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Project Mcip: Mathematics Curriculum Improvement Project : An Evaluative Study of a College-School Collaborative Program in Mathematics Curriculum Improved Through Staff Development

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PROJECT MCIP: MATHEMATICS CURRICULUM IMPROVEMENT PROJECT. AN EVALUATIVE STUDY OF A COLLEGE-SCHOOL COLLABORATIVE PROGRAM IN MATHEMATICS CURRICULUM IMPROVED THROUGH STAFF DEVELOPMENT.

by

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PROJECT MCIP: MATHEMATICS CURRICULUM IMPROVEMENT PROJECT. AN EVALUATIVE STUDY OF A COLLEGE-SCHOOL COLLABORATIVE PROGRAM IN MATHEMATICS CURRICULUM IMPROVED THROUGH STAFF DEVELOPMENT

This was a twelve month evaluative study of a staff development training project in its third year of implementation to train volunteer classroom teachers to restructure and improve their mathematics curriculum offerings in the classroom. The training focused on teachers using less of their mathematics textbook and worksheets and increasing the usage of manipulatives, calculators, and problem solving activities. The teachers also volunteered to perform as staff developers at their home school sites and trained colleagues at their grade level as well as in their school-at-large with MCIP materials and activities. The evaluation was based upon quantitative data collected over a period of one year as the teachers attempted to implement the components of the MCIP project into their classroom. Qualitative data were collected during the first semester of the project via school site visits, written reports and assignments, and self assessments.

The quantitative data were collected from a pre-post survey administered at the beginning of the MCIP training and one year after the teachers implemented the training in their classrooms. The survey results were analyzed using paired *t* tests, the McNemar test for significants, and a multivariate analysis of variance reported through the Hotelling-Lawley Trace *T* statistic. The results were statistically significant and indicate the MCIP participants used less of their mathematics textbooks and worksheets during the training year, and increased their usage of manipulatives,

calculators, and problem solving activities. They also incorporated more cooperative learning in their classrooms and facilitated more student discussion in their lessons. Many of their lessons during the training year focused on problem solving activities and applications of math to real life situations. Over half of the participants reported that they provided home learning activities which promoted the cooperation of students and their parents working to apply math to everyday life situations.

The participants also performed effectively as mathematics staff developers at their home school sites by training colleagues with the MCIP materials and activities. The evaluative study shows the MCIP staff development project successfully addresses the challenge of restructuring and improving elementary mathematics curriculum.

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VITA

The author, Judith RoseMary Zito, is the daughter of Anthony Zito and Irene (Skoropad) Zito. She was born December 31, 1950 in Chicago, Illinois.

Her elementary education was obtained at Lafayette and Chopin Schools in Chicago, Illinois. Her secondary education was completed in 1968 at Tuley High School in Chicago, Illinois.

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Miss Zito taught physical education and health at the high school and junior high school level from 1974 through 1978. In 1978 she became a guidance counselor at Blackhawk Junior High School, Bensenville, Illinois. She was promoted to assistant principal of Blackhawk Junior High School in 1984. In 1987, Miss Zito was promoted to a principalship position at Tioga Elementary School, Bensenville, Illinois where she is currently serving in this administrative position.

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Miss Zito presented at the State of Illinois Bilingual Conference in Oak Brook, Illinois in 1989. She has also been a guest speaker and presenter at the local level for Loyola University, Chicago, and National-Louis University, Lombard, Illinois.

Miss Zito has been a successful grant writer for Bensenville School District 2 in the areas of Bilingual Education and state funded early childhood programs.

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INTRODUCTION

In school mathematics the United States is an underachieving nation, and our curriculum is helping to create a nation of underachievers. We are not what we ought to be; we are not even close to what we can be. It is time for change - a time to renew mathematics in the United States. (Second International Mathematics Study, 1986)

Beginning with A Nation At Risk, a variety of reports during the 1980s have decried the quality of public education in our country. A recent study by the U.S. Office of Education (1987) comparing U.S. and Japanese schooling stated that improving the quality of education in the United States is necessary for our economic survival.

These reports have emphasized the fact that elementary and secondary students are not achieving as well as they should in basic skills, particularly in academic tasks that require higher-order thinking such as problem solving in mathematics.

Ginsberg (1989) found that mathematics instruction in the United States is typically inappropriate and/or poorly conceived. Textbooks are often confusing, workbooks are dull, and homework assignments can be impossible to comprehend. He strongly suggests many teachers--almost all of whom are well-intentioned and devoted to their students--are ill-prepared to teach math, do not like to teach it, and are afraid to teach it.

Stingler and Perry (1987) found that U.S. teachers spend little time offering thorough explanations of math concepts and procedures. Stevenson et al., (1987) reports that U.S. teachers spend considerably less time imparting information than do Chinese and Japanese teachers. When U.S. teachers do talk, they are more likely to give directions than to discuss content.

In their examination of U.S. mathematics classrooms, Romberg and Carpenter (1986) identified a typical situation where there is extensive teacher-directed explanation and questioning in the context of whole-group instruction followed by students working on paper and pencil assignments at their seats. Peterson and Fennema (1985) found that 43% of class time in math was spent in whole-group instruction and 47% of the time was spent with students doing seatwork.

Goodlad (1984) found that the following pattern consistently characterized teaching and classrooms regardless of the grade level or subject matter: (a) a predominance of whole-group instruction; (b) each student working and achieving alone within a group setting; (c) the teacher functioning as the central figure in determining activities and conducting instruction; (d) a predominance of frontal teaching and monitoring of students' seatwork by the teacher; and (e) students rarely engaged in active learning directly from one another or in initiating interaction with teachers.

Researchers have also documented that most of the time spent in elementary math classrooms is focused on the teaching and learning of lower-level skills and concepts in math rather than on higher order thinking (Porter, Floden, Freeman, Schmidt, & Schwille, 1987).

Peterson and Fennema (1985) found that during fourth grade math classes, students spent only 15% of their time engaged in learning higher-level math content, 62% of their time engaged in learning lower-level math content, and 13% of their time not engaged in learning math at all.

Peterson (1988) sums up the picture of U.S. elementary math classrooms today as teacher-directed whole-group instruction on predominately low-level math content followed by teacher monitoring of individual student seatwork that emphasizes mathematical knowledge and skills.

The History of MCIP

The purpose of this study was to review and evaluate the Chicago Archdiocesan Schools' efforts in improving mathematics education at the elementary level.

In 1986, the Chapter II Principals' Advisory Committee of the Chicago Archdiocese identified the improvement of teaching in science and mathematics as one of two primary needs in their schools. Principals indicated they were eager to move from a textbook-based curriculum to an activities and problem solving oriented mathematics curriculum. In 1987 over 225 school evaluation visitations in the Chicago Archdiocesan schools documented the need for teacher training in delivery of mathematics instruction.

The Curriculum Committee of the Archdiocesan Education Office in response to national reports on the state of mathematics curriculum and instruction and to local needs identified by elementary principals, revised their mathematics objectives according to guidelines from both the National Council of Teachers of Mathematics and the National Assessment of Education Progress.

The Curriculum Committee determined that setting goals for mathematics improvement was not enough and requested technical assistance with the implementation of the revised mathematics curriculum from the School of Education at Loyola University, Chicago. A grant was written in 1986 to the Illinois Board of Higher Education requesting funding from the Federal Education For Economic Security Act Title II (Public Law 98-377) by two professors from the Education Department of Loyola University.

The grant entitled "Mathematics Curriculum Improvement Project" (MCIP), is a teacher-leader staff development training model designed to provide training to elementary classroom teachers in implementing an activity-oriented approach to mathematics curriculum and instruction. MCIP addresses four needs identified in an assessment instrument designed by the Chicago Archdiocesan Education Office and administered to 360 elementary school principals. The four needs identified by more than half of the principals as having highest priority are: (a) workshops and institutes for professional development of teachers; (b) provision of consultation services for curriculum and/or instructional problems at individual schools; (c) provision of consultation services for short and long-range planning and research at individual schools; and (d) provision of resources for innovative programs. More detailed analysis of this data indicates that three of these four needs have highest priority among Black and Hispanic schools; have shown little change in priority since 1976; and have been viewed as ineffectively addressed within the system by over 75% of the principals.

Because of minimal resources, staff development in the Chicago Archdiocesan schools is more problematic than in other school systems. Each school is organized as a district but without necessary resources for curriculum or staff development personnel. The principals identified that classroom teachers have great powers as decision-makers in their classrooms. Therefore, teachers need to be trained to act with the principal as curriculum leaders.

The vision of MCIP is to combine the resources of Loyola University, the Archdiocesan School System and other interested public and private school systems, and the Illinois Board of Higher Education to:

- improve the mathematics competencies of teachers;
- implement a mathematics activities-oriented curriculum faithful to the objectives outlined by the Archdiocesan Education Office Curriculum Committee, the Illinois State Board of Education, and the National Council of Teachers of Mathematics;
- develop a group of teacher-leaders; and,
- develop an internship program for excellent elementary education students.

MCIP attends to three of the five policy objectives of the Illinois Board of Higher Education designed to assist with efforts to improve elementary education in the state:

- to improve preparation of new teachers;
- to improve school curricula and instruction in mathematics; and
- to assist with district-defined teacher training, retraining and inservice training.

The Mathematics Activity Teachers Handbook (M.A.T.H.) is the fundamental component of the MCIP program. The handbook was written to demonstrate how to make mathematics instruction more productive. M.A.T.H. is intended as an aid for teachers who wish to free themselves from the tyranny of traditional textbook design.

There are nine main chapters in the handbook: Data Collection and Graphing, Algebra, Probability, Statistics, Coordinate Geometry, Integers, Fractions, Ratios and Percents, and Whole Numbers and Decimals. These topics complement the content objectives of the Office of Catholic Education of the Chicago Archdiocese. There are appendices in the handbook that were developed in response to teacher input and interest.

Each chapter begins with a discussion question. The discussion question is intended to relate the topic to students' real life experiences. Following each discussion question is a suggested bridge activity to assist students to make the transition from discussion of concepts to actual hands-on classroom learning activities.

Each chapter has four to five learning activities from which to choose. They are designed to meet the developmental needs of students rather than provide standard grade level experiences typically published in textbooks.

Suggested home learning activities and games are provided for each topic. These activities assist students with continued practice and application of classroom instruction at home utilizing parent involvement.

Each chapter concludes with sample evaluation questions upon which teachers may expand to assess the effectiveness of their instruction. Appendices were developed and added to the handbook in response to teachers who expressed particular needs and concerns as they implemented the M.A.T.H. curriculum.

The handbook is organized in loose-leaf notebooks to act as living documents for school-wide implementation. The successful implementation of M.A.T.H. is focused on easy access to the material at each school site and ease of instructional delivery in the classroom. M.A.T.H. meets 95% of the mathematics Model Learning Objectives for the end of grades 3, 6, and 8 developed by the State of Illinois.

Title II Archdiocesan funds have been used for development of M.A.T.H. materials. In 1986 five major chapters and appendices were completed. In the second year of funding, four additional major chapters and appendices had been completed. By 1988, the year of this study, all of the major chapters had been completed. These chapters correspond to the Archdiocesan mathematics curriculum goals. All of the learning activities in M.A.T.H. are designed to reinforce basic skills while introducing higher level mathematics concepts.

MCIP began in the Spring of 1986. The inservice served three purposes: to improve the mathematics competence of the participants, to help them become lead teachers in their schools, and to acquaint them with the best classroom materials available. The timing of the summer inservice program is divided equally among these three major topics.

The inservice plan was divided into three components. Thirty teachers from the Archdioscean schools worked with Loyola faculty and graduate students to develop and pilot M.A.T.H. handbook activities. During Summer and Fall 1986, 40 teachers participated in workshop training to develop existing school personnel as instructional leaders in mathematics.

Each principal who committed to the school particpation had to agree to do the following:

- select a teacher from his/her school who is interested in curriculum development and enjoys the confidence of his/her colleagues;
- support this teacher's efforts to work with one other teacher in his/her school and two or three other teachers in another school;
- reserve 10-15 minutes of each monthly faculty meeting to a discussion of the progress of this program; and
- share information about his/her school's progress at monthly council meetings.

