities that use unique resources. For example, at Gilcrease Museum, the teachers spent two days discovering how the human's sense of environment has changed over time through activities that included examining archeological artifacts and studying Native American and western artwork.

The goal of Sense-Sational Science is to develop interdisciplinary connections between science, mathematics, social studies, and fine arts. Using science as the foundation, teachers develop interdisciplinary teaching units that build upon the curricula already in place at their home schools.

Developing a professional community is emphasized through team activities and through extensive interaction with the education directors at each community institution. In its second year, the program plans to invite a group of teachers to return to assist in instruction.

Independent evaluation of these programs in a study commissioned by the Regents has shown that both are very successful. The pre-/post-testing has shown growth in content knowledge. Furthermore, questionnaires completed by the teachers have been positive, and pre-/post-concept mapping exercises have shown much greater understanding of concept connections.

Comparison of the Programs

The objectives of these two programs are very similar. Both began by addressing a particular audience and target achievement gap, and both grew to embrace additional populations. These two programs also seek to enhance content knowledge and pedagogical technique, build leadership skills, develop a professional community, and develop extended partnerships.

Table 1 shows that there are some common approaches to objectives, like partnership building, but several of the objectives are addressed in remarkably different ways.

Table I
Comparison of Successful Programs

Objective	KESAM	Sense-Sational Science
Address target audience and achievement gap	Initial focus on rural teachers who serve substantial Native American populations	Initial focus on urban / suburban teachers who serve substantial African-American and Hispanic populations
Enhance content knowledge	Immersion, focused on math	Authentic involvement, with broad disciplinary range
Enhance instructional techniques	Use of manipulatives, puzzles, fun activities	Interdisciplinary curricula
Build leadership skills	Team leaders, returning teachers	Returning teachers
Enhance professional community	Work with teacher teams, maintain professional environment, continue communication during the academic year	Include education professionals from community groups, build professional environment, maintain communication
Create extended partnerships	Includes teachers, arts and sciences faculty, and education faculty as presenters	Includes teachers, arts and sciences faculty, and education faculty as presenters

The KESAM program has a tight focus on mathematics content and provides an intense experience that continually reinforces basic mathematical concepts. In many ways, the activities are designed in a manner that mirrors the professional development provided to train Mathematics Specialists [14, 15]. The enjoyable tone set during activities tends to diminish any math anxiety while the intensity of the pace tends to galvanize relationships between teachers, forming a very strong professional community.

On the other hand, Sense-Sational Science has a broad focus on interdisciplinary connections that draws many elementary teachers who have little initial interest in science. It engages teachers in a way that allows them to overlay social studies and fine arts with science to

address teaching standards in a number of areas at once. The excitement of the authentic involvement experience generated by providing the teachers with exceptional resources tends to generate a strong professional community that involves education professionals from area non-profit organizations, as well as teachers.

What Are the Attributes of a Successful Program?

Given what seem to be specific approaches to different audiences in distinct disciplines, are there any commonalities that give an indication of why these programs are effective? What traits can be encouraged in new programs and used as guides as the mandates of NCLB are subject to change? Based upon the comparison above, three common directions occur.

First, successful programs engage teachers in a way that generates a bond with the content area and an enthusiasm for communicating it to the teachers' students. The participating teachers in fact become true partners who are motivated to use the ideas in new and exciting ways. Teachers greatly enjoy what they have learned and want to pass it on to their students.

Second, successful programs deliver solid content enhancement tied directly to pedagogical techniques. They provide a basic understanding of what material needs to be covered by students, how it should be presented, and how it relates to real life. Teachers emerge from programs with a more complete understanding of disciplinary knowledge and a new repertoire of ways in which to present it. In the analysis scheme presented a decade ago by Mary Kennedy, the programs seek to produce change by addressing multiple pathways: they alter teacher behavior and enhance teacher content knowledge [16].

Third, the programs themselves are reflective. Much has been said about the importance of reflective behavior among teachers, but the same characteristic is important in programs [17]. Programs must use the results of evaluation and teacher input in a reflective way to alter the approaches and content areas they cover. The programs change considerably over time to address new concerns and new audiences.

What ultimately makes professional development programs successful? All three of these elements contribute to bringing teachers into a partnership in which each contributor (from higher education, public schools, or community groups) takes ownership of the materials. The landscape changes for all. The net result is that each participant presents solid material in a way that is most useful to the students.

The ultimate measure of program success is embedded in the SHEEO call for partnership. Successful programs involve all of the stakeholders—schools, school districts, and higher education institutions—in a way that maximizes the effects each can make upon successful instruction. In successful programs, teachers ultimately emerge as a full partner in the characterization and presentation of disciplinary knowledge.

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