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A NEW PERSPECTIVE FOR SCIENCE INSERVICE: PROBLEM SOLVING DEMONSTRATION CLASSROOMS

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"Project: Problem Solving in the Model Classroom" was begun one year before the Governor's II Conference as a cooperative effort between the University of Iowa and a number of Iowa school districts. The Dwight D. Eisenhower funded program was intended to develop model classrooms that used problem solving with math/science, Science/Technology/Society (STS) or technology as effective classroom practice. The project has become an integration of inservice strategies, demonstration classrooms and reform initiatives that improve science education in Iowa.

At the Governor's II Conference, we recognized that future model classrooms could benefit from our experience, specifically our rationale, development of district autonomy, demonstration classroom inservice structure and future extensions.

Rationale

In developing the rationale for Project: PSMC, we looked at the needs of Iowa teachers, effective staff development and current goals of science reform, with special emphasis on proven strategies in problem solving. As our rationale evolved, we recognized a problematic situation in terminology: namely "model classroom" versus "demonstration classroom." After examining the implications of both terms, we concluded that the resolution depended upon the intended outcome of the site. If the goal was to present the strategy as a standard to which everyone should conform, then "model classrooms" was the appropriate term. If the goal was to have teachers understand problem solving and initiatives and implement them into their curriculum, then the best term was "demonstration classrooms." Because our goal is to model reform in "demonstration classrooms," we changed terminology to reflect our beliefs. We now refer to our project as Problem Solving Demonstration Classrooms (PSDC).

In 1992, *An Assessment of Elementary and Secondary Curriculum Needs and Supply and Demand for Teachers in Mathematics and Science in Iowa* (Sweeney, Kemis, Lively, & Sorenson), found that more than 50 percent of the responding educators indicated that model demonstration classrooms in their districts would be a good way to demonstrate effective curriculum and instruction in mathematics and science. Research in demonstration lessons suggests benefits in this type of instruction. Putnam (1985) found that teachers observing demonstration lessons reported them more beneficial than videotapes in supplementing understanding of a methodology, connection of lessons and the teacher decision-making process. Pinnell (1988) found that observations of lessons allowed teachers to move from a "how-to" concern to an understanding of the processes found in effective teaching. Not only can demonstration lessons provide insight and understanding of effective classroom practices, but Iowa teachers are interested in attending them.

Staff development programs share a common purpose: profound and enduring change for teachers. To achieve this change, effective practices in staff development should be utilized. For the demonstration classroom, two areas need consideration: (1) effective staff development practices, and (2) observational models.

First, the fundamental components of effective staff development are long term support, peer coaching, team building and addressing school/district needs (O'Brien 1992, Fullan 1991, Joyce & Showers 1988, Showers 1985). To fulfill these goals, teachers with common needs are brought together for an extended period of time. As they participate in peer and cognitive coaching, professional dialogue is facilitated. The outcome is an educator who explores the thinking behind his/her practice, develops collegial relationships, has a shared understanding of goals and has acquired new skills and strategies (Garmston, Linder & Whitaker 1993, Showers 1985).

Second, the clinical supervision model (Acheson & Gall 1992) is critical to observational staff development. The observation period is supplemented by pre- and post-conference meetings in a formative setting to encourage the professional growth of a visiting teacher in a non-threatening way. Together, effective staff development findings and the clinical supervision model provide the framework for staff development using demonstration classrooms to model reform initiatives.

The direction for demonstration classroom development was provided by the standards set by Science for All Americans, Benchmarks, and the National Council of Teachers of Math (Rutherford & Ahlgren 1990, AAAS 1993, NCTM 1991). Essential elements from Science for All Americans "Effective Learning and Teaching" include learning by experience, successful participation of all students, multiple opportunities for application and effective questioning (Rutherford & Ahlgren 1990). The Benchmarks "Habits of Mind" promotes problem solving through manipulation and observation, use of communication skills, computation and estimation, and use of critical response skills (AAAS 1993). The math standards (NCTM 1989) view focuses on the process of solving problems, creating problems from real-world activities and working with thought-provoking questions.