MCIP focused on improving the teachers' mathematics background in algebra, statistics, probability, geometry and data collection. Participants attended 4 days of inservice amounting to 24 hours of training. Following the inservice workshop, ten hours of training with one teacher from their school and two or three teachers from another school occurred. The participants had available to them up to ten hours of assistance from undergraduate students enrolled at Loyola University. Participants received a stipend of $225 for their work during this phase. They also had the option of receiving up to four hours of graduate credit at reduced cost. They received $50 for their participation and implementation of one chapter from the handbook. Participants were also expected to continue training and implementation of M.A.T.H. learning activities throughout the 1986-87 school year.

MCIP received additional monies of $50,000 in 1987 and expanded the inservice training to include additional mathematical content training sessions on graphing, statistics, probability, and calculators. State-of-the-art materials were introduced from DePaul University, Fresno State College, and the Pentathlon Institute.

The Activities Integrating Math and Science (AIMS) from Fresno, California was employed at a cost of nearly $1,000. This National Science Foundation disseminated program was received most enthusiastically by the MCIP participants.

In addition, the 1987 MCIP summer institute sponsored a special session with David Page, a nationally known expert on the use of calculators in the classroom. Topics involving parent involvement, curriculum reform, and the latest educational research were addressed by leading authorities including Dr. Ralph Tyler, Dr. Herb Walberg, and Dr. Anita Pankake. In the third year of MCIP, the focus of this dissertation study, $65,000 was granted to the program to train 53 teachers from 38 schools in the Chicagoland area.

The 47 teachers selected to participate in MCIP/88 came from elementary schools in the Chicago and Joliet Catholic dioceses, the Chicago public school system, suburban public schools, and the Hillel Torah Jewish school system. Forty-two percent of the teachers worked in schools serving a large minority population; 21% of the participants were minority men and women. All of the schools were in Illinois with 8% of the schools in Lake County, 3% in DuPage County, 3% in Will County, and 86% in Cook County. Eighty percent of these participants were private school teachers.

MCIP/88 selected the best of the training programs from the previous years and added additional resources to meet teacher needs. Educational directors from local museums, zoos, and educational service centers gave presentations to inform teachers of educational programs available to them back at their home school sites.

Staff development training focused on conducting research, creating an inservice budget, developing local inservice programs, working with the building principals to implement workshop training for all faculty members at the school site, and developing local resources to improve mathematics curriculum. Six objectives were developed for the participants of MCIP/88.

<u>Objective #1</u>

Twenty-five participants from the 1987 summer workshop will expand their leadership skills developed in the program by extending the MCIP program to a total school effort. The selected schools have agreed to the following:

Analysis of the school mathematics curriculum to provide for:

a) schoolwide use of M.A.T.H. chapters on a monthly basis;

b) parent training in home learning strategies for math at monthly PTA or Home/School meetings;

c) at least two community math events;

d) a school display of students' M.A.T.H.;

e) timely news releases;

f) weekly sharing sessions for teachers;

g) a math focus for the 1988-89 academic year inservice effort;

h) a summer math take-home activities booklet; and

i) development of a plan to have algebra as the standard eighth grade curriculum within two years.

Classroom mathematics instruction will be characterized by:

a) extensive use of problem solving;

b) use of calculators;

c) reading instruction in mathematics;

d) library activities in mathematics;

e) use of manipulatives;

f) use of computers; and

g) integration of math in other content areas.

Objective #2

In addition to the 25 veteran participants mentioned in Objective #1, 25 new participants will be selected for the summer institute. All participants will increase their own competencies in mathematics. The summer institute will focus on problem solving, classroom application of historical mathematics, classroom applications of calculators and computers, and integration of mathematics instruction with science and other subject areas.

Objective #3

New participants will learn staff development skills so that they may become mathematics leaders, first in their own school, and second, within their school system. They will work towards institutionalizing the improved mathematics curriculum.

Objective #4

New participants will implement the MCIP program in their own school and train at least three additional colleagues.

Objective #5

The MCIP will prepare 25 undergraduate education majors for leadership roles as mathematics teachers. Candidates must be elementary education majors who are minoring in mathematics and have a minimum B+ overall grade point average. These interns will attend the same sessions as the participants and work with them in their schools.

Objective #6

Participants will continue to implement MCIP in their schools during the remaining academic year.

The Problem

The purpose of this study was to evaluate the MCIP/88 staff development training of participants by measuring if the participants could change their attitudes about when to introduce new mathematics concepts into the elementary school curriculum. Also, the study examined if participants could change two instructional behaviors, namely, how they planned for and how they taught mathematics to their students.

MCIP/88 builds upon the success of the 1986 and 1987 programs. Activities that were highly rated in 1987 were kept and/or expanded. In two years MCIP has shown that 84 talented and dedicated teachers can change their mathematics curriculum. MCIP/88 attempts to show that these were not unique events (Schiller, 1988).

Research Questions

The evaluation was based on the following questions:

1. Did participants gain more confidence in their ability to teach mathematics during the year they participated in MCIP?

2. Did the attitude of participants change in terms of how they rated the importance, difficulty, and enjoyment of teaching mathematical topics over a one year period?

3. Did the participants change their opinion regarding the importance of following the sequential order of textbook topics when planning for and teaching mathematics as they participated in MCIP/88?

4. Was the frequency of manipulative activities increased in the participants' mathematics lessons after MCIP training?

5. Did the opinion of the participants change when recommending what grade level to introduce mathematics topics into the elementary school curriculum as measured by a pre and post assessment?

6. Did the participants change the frequency of use of instructional activities in the areas of classroom discussion, cooperative learning, home learning activities, work sheets, drilling activities, calculators, problem solving, use of textbook, manipulatives, and use of learning center materials during the MCIP training year?

7. Did the participants change their opinion regarding what mathematics topics they plan to introduce the coming school year as measured by a pre and post assessment?

8. Did the participants show evidence of wanting to participate differently in curriculum decision making after MCIP training?

9. Were the participants active as staff developers in their home schools as they participated in MCIP during the 1988-89 school year?

Limitations of the Study

The findings of this study can relate only to the subjects participating in the MCIP/88 project. The majority of the subjects are classroom teachers in the Chicago Archdiocesan Schools. The rest of the subjects are from public and private schools in the Chicagoland area. All of the subjects volunteered to participate in the training and received payment for their year-long participation. The technique of random sampling for data collection was not observed.

Summary

The purpose of this study was to evaluate the MCIP/88 staff development training of participants by measuring if the participants could change their attitudes about when to introduce new mathematics concepts into the elementary school curriculum. Also, the study examined if participants could change two instructional behaviors, namely, how they planned for and how they taught mathematics to their students.

An important feature in the study was to evaluate the MCIP grant to determine if this training can be a viable means to improve elementary mathematics teaching in the classroom. The justification, importance of the study, the problem, the research questions, and the limitations of the study were included in this chapter.

Chapter II

REVIEW OF THE LITERATURE

This chapter presents a review and discussion of literature used by the researcher as a foundation by which to evaluate the MCIP Program. The first section of the review summarizes the status of elementary mathematics education in the United States from an international, national, and State of Illinois perspective.

International Perspective

In 1982 students and teachers from 500 8th and 12th grade mathematics classes in the United States participated with 12 countries in the Second International Mathematics Study (SIMS). SIMS is a comprehensive study of the teaching and learning of mathematics. The SIMS study specifically addresses problems in international education requiring quantitative methods. The central purpose of the study is to identify how patterns of school organization and teaching practices affect the achievement of students.

The Second International Mathematics Study has three purposes. They are:

- to investigate the ways in which mathematics was taught at this time.
- to describe student attainment in terms of both attitude and achievement.
- to relate these outcome variables to the curriculum studied and the way it was taught.

United States' participation in 1982 was intended as a means to evaluate mathematics curriculum and student performance. This information would be the basis to guide mathematics educators in determining mathematic goals for the future. As data was collected it became apparent that an urgent response was necessary to address the disappointing results which began to emerge.

> The performance of U.S. students on the international mathematics tests was at or below the international average for the younger group (eighth grade) and was very low for the older group (twelfth grade college preparatory mathematics). In some cases, the advanced senior high school group placed among the lowest one-fourth of the nations in the Study. (p. 5)

An analysis of the data points to the curriculum as the major problem in the United States. "It is the mathematics curriculum that shapes the textbooks that set the boundaries of instruction. It is the mathematics curriculum that distributes goals and content during the years of schooling." (p. 9)

The SIMS Study suggests the fault of the mathematics curriculum in the United States is due to content design; it does not provide teachers with a means by which to cover mathematics topics in depth. Learning goals and expectations are diffused and unfocused. Mathematics content and learning objectives are carried over year after year, thereby creating a curriculum that is shaped by unmastered mathematics content introduced from previous years.

> From an international perspective, our eighth grade curriculum resembles much more the end of elementary school than the beginning of secondary school. And at the twelfth grade level, many topics are dealt with only briefly, rather than a few topics being pursued in depth. Consequently, again from an international point of view, relatively few of our students are engaged in a full-fledged course in calculus and those who are so enrolled are achieving at only average levels, at best.
>
> The mathematics curriculum, furthermore, fails to fairly distribute opportunities to learn for children. As early as the junior high school grades, tremendous differences are created in what mathematics U.S. children have the opportunity to learn and, therefore, in what they are able to achieve. These

> differences in opportunity set boundaries on the degree to which individual students are able to reach their fullest potential, boundaries that leave less to reward individual efforts than in any of the other countries for which data were available. Nor are these differences in opportunity-to-learn distributed appropriately so that each student receives the challenge most appropriate to her or his abilities. Socially, as well as organizationally, the mathematics curriculum in U.S. schools falls very short of its potential. (p. 11)

National Perspective

National Assessment of Educational Progress (NAEP)

The National Assessment of Educational Progress (NAEP) is a congressionally mandated project established to conduct national surveys of the educational performance of American youth. NAEP is supported by the U.S. Department of Education, Office of Educational Research and Improvement, and the Center for Education Statistics. Since 1983, Educational Testing Service has assumed responsibility for the administration of the project which had been previously administered by the Education Commission of the States.

Since 1972 NAEP has assessed the mathematical performance of students ranging from 9 to 17 years of age. The most recent report published in 1986 includes a study of mathematical performance of 3rd, 7th and 11th grade students.

The overall finding of NAEP's 1986 survey of the state of school mathematics in the U.S. concludes that:

> While average performance has improved since 1978, the gains have been confined primarily to lower-order skills. The highest level of performance attained by any substantial proportion of students reflects only moderately complex skills and understandings. Most students, even at age 17, do not possess the breadth and depth of mathematics proficiency needed for advanced study in secondary school mathematics. (p. 10)

NAEP describes current mathematics instruction as dominated by teacher explanation, extensive use of the chalkboard, and lessons designed exclusively around textbooks and workbooks. Innovative forms of instruction which may include small group activities, laboratory work, and special projects are non-existent.

> Evidence concerning the nature of mathematics education suggests that the curriculum continues to be dominated by paper and pencil drills on basic computation. Little evidence appears of any widespread use of calculators, computers, or mathematical projects. This picture reflects classrooms more concerned with students' rote use of procedures than with their understanding of concept development of higher-order thinking skills. (p. 12)

Among NAEP's recommendations to improve the state of school mathematics in the United States is the clear message that:

> ...to retain a prominent place in today's technological world, our nation clearly needs to increase the percentage of secondary school students taking advanced mathematics classes. However, care should be taken to implement reforms at all grades, not just at the high-school level. Increasing course requirements at the upper grade levels will ensure that fewer students reject the opportunity to take more mathematics, but it will not address the fact that students in elementary and middle schools also need more challenging curricula. (p. 120)

National Council of Teachers of Mathematics

Curriculum and Evaluation Standards for School Mathematics

In response to a call for reform in the teaching and learning of mathematics in the early 1980s from such reports as A Nation at Risk, and Educating Americans for the 21st Century, The National Council of Teachers of Mathematics established the Commission on Standards for School Mathematics as a means to improve the quality of school mathematics in the United States.

