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by Joseph A. Meyinsse

For a number of years the movement to reform the content and processes of mathematics education has gained momentum. At this time the consensus of professional thought based on student performance is that the old methods of teaching based on performance objectives have failed. As a result, these must be replaced from kindergarten through college by methods which emphasize hands-on activities and thereby actively involve the learner in the educational process and which promote the development of higher order cognitive skills. It is also the consensus that this process will develop students who are mathematically and scientifically literate and who are well-equipped to function in and to contribute to a complex, technologically-based society. The processes necessary to effect the desired transformation in the mathematical education of our children have been codified in the National Council of Teachers of Mathematics (NCTM) *Standards*, while those necessary to effect essential changes in the education of their teachers have been documented in the Mathematical Association of America (MAA) publication, *A Call for Change*.[1]

In 1991 the National Science Foundation (NSF) established the Statewide Systemic Initiative (SSI) program. To paraphrase the program's mission, SSI seeks to encourage improvements in science, mathematics, and engineering education through comprehensive systemic changes in the education systems of the states. The SSI program represents a strategy aimed at strengthening the infrastructure for science and mathematics education through the alignment of state policies and resources. Twenty-five states and Puerto Rico received five-year matching grants through the initial funding cycle of the SSI program.

The Louisiana Systemic Initiative Program (LaSIP) was designed to reform mathematics and science education in order to adequately prepare students for this rapidly changing age of technology. In June 1996, Louisiana was one of only two states to be awarded "second-cycle" SSI funding from NSF.[2] The primary focus of LaSIP has been professional development for classroom teachers. Initially, in-service training was aimed at mathematics and science teachers in grades four through eight; however, the program has broadened its range and scope to include K-3 and 9-12.

Project MIME

The Department of Mathematics at Southern University has conducted four in-service LaSIP Projects for teachers of grades 5-8 for three years and 9-12 for one year through a program known as *Modeling Integrated Mathematical Experiences* (MIME). The project, funded originally during the 1993-1994 academic year, has now been funded for its fifth year in grades 9-12. The project, co-directed in 1996-1997 with Dr. Lovenia DeConge-Watson, is under my direction for this year.

Project MIME for secondary school is designed to enhance the mathematical knowledge and the pedagogical proficiency of mathematics teachers to facilitate the modernization of mathematics education; to facilitate the implementation and integration of the NCTM *Standards* into the mathematics curriculum in East Baton Rouge and surrounding parishes; to enhance teaching, learning, assessment effectiveness, and the learning environment by the utilization of the best of educational technology; and to institutionalize in teacher education courses the changes recommended by the MAA in *A Call for Change*.

The principal goals of the program are:

1. to provide a model for in-service instruction which integrates content, methods, and technology;
2. to provide teachers with knowledge of and practice in the use of manipulatives and models to facilitate conceptual learning;
3. to enable teachers to use computers and calculators as tools in classroom administration and in the teaching of mathematics;
4. to introduce teachers to the range of educational software available, their sources, and criteria for selection;
5. to provide teachers with a knowledge of the methodologies essential to fostering in their students the development of number sense, problem-solving skills, and critical thinking skills;
6. to enhance the teaching proficiency and assessment methods;
7. to engender in teachers a greater understanding and appreciation of the interconnections of mathematics and the importance of their engendering the same in their students;
8. to enable teachers to communicate mathematical ideas fluently and to facilitate the acquisition of this fluency in their students;
9. to provide teachers with the content knowledge in mathematics needed to give them confidence and enthusiasm in their presentation of mathematics;
10. to facilitate permanent change at the school and parish level consistent with the guidelines established by NCTM in its two documents on curriculum and teaching standards.[3]

Comprehensive Work Plan

The project spans three weeks during the summer with four additional workshops in the academic year. Frequent on-site visits by the site coordinator are made during the academic year. Unique course methodology involves a six step, iterative teaching-and-learning process. The first step takes participants through the content found in the pertinent curriculum in a manner proposed by NCTM. The second step repeats step one utilizing grade-appropriate technology and manipulatives. The third step extends the knowledge base of participants in content areas related to the targeted curriculum in a manner consistent with MAA's *A Call for Change*. Step four requires participants to plan and present mathematical content using methodologies consistent with earlier steps. This involves participants in modeling cooperative learning, and the resulting presentations are made at workshop during the academic year. The fifth step involves on-site collaboration with principals and supervisors from the targeted schools to facilitate and monitor implementation of the summer component. The final stage involves workshops designed to institutionalize the changes identified and validated during the earlier steps of the project. Workshops are held for the participants' principals in the summer and during the academic year to ensure support of the participants in their efforts to implement reform in their respective schools.

Objectives for Participants

By completion of the project year, the participants will have:

1. gained insight into the power of mathematical discussion to ascertain the why's and how's of mathematics;
2. emphasized activities involving estimation and mental computation by the study of the differences in structure and function of various number systems;
3. developed a greater sense of security, confidence, and enthusiasm in the teaching of mathematics, thereby enhancing its learning;
4. developed an understanding of appropriate areas of calculation and computers to enhance reasoning, visual, and problem solving skills;
5. experienced hands-on use of the computer for classroom management;
6. developed an appreciation of the computer as a demonstration tool for teachers and as a laboratory instrument for students;
7. gained experience in modeling mathematics problems with manipulatives;
8. enhanced their awareness of diversity issues involved in teaching and learning styles of students.