The long standing goal of science education is problem solving (Stewart 1982, Wavering 1980, Champagne & Klopfer 1977). Furthermore, Weiss (1987) found that 67 percent of science teachers identify the development of problem solving skills as an important learning objective. However, the classroom situation is much different. NAEP (Educational Testing Service 1990) researchers found that science teachers' instruction often focused on traditional practices: textbook and lecture. In a recent study, 60 percent of eighth graders reported that their teachers lectured several times a week and 97 percent felt that too heavy an emphasis was given to science facts and terminology. Teachers recognize the need to incorporate problem solving; yet most are unable to address this need with current practices.

A popular method of problem solving in science is the Search, Solve, Create, and Share (SSCS) model developed at the University of Iowa (Pizzini 1987). Teachers in many states have participated in SSCS workshops, inservices and conferences (Pizzini & Shepardson 1991b). This model is known for its utilization of student generated questions, extensions of classroom curriculum and ability to accommodate 1061 themes. The four phases in an SSCS cycle are (1) Search --students identify a researchable question on a topic that they would like to investigate; (2) Solve—students design and implement an investigation related to their researchable question; (3) Create—students analyze and interpret data, then find a means to communicate their findings; and (4) Share—students share their results and evaluate their investigation (Pizzini 1990). A "cycle" can take a few days to several weeks to complete.

Abell (1988) and Pizzini and Shepardon (1993, 1992, 1991a) found several positive effects for both student and teacher participants in SSCS programs. For teachers, SSCS staff development programs provide insight and understanding into effective classroom problem solving (Pizzini & Shepardson 1991b). Key to this is the use of peers as instructional leaders. Abell (1988) found that a group of teachers who used SSCS over a 10-month period decreased the amount of time spent in procedural talk and lecture and increased the amount of time spent observing, questioning and listening to the students. Shepardson and Pizzini (1993, 1992, 1991a) found that students who participated in SSCS like science more, understand and know what they are to learn, ask more and higher order questions, and increase in content achievement. The SSCS model is a viable way for teachers and students to increase their use of problem solving in the classroom.

Development of District Autonomy

In developing the Eisenhower proposal for the Problem-Solving Demonstration Classrooms, one of the most critical decisions made was the selection of participating districts and demonstration teachers. We determined the "readiness" of a district by analyzing the district's philosophies and goals; available administrative and financial support; interest, commitment and enthusiasm for integrating problem solving as an effective classroom practice; receptiveness of the affiliated Area Education Agency and willingness to collaborate with personnel from the University of Iowa. The ideal demonstration teacher would have an interest in facilitating the implementation of SSCS in the classroom, an innovative use of the model and a commitment to the use of the SSCS problem solving model through prior SSCS inservice experience. The three selected districts and their respective Area Education Agencies were Fort Dodge (Arrowhead), Iowa City (Grant Wood) and Muscatine Community Schools (Mississippi Bend).

District leadership teams consisting of an Area Education Agency consultant, a district administrator and/or science coordinator, a building principal and two to four demonstration teachers, were given autonomy to decide the number of demonstration classrooms, building sites, demonstration teachers, content/concepts, grade levels, number of visiting educators, duration and number of visitations and scheduling. Allowing this autonomy encouraged the district to pursue an area of interest while meeting the goals of the current reform initiatives. One result of this practice was the development of specific district emphases: Science-Technology-Society (STS), math/science integration, and technology with SSCS problem solving.

Demonstration Classroom Inservice Structure

In the PSDC, our goal is to effect profound and enduring change in teachers' instructional strategies. To facilitate this, leadership teams develop inservice strategies consistent with effective professional development. Specifically, Problem Solving Demonstration Classrooms utilize long term staff development, peer and cognitive coaching, team building, local needs assessments and the clincial supervision model (Acheson & Gall 1992, O'Brien 1992, Fullan 1991, Joyce & Showers 1988, Showers 1985). Teachers involved in our program attend workshops, conferences and staff development on SSCS problem solving. Following this, they select components of SSCS to note during their classroom visits. During the observation, they use the clinical supervision model (Acheson and Gall 1992). Finally, communication and interaction follow the observation. Supplemental materials, including videos, materials, handouts and handbooks may also be provided by sites.