Curriculum and Evaluation Standards for School Mathematics is a document published by NCTM to provide a set of standards for the K-12 level to guide educators in evaluating the quality of mathematics curricula and student achievement in U.S. classrooms.

> The Standards is a document designed to establish a broad framework to guide reform in school mathematics in the next decade. In it a vision is given of what the mathematics curriculum should include in terms of content priority and emphasis. The challenge we issue to all interested in the quality of school mathematics is to work collaboratively to use these curriculum and evaluation standards as the basis for change so that the teaching and learning of mathematics in our school is improved. (p. v)

The Standards reflects a consensus of the Commission that all students need to learn more and varied mathematic concepts and that instruction in mathematics must be significantly revised.

The Commission was charged with two tasks to address the national call for reform:

1. Create a coherent vision of what it means to be mathematically literate both in a world that relies on calculators and computers to carry out mathematical procedures and in a world where mathematics is rapidly growing and is extensively being applied in diverse fields.

2. Create a set of standards to guide the revision of the school mathematics curriculum and its associated evaluation toward this vision.

NCTM defines a standard as a statement that can be used to judge the quality of a mathematics curriculum or methods of evaluation. Standards represent what is valued.

NCTM states three reasons why they have adopted a set of standards to improve mathematics: (a) to ensure quality; (b) to indicate goals; and, (c) to promote change.

> For NCTM the development of standards as statements of criteria for excellence in order to produce change was the focus. Schools, and in particular school mathematics, must reflect the important consequences of the current reform movement if our students are to be adequately prepared to live in the twenty-first century. The standards should be viewed as facilitators of reform. (p. 2)

The goals reflected from the standards address the concern for mathematical literacy for all students. The five goals for students are: (a) to learn to value mathematics; (b) to become confident in their ability to do mathematics; (c) to become problem solvers; (d) to learn to communicate mathematically; and (e) to learn to reason mathematically.

The Standards are divided into four sections: K-4, 5-8, 9-12, and Evaluation. Each grade area has its own distinct curriculum standards to use as a guide in evaluating and developing mathematical learning activities. For the purposes of this research the elementary standards will be reviewed.

NCTM finds that the mathematics curriculum in the U.S. at the K-4 level is in need of reform. The reform must include an examination and change of content, and approaches to instruction.

> A long-standing preoccupation with computation and other traditional skills have dominated both what mathematics is taught and the way mathematics is taught at this level. As a result, the present K-4 curriculum is narrow in scope; fails to foster mathematical insight, reasoning, and problem solving; and emphasizes rote activities. Even more significant is that children begin to lose their belief that learning mathematics is a sense-making experience. They become passive receivers of rules and procedures rather than active participants in creating knowledge. (p. 15)

The K-4 standards are based on several assumptions to improve mathematics curriculum and student learning outcomes. The K-4 curriculum should:

1. be conceptually oriented,

2. should actively involve children in doing mathematics,

3. emphasize the development of children's mathematical thinking and reasoning abilities,

4. emphasize the application of mathematics,

5. include a broad range of content, and

6. make appropriate and ongoing use of calculators and computers.

Mathematics curriculum at the 5-8 level was evaluated by NCTM to be routine. and irrelevant.

> Many students view the current mathematics curriculum in grades 5-8 as irrelevant, dull, and routine. Instruction has emphasized computational facility at the expense of a broad, integrated view of mathematics and has reflected neither the vitality of the subject nor the characteristics of the students. (p. 65)

NCTM suggests an ideal 5-8 curriculum would expand students' knowledge of numbers, and incorporate computation, estimation, measurement, geometry, statistics, probability, patterns and functions, and the fundamental concepts of algebra. Each of these mathematics topics should be taught as an integrated whole, not in isolation. The connection between them should be a prominent feature of the curriculum.

Other needed features of the 5-8 curriculum include:

1. emphasis on the application of mathematics to real-world situations as well as other settings pertinent to middle school students,

2. development of communication skills with and about mathematics and mathematical reasoning, and

3. include the use of calculators, computers, and videos when appropriate.

The need to reform mathematics curricula in the United States is necessary and immediate. NCTM suggests that the Standards advocates students' active involvement in learning, a stance that has important implications for the way content is to be treated during instruction. Rather than a routine presentation of mathematical ideas in a polished, finished form for students to assimilate, instruction should provide frequent opportunities for students to generate, discuss, test, and apply mathematical ideas and verify their findings.

State of Illinois Perspective

Illinois State Goals for Learning

The Illinois State Board of Education introduced reform legislation in 1985 to provide an opportunity for local school districts and the State Board to work cooperatively to improve education in the state. A key component to the legislation was a mandate to develop learning goals and assessment systems in the areas of mathematics, language arts, biological and physical sciences, social studies, fine arts, and physical development and health.

Public Act 84-126 effective August 1, 1985, amended The School Code of Illinois to include a definition of schooling and a requirement that goals for learning be identified and assessed.

The new law requirements include that:

1. The State Board of Education must establish goals consistent with the primary purpose of schooling.

2. Local school districts must establish student learning objectives which are consistent with the primary purpose of schooling and which meet or exceed goals established by the State Board.

3. School districts must also establish local goals for excellence in education.

4. The State Board must establish assessment procedures for local school districts.

5. School districts must assess student learning to determine the degree to which local goals and objectives are being met.

6. School districts must develop local plans for improvement in those areas where local goals and objectives are not being met.

7. School districts must disseminate the local goals and objectives to the public, along with information on the degree to which they are being achieved and, if not, what appropriate corrective actions are being taken by the district.

8. The State Board must approve the local school district objectives, assessment systems, plans for improvement, and public reporting procedures.

Beginning in 1987 each school district in Illinois was required to submit its goals and objectives for student learning to the State Board of Education. The district goals were to meet or exceed the State Goals for Learning and had to identify local goals for excellence in education..

The broad and general state goals for mathematics consisted of the following:

- perform the computations of addition, subtraction, multiplication, and division using whole numbers, integers, fractions and decimals;
- understand and use ratios and percentages;

- make and use measurements, including those of area and volume;
- identify, analyze and solve problems using algebraic equations, inequalities, functions and their graphs;
- understand and apply geometric concepts and relations in a variety of forms;
- understand and use methods of data collection and analysis, including tables, charts, and comparisons; and
- use mathematical skills to estimate, approximate and predict outcomes and to judge reasonableness of results.

The State goals are broadly stated and are intended as terminal goals that all students must achieve by the completion of their elementary and secondary school years. The legislative intent was to focus less on when or how the desired knowledge and skills are acquired, and more on the ultimate results of local school district efforts. Each school district has been given the maximum flexibility for deciding how to meet their specific mathematical goals for all students.

Local districts are required to write and submit their mathematics goals to the State Board of Education for approval. The goals must meet or exceed the State Goals for learning. Each district must begin by identifying what learning objectives students must meet upon completion of their schooling. The approved learning objectives should then become the framework within the school district used to measure student learning outcomes.

The goals generated by each school district may serve as a basis for its district-level assessment program but are not meant as the basis for the State to assess student learning outcomes. State assessment has been based on the more district-level assessment program but are not meant as the basis for the State to assess student learning outcomes. State assessment has been based on the more general learning goals in the State Goals for Learning listed above.

The intent of this new reform movement in the State of Illinois is to extend the usefulness of school mathematics. The State is promoting a revision in mathematics curriculum to include problem solving, increased use of technology, concepts of elementary statistics and probability, real-life applications, geometric concepts and skills, and estimation and mental mathematics.

Summary

The SIMS, NAEP, NCTM Standards, and the State of Illinois Reports present data which clearly indicates that mathematics education in our schools needs immediate restructuring. The SIMS report states students in U.S. schools have less of an opportunity to learn advanced mathematics due to inadequate mathematics curriculum. Teachers are not given appropriate training and materials to cover mathematics concepts in depth. The NAEP study identifies that mathematics curriculum in the U.S. is inadequate due to a major emphasis on paper and pencil drills and lessons designed exclusively upon textbooks and workbooks.

NCTM Standards suggests a complete restructuring of mathematics is an immediate need in this country. This restructuring should focus on changing mathematics curriculum to allow students to become active learners when learning mathematics, with emphasis on application, reasoning and thinking skills, and most importantly, demonstration throughout each lesson that mathematics is a sense-making experience.

The intent of the State of Illinois reform movement is to mandate each school district to revise mathematics curriculum to extend the usefulness of mathematics for each student. The authors of the Mathematics Curriculum Improvement Project attempt to address some of the inadequacies of mathematics education on a local level through the development and implementation of their training model.

The next section of the literature review will focus on the process of educational change. The survey questions written to evaluate and measure the effectiveness of the MCIP training were designed to identify whether or not the participants could change their attitudes about when to introduce new mathematical concepts into the curriculum as well as their approach to planning for and teaching mathematics to their students.

The Process of Change

Sarason (1971) states that educational change depends on what teachers do and think - its' as simple and as complex as that. Berman and McLaughlin (1978) find that successful educational change requires the serious and active participation of the classroom teacher. MCIP is based on the premise classroom teachers will be trained with improved mathematics curriculum offerings and train others in their home schools to improve the state of mathematics at the building level.

A study by Lortie (1975) done in Dade County, Florida involving approximately 6,000 teachers reveals the general condition most classroom teachers are involved in as they go about the business of education.

1. Teacher training does not equip teachers for the realities of the classroom. Nor is it to be expected to do so in light of the abruptness of the transition.

2. The cellular organization of schools means that teachers struggle with their problems and anxieties privately, spending most of their time physically apart

problems and anxieties privately, spending most of their time physically apart from their colleagues.

3. Partly because of the physical isolation and partly because of norms of not sharing, observing, and discussing each other's work, teachers do not develop a common technical culture.

According to Lortie (1975), the lack of a technical culture, an analytic orientation, and a serious sharing and reflection among teachers creates ambiguity and ad-hoc-ness. "The teacher's craft...is marked by the absence of concrete models for emulation, unclear lines of influence, multiple and controversial criteria, ambiguity about assessment timing, and instability in the product." (p. 136)

4. When teachers do get help, the most effective source tends to be fellow teachers, and secondly administrators and specialists.

5. Effectiveness of teaching is gauged by informal, general observation of students. Teachers rely heavily on their own informal observations.

6. Lortie found that "striking success with one student" here and one student there was the predominant source of pride.

7. One of the predominant feelings that characterize the psychological state of teachers and teaching is uncertainty. "Teachers are not sure that they can make all students learn. (p. 132)

Fullan (1982) states that if change is to happen, it will require that teachers understand themselves and be understood by others. He also believes that the notion of change is a highly personal experience in which each teacher who is affected by the change must be given the opportunity to work through the experience so that the rewards at least equal the cost.

Fullan (1982) describes educational change as "change in practice". Change is not a single entity. It is multidimensional. There are three components to consider as educational change is attempted in implementing a new policy or program: (a) the possible use of new or revised materials; (b) the possible use of new teaching approaches; and (c) the possible alterations of beliefs. Fullan (1982) states all three aspects are critical because together they represent the means of achieving a three aspects are critical because together they represent the means of achieving a particular educational goal or set of goals.

Change is defined by many researchers not as an event, but as a process to which there are three broad phases. Phase one is defined as initiation. This entails the process that leads into and includes a decision to adopt or proceed with change. Phase two is implementation. It is at this point when first experiences of attempting to put an idea or program into practice occur. The implementation phase generally lasts two to three years. Phase three is institutionalization. It is at this point that change will be built into the system or will disappear through a decision to discard or through attrition (Berman & McLaughlin, 1978; Rosenblum & Louis, 1979; Yin et al., 1977; Zaltman et al., 1973). The time frame from initiation to institutionalization takes about three to five years. Information should be provided and assessments should be made throughout the process (Hall & Loucks, 1977; Fullan & Park, 1981).