Plan of Operation/Management Plan

The director manages the project with active participation of two faculty members, two secondary school teachers, and a full-time site coordinator. The close collaboration of the director, faculty, secondary school teachers, and the site coordinator assure coherence and continuity in content as well as methodology throughout the project. Weekly staff meetings are held during the summer for the purpose of assessing the project based on feedback from daily journal entries of participants.

Two courses are offered in conjunction with the project. The first, principles of algebra for secondary school teachers, emphasizes cooperative learning using the Harvard Consortium method of the "Rule of Three."[4] Several members of the staff have been teaching the algebra course as a pilot for a calculus consortium. Graphing calculators, computer software, and hands-on manipulatives are used to give conceptual insight and understanding of the Theory of Algebra concepts. Less emphasis is placed on algorithms. Because emphasis is placed on solving problems of the real world, algorithms are utilized only as tools for better understanding.

The second course offered in conjunction with Project MIME, principles of geometry, is taught in the same spirit as the algebra course. The computer software Geometer's Sketchpad is used to study geometry inductively by investigation: experimenting, probing, and analyzing theory. Several concepts are studied simultaneously, and constructions are done by ruler and compass as well as by computer. Projects focus on concepts and constructions which are not easily understood in order to ensure basic understanding. This includes work toward basic understanding of proofs, both direct and indirect.

During each course sessions described above, the participants model teaching strategies of group learning while also modeling various assessment techniques. Among the assessment techniques modeled are oral interviews, observations, group assessment, portfolios, and individual assessments. Participants work in groups of four or five and are involved in discussions and hands-on experience. They plan, develop, and model units of lesson plans for their pertinent grade levels using state-of-the-art manipulatives, calculators, and computer software. Another integral part of the project is, as with previous projects, the reading and critical analysis of articles from professional journals in mathematics education, such as *Teaching Children Mathematics, The Mathematics Teacher*, and other periodicals.

Academic Year Program

During the academic year, four workshops are conducted. The workshops are planned by the site coordinator and conducted by the staff, the participants, and invited professionals. During these workshops, the participants have the opportunity to give classroom demonstrations on content as well as methodology and to get feedback on their students' use of calculators, computers, and manipulatives in their classrooms during the academic year. They are able to use the computer laboratory and receive further instruction and prepare for the sessions in their classes. They also use this time to

share successes and failures and assess their procedures with the staff and other participants.

Recruitment

Recruitment is done as much as possible through the principals, supervisors of the targeted parishes, and past participants of prior Southern University LaSIP projects. Recruitment brochures are sent to parish, private and state supervisors of the parishes of West Baton Rouge, Iberville, East and West Feliciana, Ascension, Tangipahoa, and East Baton Rouge. An attempt is made to recruit a minimum of two teachers from a school in order to encourage continuity and support of reform in teaching. Principals are asked to commit to the support of reform teaching by signing the application forms of participants from their respective schools, and by giving teachers the necessary time to develop course syllabi for reform teaching.

Evaluation

The project is evaluated both internally and externally relative to administrative and instructional progress toward project goals. Formative evaluation will be on-going, and a summative evaluation will be conducted at the termination of the project. Review components are as follows: 1) an external review conducted at the end of each project year by LaSIP; 2) daily journal entries by participants to evaluate each course as to completeness, understanding and clarity of the subject matter covered. An overall evaluation of the summer component is conducted at the end of each summer; 3) each day of the training session, a summary of the daily journal commentary is distributed to the staff. This information is used by the staff to make adjustments in content and/or pedagogy necessary to optimize learning and retention of content, and participation in the class activities. Weekly staff meetings during the summer provide additional opportunities for the staff to adjust schedules, coordinate special activities, and address any special needs of participants when necessary; and, 4) the site coordinator makes several visits to observe each participant and students in the classroom. A checklist is used to facilitate data collected. The data contained in the resulting site-visit reports is analyzed, summarized, and transmitted to the staff, advisory council, and external evaluator for their use in determining progress toward attaining program objectives.

Dissemination

The participants from each school are required to demonstrate to other teachers at their respective schools reform methods of teaching learned during the summer session of the project. A timetable is set for these demonstrations and are attended by at least one person from the project staff. They are encouraged to present papers on teaching techniques at conferences to motivate other teachers to enroll in reform programs. The participants are required to demonstrate reform teaching strategies whenever the site coordinator visits the school. After each visit the site coordinator presents a report to the project staff.

Conclusion

The implications of Project MIME for educational reform are substantial. The participants have realized that instruction is not a homogenous system driven by standards and assessment, but rather, it involves several related systems: teachers' knowledge, values and commitments; reflection on classroom practice; learning from one another; and continuing professional development. The participants shift roles from transmitters of facts to facilitators of learning who create an environment and provide materials that allow students to actively explore and make their own connections. As a result, teachers report a sense of personal excitement in teaching mathematics from a different approach. They search for new materials which will stimulate students to learn in an interactive environment, in their own way, at their own pace.

Notes

[1]National Council of Teachers of Mathematics (NCTM), Curriculum and Evaluation Standards for School Mathematics (Reston, VA: The Council, 1989).

[2]Conference Proceedings, *Goals 2000: Educate America Act* (Louisiana Goals 2000, 1994).

[3]Mathematical Association of America. *A Call For Change: Recommendations for the Mathematical Preparation of Teachers* (Washington, D.C.: MAA, 1991).

[4]Deborah Hughes-Hallett, Andrew Gleason, et al. *Calculus: Harvard Consortium Calculus* (New York: Wiley and Sons, 1992)

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