Introducing Math Teachers to Inquiry

Program Description

Introducing Math Teachers to Inquiry is a year-long professional development program implemented in three cycles. It began as a National Science Foundation (NSF) Teacher Enhancement Program and subsequently became the introductory component of a Local Systemic Change (LSC) initiative also funded by the NSF. The program's goals are to improve school-wide mathematics instruction and students'learning through an inquiry approach to instruction and to develop a better understanding of what it means and what it takes to achieve pervasive, long-lasting changes in middle school mathematics. The LSC program is a partnership among four districts in the greater-Rochester area, the University of Rochester and Roberts Wesleyan College.

The professional development processes that led to the results of this program are: (1) the use of "illustrative units" that modeled how mathematics instruction and curriculum should look; (2) engaging teachers in experiences as learners through inquiry; (3) engaging in and sharing reflections about teaching and learning; (3) developing support within the same school to increase teacher collaboration with colleagues; and (4) engaging heterogeneous participants (special education teachers, secondary certified teachers, those teaching mathematics without certification in the field, pre-service teachers, and administrators) in the same professional development experience.

Mathematics

Content

- inquiry-based instructional strategies
- mathematics reform
- mathematics content

Context

- diverse student populations including special needs students
- diverse school settings including urban and sub-urban schools
- diverse teacher populations

Program Context

Introducing Math Teachers to Inquiry was implemented in four schools in four districts in the greater-Rochester area in conjunction with two local institutes of higher education. Each district and school has participated in both the teacher enhancement program and the current local systemic change initiative developed by the researchers. The schools have a strong interest in and desire to improve mathematics instruction.

STAFF DEVELOPMENT PROGRAM

Introducing Math Teachers to Inquiry is a year-long staff development program consisting of a week-long intensive summer institute followed by supported field experiences and follow-up meetings during the school year. The program introduces teachers to the vision of mathematics articulated in the standard of the National Council of Teachers of Mathematics (NCTM). It also helps teachers: gain a personal understanding of what it means to teach mathematics through inquiry; begin to implement this type of teaching in their classrooms; and recognize the need for further professional development and school reform.

The summer institute engages teachers in the experience of inquiry-based instruction as learners. Teachers gain the skills and necessary materials to implement one of the illustrative units using inquiry-based instructional strategies. Teachers learn to actively engage students in the construction of mathematical knowledge, develop units for implementing the processes in their classrooms, and implement the instructional processes in their classrooms with the support of the institute facilitators and a school-based team made up of other participating teachers. They also read, discuss, and reflect about mathematics and mathematics teaching and learning, using contemporary perspectives.

During the school year, teachers adapt and implement one of the illustrative units in at least one class at the beginning of the school year and an additional unit at some point later in the school year. Teachers meet regularly with a support team to discuss their experience with the units. Follow-up involves sharing field experiences with colleagues, attending sessions to address common issues and concerns raised during field experiences, and planning new units.

Process

- training
- modeling
- demonstrations
- curriculum development
- classroom observations
- coaching
- reflection
- collegial interaction

Intended Audience

- entire department or team
- individual volunteer teachers

SUMMARY OF RESULTS

Introducing Math Teachers to Inquiry changes teachers' classroom practices, engages students in inquiry-based learning, and improves student achievement on classroom-based performance assessments. Further analysis of the impact of the program will determine with greater certainty what effect the program will have on student achievement.

EVIDENCE OF INCREASED STUDENT ACHIEVEMENT

Success Indicators

- classroom-based performance assessments
- individual student performance
- teacher journals
- teacher observations
- teacher surveys

Evidence of student success in this project is a measure of student performance on classroom-based performance assessments that demonstrate students' understanding and application of mathematics concepts related to the specific units teacher designed and implemented. Because teachers selected the content of the units they designed and implemented, standardization of student achievement measures was not possible.

Evidence of the impact on student learning is drawn from case studies of two eighth-grade classes. The data from one class are based on students' test results at the completion of a unit on the topic *area.* In this class, after 11 days of instruction, the mean results of the 23 students was 44.26 of 50 or 88 percent. This score was considerably higher by approximately 10-15 percentage points than any previous unit tests these students had taken. The three learning-disabled students in the class scored first, second, and fourth.

The other case study was based on students' involvement in a 31-day Tessellations Unit. A majority of students were successful in most of the subgoals of the unit. Classroom assessment measures included a variety of approaches to assessing students' problem-solving such as: using a problem-solving heuristic; solving teacher-posed problems; posing their own problems; and a long-term group inquiry project involving a presentation.

This type of evidence makes it difficult to conclude that the program leads to increased student achie vement. But, the case studies, classroom observations, teacher journals and surveys demonstrate that students' success with difficult mathematics concepts is associated with inquiry-based instruction.

Introducing Math Teachers to Inquiry provides a unique staff development design that guides teachers through changes in classroom practice that encourage the use of inquiry-based instruction. Model units allow instructors to redesign lesson plans to incorporate any content. The program provides classroom-based collegial support. While the data to support increased student achievement are not strong for this project, the potential for a measurable impact exists.

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DOCUMENTATION

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