Doyle and Ponders (1978) identify the criteria teachers observe when considering change as congruence, instrumentality, and cost. Congruence is associated with the teachers' estimate of how their students will react to the change. Instrumentality refers to the procedural content and clarity of the proposal for change. Fullan (1982) clarifies this point by stating that teachers must have some understanding of the operational meaning of the change before they can make a judgement about it. Cost is defined as the ratio of investment to return as far as the teacher is concerned. Doyle and Ponders (1978) identify money as a minor consideration; personal costs in time, energy, and threat of sense of adequacy, with no evidence of benefit in return, seem to surface as the major problems with changes in education over the past 20 years. However, Huberman (1981) finds when change does involve a sense of mastery, excitement, and accomplishment; the incentives for trying new practices are powerful.

Factors Affecting Change

Joyce (1979) defines educational change as technically simple and socially complex. The difficulties with change are due in large part to the planning and coordinating of a multi-level social process involving hundreds of teachers. Many of the curriculum developments and educational change adoptions of the 1960s and 1970s did not get implemented in practice, even when implementation was desired (Silberman, 1970; Fullan, 1972; Fullan & Pomfret, 1977). Implementation is the process of putting into practice an idea, program, or set of activities new to the people attempting or expected to change. There are major factors that affect and promote change. Fullan (1982) states the change process can be regarded in three phases: (a) factors leading up to and affecting adoption; (b) factors affecting implementation; and (c) outcomes.

Figure 1 outlines 15 factors Fullan has identified in his research as influencing implementation (the extent to which teachers and students change attitudes, behaviors, etc.) in the direction of desired change. The identified factors encompass a system of variables which interact to promote change in a positive direction. Fullan (1982) stresses that the more these factors are supporting implementation, the more change in practice will be accomplished.

Figure 1. Factors affecting implementation

A. Characteristics of the Change

1. Need and relevance of the change
2. Clarity
3. Complexity
4. Quality and practicality of program

B. Characteristics at the School District Level

5. The history of innovative attempts
6. The adoption process
7. Central administrative support and involvement
8. Time-line and information system (evaluation)
9. Staff development and participation
10. Board and community characteristics

C. Characteristics at the School Level

11. The Principal
12. Teacher-teacher relations
13. Teacher characteristics and orientations

D. Characteristics External to the Local System

14. Role of government
15. External assistance

The following sections amplify Fullan's ideas as contained in each lettered section of the previous outline.

Characteristics of Change

Four characteristics of change that enhance successful implementation are: need, clarity, complexity, and quality and practicality of materials. Fullan (1982) notes many innovations are attempted without a careful examination of what is perceived to be priority needs. Rosenblum and Louis (1979) found that the degree to which educators identify unmet needs was one of the four readiness factors associated with successful implementation. Other studies have identified that implementation is more effective when relatively focused or specific needs are identified (Emrick & Peterson, 1978; Louis & Sieber, 1979).

Clarity of goals and means is a continuous problem in the change process (Fullan, 1982). Gross et al., (1971) found that a majority of teachers are unable to identify the essential features of the innovation they are using. Problems related to clarity have been found in almost every study of significant change (Aoki et al., 1977; Charters & Pellegrin, 1973; Miles, 1978; Simms, 1978, Weatherley, 1979). Fullan (1982) further states that lack of clarity represents a major problem at the implementation stage; teachers find that the change is not clear as to what it represents in practice.

Complexity in Fullan's research is viewed as the difficulty and extent of change required of the teachers responsible for implementation. Change can be evaluated with regard to difficulty, skill required, and the extent of adjustment of beliefs, teaching strategies, and use of materials. Fullan (1982) suggests that complexity creates problems for implementation; however, it can result in greater change because more is being attempted. Berman and McLaughlin (1977) found that ambitious projects may be less successful in absolute terms of the percent of goals achieved, but they usually stimulate more teacher change than projects attempting much less.

The last factor identified as affecting change is the quality and practicality of learning materials, technologies, or other products. The National Diffusion Network (NDN) confirms: "well articulated adoption materials, which...are complete, well organized, comprehensive and detailed" and address "how to" concerns are more effective at the implementation stage; at earlier awareness stages, concise overview materials are better (Emrick et al., 1977; Emrick & Peterson, 1978). Learning materials especially at the time of initial implementation must pass the test of the practicality ethic of teachers (Doyle & Ponders, 1977-78). Berman (1981) states that for implementation to gather momentum teachers must experience some sense of meaning and practicality relatively early in the process of attempting change; otherwise they will eventually abandon the effort.

To summarize this section on the characteristics of change, Fullan (1982) notes the lack of a demonstrable need for change, the lack of a clear picture of the discrepancy between current practice and what is proposed, insufficient attention to the complexity of change in terms of extent and difficulty, and the lack of adequately developed and good quality practical materials constitutes one major barrier to implementation. Implementation is a problem of individuals developing meaning in relation to specific policy or program directions (Fullan, 1982).

Change is a difficult personal and social process of unlearning old ways and learning new ones (Marris, 1975; Sarason, 1981). Deeper meaning and solid change must be born over time; one must struggle through ambivalence before one is sure for oneself that the new version is workable and right (Fullan, 1982).

Characteristics at the School District Level

Fullan (1982) has identified six factors that make changes within school systems effective. The six factors are: the history of innovative attempts, the adoption process, central administrative support and involvement, staff development approaches, the time-line and information system, and board/community characteristics.

The more teachers have had negative experiences with previous implementation attempts in the district or elsewhere, the more cynical or apathetic they will be about the next change presented regardless of the merit of the new idea or program (Sarason, 1971). Districts, provinces or states, and countries can develop an incapacity for change as well as a capacity for it (Berman & McLaughlin, et al., 1979; Lambright et al., 1980).

Fullan (1982) found that opportunistic and bureaucratically oriented adoption decisions are followed by limited implementation. Berman & McLaughlin (1979) state if the decision to change has been carefully considered with appropriate commitment and follow-through by the district, implementation is more likely to be taken seriously by teachers and principals. Rosenblum and Louis (1971) found that the degree of community and staff participation in the early phases of the planning process turned out to be negatively related to successful implementation. Giacquinta (1973) suggests for most large scale changes only a few district administrators make the big decisions. Fullan (1982) has concluded that the solution is not for everyone to participate in the planning, but it is the quality of the planning process that is essential. Miles (1980) supports this notion stating the quality of the adoption process already sets the stage for subsequent success or failure. Fullan (1982) believes that for change in practice to succeed, it is necessary to have implementation-level participation in which decisions are made about what does and what does not work.

The role of the district administrative team in the process of change is critical. Fullan (1982) suggests that individual teachers and single schools can bring about change without the support of central administrators, but district-wide change will not occur. Although it has always been said that the superintendent and the principal are critical to educational change, it is only recently that we are beginning to understand more specifically what that means in practice (Emrick & Peterson, 1978). Rosenblum and Louis (1979) suggest that a degree of centralization is necessary for implementing comprehensive changes across schools, and that strong norms of classroom autonomy in some districts may actually inhibit organizational and district-wide changes. Fullan (1982) goes on further to state that the chief executive officer and other key administrators set the conditions for implementation to the extent that they show specific forms of support and active knowledge and understanding of the realities of attempting to put a change into practice.

Educational change consists of learning new ways of thinking and doing, new skills, knowledge, attitudes, etc. Staff development is one of the key factors related to this change in practice (Fullan, 1982). The amount of staff development training is not necessarily related to the quality of implementation, but it can be if it combines pre-implementation training with training during implementation, and uses a variety of trainers (Louis & Rosenblum, 1981). Pre-implementation training in which intensive sessions are used to orient people to new programs does not work (Berman & McLaughlin, 1978; Downey et al., 1975; Miles, 1978; Smith & Keith, 1971).

One shot workshops prior to and even during implementation are not helpful (Rosenblum & Louis, 1979). Workshop trainers and program consultants are frequently ineffective. Consultants inside the district are unclear about their role and how to be effective consultants (Simms, 1978; Lippitt, 1979). Teachers state they learn best from other teachers, but research shows that they interact with each other very infrequently (Lortie, 1975). When teachers are trained as staff developers, they can be very effective in working with other teachers (Stallings, 1980). Teachers say they need direct outside help, if it is practical and concrete; and they find those qualities to be the exception rather than the rule (Fullan, 1982). Researchers report that concrete and skill-specific training is effective, but "only for the short run" (McLaughlin & Marsh, 1978).

Fullan (1981) suggests that most inservice programs are not designed to provide the ongoing, interactive, cumulative learning necessary to develop new concepts, skills, and behavior. He further proposes that failure to realize a need for inservice work during implementation is a common problem.

Huberman (1981) states that no matter how much advanced inservice or staff development training occurs, it is when people actually try to implement new approaches that they experience specific concerns and doubts. He believes that it is extremely important for teachers to obtain support at early stages of implementation. McLauglin and Marsh (1978) stress that skill-specific training by itself has only a transient effect because the use of new materials and methods is often mechanical without underlying theory assimilated. Learning new skills through demonstration and practice does not necessarily include the learning of the conceptual underpinnings necessary for lasting use (Joyce & Showers, 1980; Bussis et al., 1976; Hall &

necessary for lasting use (Joyce & Showers, 1980; Bussis et al., 1976; Hall & Loucks, 1978; McLaughlin & Marsh, 1978).

Fullan (1982) has found that staff development typically is unsuccessful due to a lack of understanding that implementation, whether voluntary or imposed, is really a process of resocialization. Resocialization is interaction. Learning by doing, concrete role models, meetings with resource consultants and fellow implementors, practice of behavior, ambivalence, gradual self-confidence all constitute a process of gaining the meaning of change more clearly. He further states that successful staff development programs combine concrete teacher specific training activities, ongoing continuous assistance and support during the process of implementation, and regular meetings with peers and others.

The issue of time is a neglected aspect of the implementation process. Sarason (1971) recognized time as a critical factor. In practice, the desire of the agents of change to get started - not only because of internal and external pressures but also because of the awareness, sometimes dim, that the road ahead will not be smooth - results in bypassing the different aspects of the time perspective problem, a bypass that might have no immediate adverse consequences, but can be counted on to produce delayed, and sometimes fatal difficulties. (p. 219)

Fullan (1982) proposes that a major problem many educators had in attempting change in the 1960s and 1970s was the lack of a time perspective about implementation. The decision-makers had an adoption time perspective, not an implementation time perspective. He suggests it was not politically wise to indicate that effective action would take several years to come to fruition, or spending time and energy with implementation difficulties in programs X and Y was necessary when pressure existed for programs A, B and C to be developed and adopted. Impatience arising from the desire to bring about much-needed educational reform resulted in hasty decisions, unrealistic time-lines, and inadequate logistical support during the implementation because due dates arrived quicker than problems could be solved (Sarason, 1971).

Central decision-makers know the complexities of the adoption process; practitioners know the complexities of the implementation process. They live in two different subjective worlds. What appears to be rational to one world looks like resistance to change in the other (Cowden & Cohen, 1979).

The complexities of the implementation process and the slow development of the meaning of change at the individual level makes it obvious that change is a time consuming affair. A time line is needed which is neither unrealistically short nor casually long (Fullan, 1982).

Corwin (1973) found that community support of the school was correlated positively with innovativeness. Rosenblum and Louis (1979) found that external environmental factors pressing on the school result in change occurring. Miles (1980) asserts that attending to political stabilization in relation to the community is one of the primary tasks of planning and implementing new programs. In contemplating or introducing innovations, districts frequently ignore the community and/or the school board (Rosenblum & Louis, 1979; Bass & Berman, 1979). Fullan (1982) notes: (a) most school communities are usually not directly involved in implementation; (b) they can become aroused against certain innovations; and, (c) neither highly stable nor highly turbulent school communities constitute effective environments for implementation. The role of individual parents rather than community groups may provide one of the most powerful leverages to better community groups may provide one of the most powerful leverages to better implementation.

School-level Factors

Goodlad (1975) states the school is the unit of change. Three factors influence how schools promote successful implementation. They are the role of the principal, peer relationships, and teacher orientations (Fullan, 1982). These three factors impact the character and climate of the school as an educational organization.