This unique combination of inservice and demonstration teaching of reforms brings a "new perspective" to science and math inservice. The two components are mutually reinforcing; inservice supports the demonstration and the demonstration clarifies the inservice. The clinical supervision model was adapted to maximize the classroom visit. This model has proven to be one of our strongest components. Key to this is the use of pre-conference and post-conference meetings during the classroom visit.

During the pre-observational conference, the upcoming demonstration, the goals of the lessons and reflections on previously attempted classroom strategies are discussed. Demonstration teachers use this opportunity to help visitors select a focus for observation. To further clarify this focus, teachers are encouraged to examine the cycle through one of six "essential" elements found in SSCS: (1) students working in groups, (2) students participating, (3) the teacher as facilitator, (4) students using higher order thinking skills while communicating to each other and the teacher, (5) students generating their problem and action plan and (6) students manipulating materials to collect data.

During the Problem Solving Demonstration Classroom visit, educators observe students actively involved in student centered investigation. The six "essential" elements of SSCS are critical at this point. For example, a visiting teacher who wants to observe students working in groups would see the roles and responsibilities of students in a group that facilitate the identification of the question, the collection of data, the analysis of the data, and the sharing of data with other groups. The visiting teacher notices student behavior as a result of teacher action and records it in either a qualitative and/or quantitative manner.

The post-observational conference is primarily a time of reflection, discussion of data collected and sharing of plans for use of SSCS strategies. Instruction, curriculum, evaluation, philosophy, objectives and rationale may also be discussed at this time. There never seems to be enough time to cover all of the topics visiting educators want to address. To us, this active dialogue reinforces the importance of the post conference in the clinical supervision model.

Throughout the entire inservice period, as teachers explore SSCS in their classrooms, the staff emphasizes appropriate feedback and networking among teachers. Formative, not summative feedback is the focal point to encourage implementation (Acheson & Gall 1992). The networking conducted by the visiting teachers provides a support group to reduce teacher isolation and promotes teaching as craft, with professional learning as an unending process (Rosenholtz 1989). Ultimately, wholistic participation in the inservice and demonstration classrooms allows teachers to internalize SSCS so that it becomes natural, flexible and adaptable, resulting in enhanced teacher performance through problem solving.

1993-94 and Beyond

This year we have observed the evolution of seven sites within three districts. An Iowa City site emphasized math and science integration through problem solving. Muscatine developed four sites that use technology (computers, modems, CD Rom players) and problem solving. Fort Dodge developed two sites which have integrated SSCS and STS. Over 100 teachers have visited these sites.

To assess the total impact of these classrooms, we are collecting qualitative and quantitative data. Initial findings show that teachers, staff developers and administrators value the demonstration classrooms. Teachers report their understanding of SSCS enhanced through observation. One participant said, "I went to the summer workshop and followed along. It was so different when I saw it with the students." Participants have also stated that discussion with fellow educators encouraged them in their first attempts to implement SSCS. Overall, teachers have expressed the importance of "experiencing" the SSCS methodology in a classroom during the district inservice. Administrators and staff developers see the potential of the demonstration classroom. On more than one occasion we have been told that "this has all the critical components of effective inservice. It addresses teacher needs, clarifies proven methodologies and reduces teacher isolation." One teacher has summed up the feelings we heard repeatedly: "The demonstration classroom should be in every inservice that we are required to attend. It provides a comprehensive view of how to teach effectively."

During this next year, we are initiating five additional demonstration classrooms in four new school districts and constructing a handbook that reflects our experiences. The new sites are congruent with our rationale: inservice and demonstration teaching, problem solving and promotion of math and science reforms. Our leadership teams are currently constructing a Demonstration Classroom Handbook that will be available in late spring. This handbook will cover the importance of teacher inservice, logistical issues, demonstration visitation information, selected readings, effective staff development techniques, a thorough rationale and examples of lessons from demonstration sites.

Finally, neither inservice or demonstration teaching are new. The combination of demonstration teaching with effective inservice techniques to model math and science reform is. As Iowa educators implement this "new perspective," we need to listen, question and learn from one another. This active dialogue encourages a well thought-out program that ultimately can improve science inservice.

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