Various studies on school effectiveness show principals strongly influence the likelihood of change, but it also indicates that most principals do not play instructional leadership roles (Fullan, 1981; Leithwood & Montgomery, 1981). Berman and McLaughlin (1977) found educational projects having the active support of the principal were most likely to succeed. Berman and McLaughlin (1978) go on to suggest that one of the best indicators of active involvement is whether the principal attends workshop training sessions. Fullan (1982) believes that unless principals gain an understanding of a given program and concerns of the teachers in relationship to it, he or she will not be able to provide support for implementation. Emrick and Peterson (1977) identified administrative support as one of the key factors influencing successful implementation of new programs at the building level.

The change process is influenced and supported by peer relationships which emerge in the school (Fullan, 1982). With change defined as a process of resocialization; interaction is the primary basis for social learning. New meanings, new behaviors, new skills depend significantly on whether teachers are working as isolated individuals (Lortie, 1975; Sarason, 1971) or exchanging ideas, support, and positive feelings about their work (Little, 1981; Rutter et al., 1979). Fullan

(1982) has found in his research that the quality of working relationships among teachers is strongly related to implementation (Berman & McLaughlin 1979; Rosenblum & Louis, 1979; Miles et al., 1978).

Fullan (1982) has identified a teacher's sense of efficacy also leads to successful implementation and positive student learning. In school effectiveness research, one of five generalizations related to improvement in student learning is concerned with whether teachers think and expect that all students regardless of family background can reach appropriate levels of achievement (Edmonds, 1979; Cohen, 1980). The Rand study found a strong relationship between a teacher's sense of efficacy and positive impact of change on various measures of success, including percentage of goals achieved, reports of improved student performance, and teacher change (Berman & McLaughlin, 1977). Edmonds and Rutter (1979) suggests that efficacy is more of an organizational feature of schools which come to have a school-wide emphasis and expectation that teachers can improve student learning.

The External Environment

The last set of factors that Fullan has identified which influence educational changes are government agencies and external assistance. In the United States the major authorities of our educational system are the state departments of education and federal agencies. Other agencies such as regional R & D laboratories and centers also attempt to support educational implementation across the country (1982).

Legislation, new policies, and new program initiatives arise from public concerns that the educational system is not doing an adequate job of teaching basics, developing career-relevant skills for the economic system, producing effective citizens, and meeting the needs of recent immigrants or handicapped children or cultural minorities (Fullan, 1982). The problem arises because local school systems and external authority agencies have not learned to sufficiently establish a processual relationship with each other (Cowden & Cohen, 1979). Lack of role clarity, ambiguity about expectations, absence of regular interpersonal forums of communication, ambivalence between authority and support roles of external agencies, and solutions which are worse than the original problems combine to erode the likelihood of implementation (Fullan, 1982). He concludes that the difficulties in the relationship between external and internal groups are central to the problem and process of meaning.

Federal and state governments are the major direct and indirect sources of external assistance to school systems in our country (Fullan, 1982). Technical assistance for implementation (materials, consultancy, staff development, etc.) are frequently available in federal or state-sponsored innovative programs. Louis and Rosenblum (1981) found that outside assistance or stimulation can have a powerful influence on implementation, depending on factors that exist at the local level.

Summary

To summarize the change process in education and the process of successful implementation of new programs Fullan (1982) states the following:

> Change involves the development of meaning in relation to a new idea, program, or set of activities. It is individuals who give meaning and yet these individuals are insignificant parts of a gigantic, loosely organized, complex, messy social system which contains myriad different subjective worlds.
>
> Effective implementation depends upon the makeup of the local district, the character of individual schools and teachers, and the existence and form of external relationships interacting to produce conditions for change or non-change. It takes a combination of the right factors to support and guide the process of resocialization which respects the maintenance needs of individuals and groups and at the same time facilitates, stimulates, prods people to change

through a process of incremental and decremental fits and starts on the way to institutionalizing or discontinuing the change in question. (p. 79)

Chapter III

METHODS AND PROCEDURES

The purpose of this study was to evaluate the MCIP/88 staff development training of participants by measuring if participants could change their attitudes about when to introduce new mathematical concepts into the elementary school curriculum. Also, the study examined if participants could change two instructional behaviors, namely how they planned for and how they taught mathematics to their students. This chapter includes a description of the subjects, a description of the staff development training, an outline of the survey instrument and procedures observed, an explanation of the evaluation rationale, and a description of the statistical procedures used in the evaluation study.

The Sample

Participants in MCIP/88 were drawn from a target population of 50 schools from both the public and private sectors of Cook, DuPage, Lake, and Will Counties in Illinois. Recruitment announcements were sent out to Archdiocese of Chicago teachers who had participated in extended MCIP inservice over the previous two year period. Invitations also went out to teachers who had not had prior experience in the MCIP program. There were 47 teachers who volunteered to participate in the MCIP/88 training. Thus, these 47 teachers became the sample for this research study.

A profile of the participants reveals 25 of the teachers had previous experience with MCIP training. The remaining 22 teachers had no prior experience in the program. Twenty-two participants were self-contained elementary classroom teachers. Eleven were subject area mathematics teachers. Twelve of the remaining teachers had other teaching responsibilities. The majority of teachers (31%) had one to five years of teaching experience. Nineteen percent had six to ten years of experience. Twenty-five percent had 11 to 15 years of experience. Twelve percent had 16 to 21 years of experience, and 10% had 23 to 35 years of experience. Fifty-two percent of the participants indicated they had taken three to five college mathematics courses before participating in MCIP/88; 8% indicated they had no mathematics course work before the training; and 8% indicated they had taken 10 to 12 mathematical courses before their participation in the training. Thirty-four participants in the training program have a BA degree. Twelve have an MA degree. One participant indicated she had a Certificate of Advanced Study Degree.

Description of the Staff Development Training

The 1988 summer workshop was scheduled and implemented over a six day period on August 1, 3, 8, 10, 15, and 17. The workshop met for six hours each day from 9:00 A.M. to 3:00 P.M. The scheduled learning activities included the following.

Mathematics Instruction

In small group formats, the participants were instructed in the use of teaching strategies to incorporate algebra, measurement, use of calculators, statistics, probability, computers, and integration of mathematics with music into their classroom curriculum. AIMS (Activities Integrating Math and Science) materials and classroom curriculum. AIMS (Activities Integrating Math and Science) materials and training were also included in the series.

Three hours of the workshop were devoted to training the participants with written material from the M.A.T.H. appendices that included incorporating math with physical education, teaching mental math tricks, incorporating math with social studies and art, and reviewing strategies to teach math to special education students. During each workshop day, a one hour lecture series was planned with experts in various fields. The lecture series consisted of the following: hands-on science, parent involvement, resource presentation by area museums, zoos, and other community agencies, staff development, reading in science and math, and math and the library.

Six M.A.T.H. Handbook chapters were chosen as a basis for workshop instruction to improve mathematics teaching in the participants classrooms. These chapters included: coordinate geometry, data collection and graphing, whole numbers and decimals, integers, fractions, and ratio and percents. Mathematics Pentathlon games were scheduled the last hour of each workshop day to teach the participants how to motivate and encourage elementary aged students to review and practice basic math facts through the use of card game formats.

Application and Outside Assignments

Each day participants were gathered in small group planning sessions to discuss how to incorporate the workshop training into a staff development plan for their home school sites. Each participant was required to choose three teachers from their school and provide ten hours of MCIP training and share materials with them. They were expected to work as a team to improve the mathematics curriculum within their school setting. They also discussed and planned how to use a budget stipend of $150 that was to be given to them at the end of the workshop to assist in the implementation of their staff development plan. The independent homework assignments chosen to support and reinforce the MCIP staff development training included reading assignments on selected staff development components and theories, an assignment to prepare a detailed budget plan that would assist in implementing staff development plans at each participant's home school site, and an outline of how each participant would introduce MCIP to their home school faculty.

Follow-Up Meetings

Follow-up meetings after the August workshop were scheduled to provide each participant with continued training, support and a vehicle to report successes and concerns to the project directors. Small group meetings were held in convenient locations for participants during the first three months after the summer workshop. Each small group was facilitated by an experienced MCIP participant who had three years of training. Each meeting was scheduled after a school day and lasted for one and one-half hours. The participants shared his/her experiences as they began to implement their staff development plan at their school site. Group problem solving and strategy sessions took place as needed.

In December a whole group meeting was scheduled. Each participant was encouraged to invite all of the members of their team and their building principal to attend. Discussions and mid-year formative program evaluations occurred.

The Survey Instrument and Procedures

The participants received an attitude survey developed by this researcher and the principal investigator of MCIP on the first day of the August workshop (Appendix

C). Each participant responded confidentially to 28 items. Each participant was asked about his/her teaching background, his/her confidence in teaching mathematics, the importance of following the order of a math textbook when planning and teaching mathematics, the use of manipulative materials in math lessons, his/her desire for greater participation in making decisions about mathematics curriculum in their respective schools, and the degree to which each regarded the importance, enjoyment and ease of teaching mathematic concepts typical of an elementary mathematics curriculum. They were asked at what grade level they would recommend the introduction of particular math topics, and what topics they had introduced the past school year to their students. They also indicated what math topics they were planning to introduce the coming school year. On the sixth day of the workshop each participant was given a portion of the same survey which addressed at what grade level they would recommend introducing math topics to their students and what topics they planned to introduce the next school year.

Exactly 12 months after the MCIP/88 workshop training each participant was mailed a post-survey. The survey contained the same items as the pre-survey. New sections were added that requested the participants to indicate what instructional strategies they had implemented in their mathematics lessons from the school year just completed. Questions about how participants may have acted as a staff developer in their grade level, with their entire school faculty or with other educators in various settings were also asked. Participants concluded the post-survey by indicating whether or not they had continued to pursue professional mathematics training or course work after the MCIP staff development training.

To gain an in-depth view and understanding of what effect the MCIP/88 staff development training had upon the participants, a doctoral graduate student working with the project was assigned to assist in the selection of five participants to monitor and observe during the training session. This graduate student was also assigned to visit and observe each of these participants at their home school site as they attempted to implement their staff development plan during the first half of the school year. Throughout the semester, information was obtained via telephone conversations, school site visits, written reports and assignments, as well as through staff and self evaluation forms.

The Evaluation Rationale

There are a variety of approaches to evaluation. Worthen and Sanders (1973) define evaluation as determining the worth of a thing. They suggest that it involves obtaining information for use in judging the worth of a program, product, procedure, objective, or the potential utility of alternative approaches designed to attain specified objectives. In Ralph Tyler's Eight Year Study he defined evaluation as the process of comparing performance data with clearly specified objectives. Scriven (1967) states that the goal of evaluation is to answer questions of selection, adoption, support, and worth of educational materials, and activities. Stufflebeam (1971) distinguished evaluation from research by stating, "The purpose of evaluation is to improve, not to prove." Isaac and Michael (1981) describe improvement as a judgment made regarding what constitutes worth or value. They suggest evaluation is a term typically associated with how effective or ineffective, how adequate or inadequate, how good or bad, how valuable or invaluable, and how appropriate or inappropriate a given action, process, or product is in terms of the perceptions of the inappropriate a given action, process, or product is in terms of the perceptions of the individual who makes use of information provided by an evaluator.

There is a difference between evaluation and research. Research has its origin in science. It is oriented toward the development of theories with most inquiries based on paradigms of experimental design. It is from this point that hypotheses are derived from theory and tested under controlled conditions and situations.

On the other hand, evaluation is a by-product of technology. Its focus is not derived from theory building; rather it is product delivery or mission accomplishment. The main focus of evaluation is to provide feedback that can lead to successful outcomes defined in practical, concrete terms. Isaac and Michael (1981) describe three major components of evaluation: (a) setting objectives; (b) designing the means to achieve these objectives; and (c) constructing a feedback mechanism to determine progress toward, and attainment of, the objectives. The evaluation of MCIP/88 conducted by this researcher is based upon the above stated components of evaluation as stated by Isaac and Michael from their published work, Handbook in Research and Evaluation.

The Statistical Design

To evaluate the MCIP/88 program, nine evaluation questions were written to address the two independent variables of instruction and curriculum and two dependent variables of attitude and teaching behaviors. The analysis of the program is based on before and after scores (means) of each participant who completed a year of participation in the project. The statistical method chosen to measure the dependent variables was a paired *t* test. A paired *t* test, is a parametric statistic, which follows the assumption of normality. It is assumed the sample being tested is drawn from a population that is normally distributed. Each participant was paired with him/herself and tested twice within a 12 month period. A paired t test was used to determine if there was a difference between the two means of each participant. If a difference was found, the next step was to determine if the difference was large enough to be considered statistically significant or whether the differences were related to chance. The alpha level to determine statistical significance was set at .05 for this study. If the t score was less than .05, the t score was considered statistically significant. If the t score was at or above .05 it was determined that the means were unequal and there was no statistical significance. The strength of the paired t test is that it controls for nuisance variables (outside or uncontrollable influences) by pairing the participant with him/herself. The known weakness of the paired t test is it does not indicate whether a statistically significant difference is an important difference. The evaluator must judge for himself by examining differences and determining if they are large enough to be considered important educationally.

In order to determine if there was a difference between experienced and non-experienced MCIP participants on their mean scores, each group was partitioned (defined as separated into their own group) for the paired t tests.

The McNemar Test was chosen to analyze statistically if participants actually did what they planned to do when introducing new mathematics topics to their students during the 1988-89 school year. The test was also used to analyze if the participants were planning differently throughout the school year, and if they had changed their opinion of when to introduce new mathematics topics into the elementary school curriculum. The McNemar Test is most often used in before and after experimental designs to detect any significant changes in proportions of subjects from one category to another. The strength of this test is its ability to detect differences in changes of proportions for dichotomous variables. The McNemar tabulates a 2 x 2 table for each pair of dichotomous variables. The test is not performed for variables with more than two values and a chi-square statistic is computed for cases having different values for the two variables.

A third statistical procedure was chosen to examine if interaction occurred between the independent and dependent variables of when to introduce mathematics topics into the elementary school curriculum. A multivariate analysis of variance was used to detect interaction. Analysis of variance is defined as a method of identifying, breaking down, and testing for statistical significance variances that come from different sources of variance. Kerlinger (1964) defines this as the dependent variable which has a total amount of variance, some of which is due to the experimental treatment, some to error, and some to other causes. Analysis of variance is designed to work with these different variances and sources of variance to detect possible interaction and/or statistical significance.

Multivariate analysis is a procedure that categorizes a family of analytic methods whose main characteristic is the simultaneous analysis of k independent variables and m dependent variables. To analyze the survey data of when participants indicated they would introduce mathematics topics into the curriculum after MCIP training, a multivariate analysis was performed. The MANOVA was used to look for interaction between the independent variables of time and group membership (experienced MCIP participants and non-experienced participants) with the dependent variable of attitude.

The Hotelling-Lawley's t test is the multivariate statistic reported. This procedure is used to test the assumption of the equality of means for repeated measure designs in which there are more than two variables. The results of these analyses are reported in Chapter 4.

Chapter IV

PRESENTATION AND ANALYSIS OF DATA

The purpose of this study was to evaluate MCIP/88 staff development training by measuring if participants could change their attitudes about when to introduce new mathematical concepts into the elementary school curriculum. Also, the study examined if participants could change two instructional behaviors, namely how they planned for and how they taught mathematics to their students. This chapter includes a presentation of the findings and an analysis of the data.

An attitude survey was administered to all 47 of the MCIP/88 participants on the first day of the workshop training. A portion of the same survey was administered the sixth day of the workshop which asked each participant what grade level they would recommend introducing math topics to their students and what topics they planned to introduce the coming school year. One year after the MCIP/88 workshop training each participant was mailed a post-survey. Thirty-three participants responded and mailed back the post-survey. There was a 70% return of all post surveys.

A quantitative evaluation of MCIP/88 will be based upon analyzed data from the pre/post surveys. A qualitative evaluation of MCIP/88 will be based upon observations, school site visits, written reports, and evaluations of five randomly selected MCIP participants. The qualitative data were synthesized by a doctoral graduate student working with the MCIP/88 project.

Survey Results and Analysis

The questions on the pre and post surveys were written to address five areas of evaluation of MCIP/88. The five areas were: (a) an examination of each participant's attitude change regarding the importance, difficulty and enjoyment of teaching math topics; (b) an analysis of each participant's recommendation of when to introduce mathematics topics into the elementary school curriculum; (c) an analysis of how each participant instructed his/her students; (d) an analysis of math curriculum offerings each participant included in his/her math lessons; and (e) an examination of how each participant performed as a staff developer at his/her home school site to begin to institutionalize the components of MCIP into the school culture.

Analysis of Attitude Changes

The attitude changes of the participants were evaluated from the following two survey questions.

Question 1

Did participants gain more confidence in their ability to teach mathematics during the year they participated in MCIP?

Table 1

Summary of Participants' Confidence Level to Teach Mathematics

N = 47	Frequency	Percent	Cumulative Frequency	Cumulative Frequency
Day One				
Very Confident	23	48.9	23	48.9
Confident	20	42.6	43	91.5
Not Sure	1	2.1	44	93.6
Somewhat Unconfident	2	4.3	46	97.9
Very Unconfident	1	2.1	47	100.0
N = 33				
One Year Later				
Very Confident	14	42.4	14	42.4
Confident	8	24.2	22	66.7
Somewhat Confident	3	9.1	25	75.8
Very Unconfident	8	24.2	33	100.0
*Adjusted per Phone Contact				
One Year Later				
Very Confident	16	48.4	16	48.4
Confident	13	39.3	29	87.7
Somewhat Unconfident	3	9.1	32	96.8
Very Unconfident	1	2.1	33	100.0

Referring to Table 1 the frequency distribution of the responses indicates on the first day of MCIP training 91.5% of the participants were confident teaching mathematics. Of the participants 8.5% indicated they were not confident as they taught mathematics. One year later the confidence level of the participants dropped to 66.7% with 33.3% indicating they were not confident teaching. This researcher questioned why there would be such a dramatic decrease in the confidence level of the participants one year after the training. The eight participants who indicated they were very unconfident were contacted by phone for clarification. Seven of the participants were very surprised they had responded as being very unconfident and indicated they wanted to change their response to the item. Five participants changed their response to confident, two chose very confident, and one individual responded she was very unconfident teaching mathematics but would not elaborate her concerns to this researcher.

The adjusted frequency distribution indicates the confidence level of participants dropped from 91.5% to 87.7% after one year in the MCIP program and the unconfident level rose from 8.5% to 11.2%. The Second International Mathematics Study (SIMS) addresses the issue of teacher confidence and states the following:

> While the levels of training and experience of U.S. mathematics teachers were not markedly dissimilar from those of teachers in high-achieving countries, some major differences were noted in the attitudes of teachers. The U.S. teachers reported that mathematics was rather easy to teach. The Japanese stated that it was difficult to teach.
>
> ...Japanese teachers perceive teaching mathematics as a difficult, demanding enterprise, the success of which had considerable impact on the achievement of their students. By contrast, U.S. teachers seemed to see teaching mathematics as less demanding and to view the learning of mathematics as an enterprise over which they had relatively little control. (p. 67)

The data imply on the first day of the MCIP/88 workshop 91.5% of the participants were confident teaching mathematics. Many of these participants may have been following a teaching format described by Goodlad (1984) as typical of most U.S. classrooms regardless of grade level or subject matter. The format is described as: (a) a predominance of whole-group instruction; (b) each student working and achieving alone within a group setting; (c) the teacher functioning as the central figure in determining activities and conducting instruction; (d) a predominance of frontal teaching and monitoring of students' seatwork by the teacher; and (e) students rarely engaged in active learning directly from one another or in initiating interaction with the teacher.

One year later after completing MCIP training 87.7% of the participants indicated they were confident teaching mathematics. This may imply that as the teachers restructured their mathematics curriculum offerings, increased hands-on math activities into the lessons, incorporated more problem solving and higher order thinking skills into the lessons, and increased student interaction and cooperative learning into the classroom, the teaching of mathematics became more challenging for the teacher. This attitude change may reflect what the Japanese teachers indicated in the SIMS report that teaching mathematics is a difficult, demanding enterprise.

Table 2

Summary Table of Confidence Level of Participants' by Group Membership

First Time Participants				
N = 15	Day One		One Year Later	
Very Confident	(6)	40.0%	(6)	40.0%
Confident	(7)	46.6%	(5)	33.3%
Undecided	(1)	6.0%		-
Somewhat Unconfident	(1)	6.0%	(3)	20.0%
Very Unconfident			(1)	6.0%
Repeat Participants				
N = 18				
Very Confident	(7)	38.8%	(10)	55.5%
Confident	(10)	55.5%	(8)	44.4%
Very Unconfident	(1)	5.0%		-

Referring to Table 2 the 33 participants were divided into separate groups of first time participants in the MCIP training and participants who have participated before (repeat participation) in MCIP. Eleven first time participants who indicated they were confident when teaching mathematics appear to maintain this attitude after one year. There were four first time participants (26%) who were not confident teaching mathematics after one year in the program.

The experienced MCIP participants appear to maintain their confidence level as they participated in the program another year. One participant who initially claimed to be unconfident when teaching math has appeared to gain confidence over time.

Question 2

Did the attitude of participants change in terms of how they rated the importance, difficulty, and enjoyment of teaching mathematical topics over a one year period?

The data presented to answer this evaluation question begins with a view of how the participants rated the importance, difficulty, and enjoyment of teaching mathematics by group membership on the first day of the MCIP workshop. Tables 3, 4, and 5 summarize the rating responses of the participants by group membership of first time participants and participants who had prior training.

Table 3

Summary of Participants' Rating of Importance of Math Topics by Group Membership

N = 47	VI	I	UN	NI	N at All
IMP					
Algebra					
First Time	19.15	23.40	4.26	-	-
Done Before	27.66	14.89	10.64	-	-
Integers					
First Time	12.77	25.53	6.38	2.13	-
Done Before	19.15	29.79	4.26	-	-
Probability					
First Time	6.52	21.74	13.04	4.35	-
Done Before	6.52	26.09	19.57	2.17	
Statistics					
First Time	4.35	21.74	15.22	2.17	2.17
Done Before	4.35	28.26	21.74	-	-
Coordinate Geometry					
First Time	2.17	34.78	6.52	-	2.17
Done Before	10.87	36.96	6.52	-	-
Data Collection					
First Time	4.35	23.91	13.04	2.17	2.17
Done Before	8.70	34.78	10.87	-	-
Whole Numbers					
First Time	36.96	8.70	-	-	-
Done Before	34.78	17.39	2.17	-	-

Table 3 (continued)

N = 47	VI	I	UN	NI	N at All
IMP					
Ratio/Percents					
First Time	19.57	19.57	6.52	-	-
Done Before	28.26	23.91	2.17	-	-
Fractions					
First Time	34.04	12.77	-	-	-
Done Before	31.91	21.28	-	-	-
Graphing					
First Time	10.87	32.61	2.17	-	-
Done Before	19.57	34.78	-	-	-
Math Games					
First Time	31.91	10.64	4.26	-	-
Done Before	19.15	27.66	6.38	-	-
Computer Software					
First Time	10.87	21.74	10.87	2.17	-
Done Before	15.22	28.26	10.87	-	-
Learning Center					
First Time	22.22	17.78	6.67	-	-
Done Before	13.33	17.78	20.00	2.22	-

Legend:

VI = Very Important　　NI = Not Important

I = Important　　N at All IMP = Not At All Important

UN = Undecided

Table 4

Summary of Participants' Rating of How Much They Like to Teach Math Topics by Group Membership

N = 47	L A Lot	L	UN	DIL	DIL A Lot
Algebra					
First Time	4.44	15.56	15.56	4.44	4.44
Done Before	22.22	15.56	15.56	2.22	-
Integers					
First Time	-	26.09	19.57	-	-
Done Before	17.39	30.43	4.35	2.17	-
Probability					
First Time	-	22.22	15.56	6.67	-
Done Before	13.33	17.78	24.44	-	-
Statistics					
First Time	-	11.36	22.73	6.82	2.27
Done Before	9.09	20.45	25.00	2.57	-
Coordinate Geometry					
First Time	-	22.22	20.00	2.22	-
Done Before	22.22	28.89	4.44	-	-
Data Collection					
First Time	6.52	13.04	26.09	-	-
Done Before	13.04	28.26	13.04	-	-
Whole Numbers					
First Time	15.22	26.09	4.35	-	-
Done Before	19.57	32.61	2.17	-	-

Table 4 (continued)

N = 47	L A Lot	L	UN	DIL	DIL A Lot
Ratio/Percents					
First Time	4.44	24.44	13.33	2.22	-
Done Before	13.33	33.33	4.44	4.44	-
Fractions					
First Time	10.57	32.61	2.17	-	-
Done Before	28.26	26.09	-	-	-
Graphing					
First Time	10.87	26.09	6.52	2.17	-
Done Before	32.61	15.22	6.52	-	-
Math Games					
First Time	21.74	19.57	4.35	-	-
Done Before	23.91	21.74	8.70	-	-
Computer Software					
First Time	8.89	17.78	17.78	-	-
Done Before	13.33	17.78	24.44	-	-
Learning Center					
First Time	11.90	23.81	14.29	-	-
Done Before	7.14	21.43	21.43	-	-

Legend:

L A Lot = Like A Lot

L = Like

UN = Undecided

DIL = Dislike

DIL A Lot = Dislike A Lot

Table 5

Summary of Participants' Rating of Ease of Teaching Math Topics by Group Membership

N = 47	VE	E	UN	H	VH
Algebra					
First Time	-	8.51	19.15	14.89	4.26
Done Before	6.38	19.15	23.40	4.26	-
Integers					
First Time	-	26.09	15.22	4.35	-
Done Before	6.52	28.26	8.70	10.87	-
Probability					
First Time	-	19.57	15.22	8.70	2.17
Done Before	8.70	17.39	23.91	4.35	-
Statistics					
First Time	-	10.87	17.39	10.87	6.52
Done Before	4.35	21.74	23.91	4.35	-
Coordinate Geometry					
First Time	2.22	15.56	17.78	8.89	2.17
Done Before	17.78	31.11	4.44	2.22	-
Data Collection					
First Time	2.17	19.57	21.74	2.17	-
Done Before	6.52	34.78	13.04	-	-
Whole Numbers					
First Time	13.04	30.43	2.17	-	-
Done Before	26.09	21.74	6.52	-	-

Table 5 (continued)

N = 47	VE	E	UN	H	VH
Ratio/Percents					
First Time	2.17	13.04	15.22	13.04	2.17
Done Before	10.87	17.39	10.87	13.04	2.17
Fractions					
First Time	4.35	28.26	2.17	6.52	4.35
Done Before	17.39	26.09	4.35	6.52	-
Graphing					
First Time	6.52	34.78	2.17	2.17	-
Done Before	23.91	21.74	4.35	4.35	-
Math Games					
First Time	8.70	19.57	17.39	-	-
Done Before	19.57	26.09	8.70	-	-
Computer Software					
First Time	4.35	19.57	21.74	-	-
Done Before	15.22	17.39	19.57	2.17	-
Learning Center					
First Time	4.44	15.56	21.74	6.67	-
Done Before	6.67	13.33	19.57	-	4.44

Legend:

VE = Very Easy　　H = Hard

E = Easy　　VH = Very Hard

UN = Undecided

The overall trend as the data is examined indicates that experienced participants generally rated the 13 items more importantly than the first time participants. Coordinate geometry, data collection, fractions, and graphing were the highest rated items of importance by the experienced participants.

The rating pattern of first time participants indicates they disliked teaching algebra, probability, and statistics more than the experienced participants. They also indicated they found algebra, probability, statistics, and coordinate geometry difficult to teach. Both groups indicated they found ratio/percents, fractions, and graphing somewhat difficult to teach.

The data contained on Tables 6, 7, 8 are a summary of rating responses all 33 participants noted on their surveys during the first day of the workshop and one year later. This researcher examined the data to look for trends establishing a change in attitude over a one year period.

Table 6

Summary of Importance Rating of Math Topics - One Year Later

	VI	I	UN	NI	N At All
IMP					
Algebra					
First Time	46.81	38.30	14.89	-	-
Done Before	51.50	36.40	9.10	3.00	-
Integers					
First Time	31.91	55.32	10.64	2.13	-
Done Before	51.50	39.40	3.00	6.10	-
Probability					
First Time	13.04	47.83	32.61	6.52	-
Done Before	24.20	54.50	18.20	3.00	-
Statistics					
First Time	8.70	50.00	36.96	2.17	-
Done Before	18.20	60.60	15.20	6.10	-
Coordinate Geometry					
First Time	13.04	71.74	13.04	2.17	-
Done Before	36.40	54.50	6.10	3.00	-
Data Collection					
First Time	13.04	58.70	23.91	-	-
Done Before	56.30	37.50	6.30	-	-
Whole Numbers					
First Time	71.74	26.09	2.17	-	-
Done Before	78.80	18.20	3.00	-	-

Table 6 (continued)

	VI	I	UN	NI	N at All
IMP					
Ratio/Percents					
First Time	47.83	43.48	8.70	-	-
Done Before	63.60	30.30	3.00	3.00	-
Fractions					
First Time	65.96	34.03	-	-	-
Done Before	78.80	21.20	-	-	-
Graphing					
First Time	30.43	67.39	2.17	-	-
Done Before	45.50	48.50	6.10	-	-
Math Games					
First Time	51.06	38.30	10.64	-	-
Done Before	72.70	21.20	6.10	-	-
Computer Software					
First Time	26.09	50.00	21.74	-	-
Done Before	36.40	42.40	21.20	-	-
Learning Center					
First Time	35.56	35.56	26.67	26.67	2.20
Done Before	36.40	48.50	12.10	3.00	-

Legend:

VI = Very Important　　NI = Not Important

I = Important　　NAI = Not at All Important

UN = Undecided

Table 7

Summary of Like to Teach Math Topics - One Year Later

	L A LOT	L	UN	DIL	DIL A LOT
Algebra					
First Time	26.67	31.11	31.11	6.67	-
Done Before	39.40	39.40	12.10	9.10	-
Integers					
First Time	17.39	56.52	23.91	2.17	-
Done Before	30.30	48.50	9.10	12.10	-
Probability					
First Time	13.33	40.00	40.00	6.67	-
Done Before	27.30	30.30	39.40	3.00	-
Statistics					
First Time	9.09	31.82	47.73	9.09	-
Done Before	21.20	39.40	36.40	3.00	-
Coordinate Geometry					
First Time	22.22	51.11	24.44	-	-
Done Before	33.33	57.60	9.10	-	-
Data Collection					
First Time	19.57	41.30	39.13	-	-
Done Before	59.40	31.30	9.40	-	
Whole Numbers					
First Time	34.78	58.70	6.52	-	-
Done Before	54.50	39.40	6.10	-	-

Table 7 (continued)

	L A LOT	L	UN	DIL	DIL A LOT
Ratio/Percents					
First Time	17.78	57.78	17.78	6.67	-
Done Before	36.40	48.50	12.10	3.00	-
Fractions					
First Time	39.13	58.70	2.17	-	-
Done Before	45.50	51.50	3.00	-	-
Graphing					
First Time	43.48	41.30	13.04	-	-
Done Before	48.50	39.40	12.10	-	-
Math Games					
First Time	45.65	41.30	13.04	-	-
Done Before	72.70	21.20	6.10	-	-
Computer Software					
First Time	22.22	35.56	42.22	-	-
Done Before	36.40	39.40	24.20	-	-
Learning Center					
First Time	19.05	45.24	35.71	-	-
Done Before	31.30	53.10	15.60	-	-

Legend:

L A LOT = Like A Lot

D = Dislike

L = Like

DIL A LOT = Dislike A Lot

UN = Undecided

Table 8

Summary of Ease of Teaching Math Topics - One Year Later

N = 47	VE	E	UN	H	VH
Algebra					
First Time	6.38	27.66	42.55	19.15	-
Done Before	21.90	46.90	25.00	6.30	-
Integers					
First Time	6.52	54.35	23.91	15.22	3.00
Done Before	15.20	57.60	15.20	9.10	-
Probability					
First Time	8.70	36.96	39.13	13.04	-
Done Before	12.10	36.40	39.40	12.01	-
Statistics					
First Time	4.35	32.61	41.30	15.22	-
Done Before	9.10	45.50	36.40	9.10	-
Coordinate Geometry					
First Time	20.00	46.67	22.22	11.11	-
Done Before	30.30	54.50	9.10	6.10	-
Data Collection					
First Time	8.70	54.35	34.78	-	-
Done Before	53.10	34.40	12.50	-	-
Whole Numbers					
First Time	39.13	52.17	8.70	-	-
Done Before	54.50	39.40	3.00	-	-

Table 8 (continued)

N = 47	VE	E	UN	H	VH
Ratio/Percents					
First Time	13.04	30.43	26.09	26.09	-
Done Before	18.20	45.50	18.20	18.20	-
Fractions					
First Time	21.74	54.35	6.52	13.04	-
Done Before	21.20	63.60	6.10	9.10	-
Graphing					
First Time	30.43	56.52	6.52	6.52	-
Done Before	45.50	45.50	3.00	6.10	-
Math Games					
First Time	28.26	45.65	26.09	9.10	-
Done Before	66.70	21.20	3.00	-	-
Computer Software					
First Time	19.57	36.96	41.30	2.17	-
Done Before	27.30	45.50	6.10	-	-
Learning Center					
First Time	11.11	28.99	48.89	6.67	-
Done Before	18.80	46.90	25.00	9.40	-

Legend:

VE = Very Easy H = Hard

E = Easy VH = Very Hard

UN = Undecided

The data from Table 6 - Importance Rating - indicate the participants rated algebra, integers, coordinate geometry, whole numbers, fractions, graphing, and ratio/percents the same in importance over a one year period. The participants clearly increased their importance ratings for data collection and math games. Data collection had the largest gain of importance moving from 71.74% to 93.80%. The rating of like to teach data collection rose from 60.87 to 90.70%. The ease of teaching data collection rose from 63.05% to 87.50%. Math games rose in importance from 89.36% to 93.90%. The rating of like to teach math games increased from 86.95% to 93.90%. The ease of teaching math games rose from 73.91% to 87.90%.

Use of math computer software remained in the same range of importance over the one year time span but there was a definite increase of participants who felt it was easier to use after their MCIP training. The ease of using software rose from 56.53% to 72.80%.

Another area to note is the importance rating of using learning center activities/materials in mathematics lessons remained the same but the ease of incorporating learning center activities/materials into the math curriculum rose from 40.10% to 65.70% after the MCIP/88 training.

Probability and statistics both show an increase in importance from the participants. Probability rose in importance from 60.87% to 78.70%. However, 40% of the participants were undecided as to how much they liked to teach probability and were also unsure how easy it is to teach this topic. Statistics gained in importance from 58.70% to 78.80%. Again a trend developed in which 36.40% of the participants were unsure how much they like to teach statistics and are also unsure how easy it is to teach this topic. The participants acknowledged the importance of these two math topics in the elementary mathematics curriculum but appeared to lack the training and knowledge to incorporate them into their own classroom math offerings.

Analysis of Instructional Changes

The instructional methodologies participants used in their mathematics lessons during the MCIP training year will be addressed from the following two questions.

Question 4

Was the frequency of manipulative activities increased in the participants' mathematics lessons after MCIP training?

Table 9

Summary Table of Participants' Use of Manipulatives

	N	Yes	No
Pre-Training	47	(43) 95.6%	(2) 4.4%
Post-Training	33	100.0%	0.0%

The data contained in Table 9 indicate 95.6% of the participants were using manipulative materials in their math lessons before MCIP/88. One year later all of the participants who responded to the survey indicated they were using manipulatives.

Table 10

Use of Manipulatives

	N	1 - 2 Days	3 - 4 Days	5 Days
Pre-Training	47	(29) 65.9%	(10) 22.7%	(3) 6.8%
Post-Training	33	(20) 62.5%	(10) 31.3%	(2) 6.3%

Table 10 clearly shows there was an increase of manipulative usage in the 3-4 day category. The increase rose by 8.6%. This may well indicate the training received in the MCIP workshop influenced the increased usage of manipulatives on a consecutive basis. The 1-2 day range of usage remained constant throughout the year which suggests these participants needed further training to learn how to incorporate manipulative materials into their lesson plans on a daily basis.

Table 11

Paired t test - Use of Manipulatives

	N	Mean	Standard Deviation	t	PR>T
Day 1	31	0.94	0.25	20.86	0.0001
One Year Later	32	1.00	0.00	-	-
Degree of Freedom	30	0.07	0.26	1.44	0.1608

Table 11 reports the results of a paired *t* test which tested for significance of change with regard to manipulative materials. The increased usage of manipulatives was not statistically significant at the .05 alpha level.

Question 6

Did the participants change the frequency of use of instructional activities in the areas of classroom discussion, cooperative learning, home learning activities, worksheets, drilling activities, calculators, problem solving, use of textbook, manipulatives, and use of learning center materials during the MCIP training year?

Table 12

Summary Table of Frequency of Instructional Activities Used During the Training Year

N = 33	More		Same		Less	
Classroom discussion	(20)	64.5%	(6)	19.4%	(5)	16.1%
Cooperative learning	(27)	87.1%	(3)	9.7%	(1)	3.2%
Home learning	(18)	58.1%	(12)	38.7%	(1)	3.2%
Work sheets	(4)	12.9%	(12)	38.7%	(15)	48.4%
Drilling activities	(5)	16.1%	(17)	54.8%	(9)	29.0%
Calculators	(21)	70.0%	(7)	23.3%	(2)	6.7%
Problem solving	(25)	80.6%	(5)	16.1%	(1)	3.2%
Textbook	(1)	3.2%	(12)	38.7%	(18)	58.1%
Manipulatives	(26)	83.9%	(4)	12.9%	(1)	3.2%
Learning Center activities	(10)	35.7%	(16)	57.1%	(2)	7.1%

Table 12 lists ten areas of instructional strategies that participants rated as to the amount of their usage during the MCIP training year. To summarize the findings, 58.1% of participants decreased the use of mathematics textbooks in their lessons, 48.4% decreased the use of worksheets in their classrooms during the 1988-89 school year. Of the participants 57.1% indicated they used learning center activities/ materials about the same as before MCIP training, 54.8% indicated they used the same amount of drilling activities. Of the participants 87.1% indicated they increased the use of cooperative learning, 83.9% increased the use of manipulatives, 80.6% increased problem solving activities in their lessons, 70.0% used more calculators, 64.5% facilitated more classroom discussion in their lessons and 58.1% provided more home learning activities throughout the 1988-89 school year as they participated in the MCIP/88 project.

Analysis of Curriculum Changes

The curriculum changes participants made in their mathematics lessons during the MCIP training year will be addressed from the following survey questions.

Question 3

Did the participants change their opinion regarding the importance of following the sequential order of their textbook topics when planning for and teaching mathematics as they participated in MCIP/88?

Table 13

Summary of Following Order of Textbook

	N	Important	Undecided	Not At All Important
Pre-Training	47	29.8%	21.3%	48.9%
Post-Training	33	29.1%	6.5%	64.6%

Referring to Table 13 the participants did change their opinion of the importance of following the sequential order of textbook topics as they planned for and taught mathematics to their students. On the first day of MCIP/88 48.9% agreed it was not at all important to follow the sequence of the mathematics textbook closely. One year later 64.6% agreed it was not important. This was a gain of 15.7% of participants who appeared comfortable to change the order in which they may have used the textbook in their mathematics lessons.

Table 14

t test for Following Order of Textbook by Group Membership

First Time	N	Mean	Standard Deviation	t	PR>T
Day One	15	2.67	0.90	11.48	0.0001
One Year Later	13	3.77	1.36	9.97	0.0001
Degree of Freedom	13	-1.23	1.24	-3.59	0.0037*
Repeating Participants					
Day One	18	3.89	0.76	21.76	0.0001
One Year Later	18	3.72	1.49	10.62	0.0001
Degree of Freedom	18	0.17	1.38	0.51	0.6156

*Significant .05

The t test results on Table 14 show that the first time participants' change in attitude of the importance of not following the sequential order of the text is statistically significant at the .05 alpha level after one year of participation in the project. Their change in attitude is not due to chance. The experienced participants' t test results are not statistically significant at the .05 alpha level.

Table 15

Summary Table of t test for Following Order Of Textbook By Time/Group Membership

Day One	N	Mean	Standard Deviation	t	PR>T
Done Before	18	3.88	0.75		0.0003
				4.2364	
First Time	15	2.66	0.89		0.0002
	Difference exists between the two groups on first day				
One Year Later					
Done Before	18	3.72	1.48		0.9280
				-0.0899	
First Time	15	3.76	1.36		0.9290
	No difference between groups one year later				
Degree of Freedom					
Done Before	18	-0.16	1.38		0.0063*
				-2.9006	
First Time	13	1.23	1.23		0.0070*
	Change over time due to group membership				

There is an interaction, it appears to exist between treatment and time.

The t test results on Table 15 indicates a difference of opinion existed between the first time and experienced participants in regard to the importance of following the sequential order of the textbook during the first day of the workshop training. The experienced participants indicated they did not believe it was as important to follow the sequential order of their textbook as closely as first time participants when planning for and teaching mathematics.

One year later the t test results shows there was no longer a difference of opinion between the first time and the experienced participants. The first time members changed their opinion and reflected what the experienced members had stated that it was not important to closely following the sequence of the text. The t test results indicates there was a change of attitude over time correlating with group membership and this was statistically significant.

Table 16

Summary Table of t test for Following Order of Textbook Day One/One Year Later

N = 33

	N	Mean	Standard Deviation	t	PR>T
Day One	33	3.33	1.02	18.76	0.0001
One Year Later	31	3.74	1.41	14.74	0.0001
Degree of Freedom	31	-0.42	1.48	-1.58	0.1247
		(No change)			

The summary of the t test on Table 16 for all of the participants in the program shows there was not a statistically significant change in attitude for all of the participants over a one year period.

To summarize up to this point after one year in the program there was a statistically significant change of attitude of first time participants who stated it was not important to follow the sequential order of the mathematics textbook when planning for and teaching mathematics. A majority of the experienced MCIP members had expressed this opinion throughout the training year.

A follow-up question was written in the survey to gather more information on whether participants did skip around and not follow their math textbook when planning for and teaching mathematics to their students.

Table 17

Summary Table of Skipping Around in Textbook Pre/Post

	N	Yes	No
Pre-Training	47	89.1	10.9
Post-Training	33	93.8	6.45

Table 17 shows an increase of participants skipping around as they used their texts. At the beginning of the workshop 89.1% of participants indicated they skipped around as they used their mathematics textbook. One year later 93.8% indicated on the survey that they skipped around when using their textbook to plan for and teach mathematics.

Table 18

Summary Table of Skipping Around in Textbook by Group Membership

	N	Skip	Do Not Skip
	33	93.80	6.45
First Time	15	92.86	7.14
Repeat Participants	18	94.12	5.88

Table 18 looks at this question from the point of view of group membership. The data show no difference between first time and experienced participants.

Table 19

Summary Table of t test for Skipping Around in Textbook

N = 33	Mean	Standard Deviation	t	PR>T
Day One	0.94	0.25	21.56	0.0001
One Year Later	0.94	0.25	21.56	0.0001
Degree of Freedom	0.00	0.37	0.00	1.0000

Table 19 examines the results of the paired t test which tested if the participants' planning and teaching behaviors were statistically significant. The participants' change of behaviors were not statistically significant after one year's time.

Question 5

Did the opinion of the participants change when recommending what grade level to introduce mathematics topics into the elementary school curriculum as measured by a pre and post assessment?

Table 20 summarizes the experienced and first time MCIP participants' recommendations of when to introduce 13 mathematics topics into the elementary school curriculum.

Table 20

Summary Table of Recommended Grade Level for Introducing Math Topics Difference Between First Time and Experienced Participants - Day 1 and Day 6

DB = Done Before FT = First Time *Statistically Significant 0.05

	DAY 1				DAY 6			
	Mean	SD	t	Prob> T	Mean	SD	t	Prob> T
Algebra								
DB	2.33	2.11	-1.88	0.06	1.36	1.38	-1.81	0.07
FT	3.76	2.86	-1.99	0.06	2.45	2.52	-1.87	0.06
Integers								
DB	2.55	2.23	-0.67	0.50	1.08	1.35	-1.78	0.08
FT	3.00	2.44	-0.67	0.50	1.95	1.91	-1.82	0.07
Probability								
DB	3.08	2.35	-1.44	0.15	1.72	1.62	-1.33	0.18
FT	4.09	2.32	-1.44	0.15	2.45	2.08	-1.35	0.18
Statistics								
DB	3.66	2.35	-2.01	.05*	2.52	1.89	-0.71	0.47
FT	5.09	2.38	-2.01	.04*	3.00	2.60	-0.72	0.46
Coordinate Geometry								
DB	2.52	1.93	-3.59	.0009*	1.36	1.43	-1.92	0.06
FT	4.90	2.46	-3.66	.0007*	2.50	2.42	-1.98	0.05*
Data Collection								
DB	2.00	2.44	-1.79	0.08	0.64	0.81	-1.05	0.30
FT	3.38	2.72	-1.80	0.07	1.00	1.41	-1.08	0.28

Table 20 (continued)

	Mean	SD	t	Prob> T	Mean	SD	t	Prob> T
Whole Numbers								
DB	0.28	0.67	-0.67	0.50	0.20	0.40	-0.70	0.48
FT	0.32	1.53	-0.71	0.47	0.40	1.33	-0.74	0.45
Ratio/Percents								
DB	3.50	1.69	-1.00	0.32	2.32	1.88	-1.72	0.09
FT	4.09	2.21	-1.02	0.31	3.27	1.88	-1.72	0.09
Fractions								
DB	1.32	1.43	-1.43	0.15	0.60	1.04	-1.24	0.22
FT	2.04	1.90	-1.47	0.14	1.09	1.57	-1.24	0.20
Graphing								
DB	1.80	1.91	-0.45	0.64	0.52	1.00	-1.81	0.07
FT	2.04	1.74	-0.45	0.65	1.22	1.57	-1.86	0.06
Math Games								
DB	0.40	0.95	1.78	0.08	0.28	0.61	0.27	0.75
FT	0.04	0.21	1.64	0.10	0.22	0.68	0.27	0.78
Computer Software								
DB	0.76	1.01	-0.47	0.63	0.24	0.43	-1.93	0.06
FT	0.95	1.59	0.49	0.62	0.36	1.45	-2.04	0.04
Learning Center								
DB	1.04	1.43	0.92	0.35	0.66	0.91	0.10	0.91
FT	0.68	1.05	0.90	0.36	0.63	1.04	0.10	0.91

The data contained on Table 20 indicate on the first day of the workshop all of the experienced participants recommended an earlier introduction of math topics into the elementary school curriculum. Six days later (on the last day of the workshop) all of the participants had lowered their recommendations of when to introduce these math topics. The first time participants appeared to have changed their recommendations to correlate closely with the recommendations of the experienced participants.

Table 21

Summary Table of t test for Recommended Grade Level To Introduce Math Topics (After Training) Difference Between Day 1 and Day 6

VARIABLE	N	MEAN	SD	t	PR>T	REC. GRADE
Algebra	45	-1.07	2.44	-2.93	0.0054*	1
Integers	44	-1.36	2.16	-4.19	0.0001*	1
Probability	45	-1.53	2.46	-4.19	0.0001*	2
Statistics	45	-1.60	2.39	-4.50	0.0001*	2
Coordinate Geometry	46	-1.70	2.43	-4.73	0.0001*	2
Data Collection	46	-1.83	2.52	-4.91	0.0001*	2
Whole Numbers	46	-0.09	0.46	-1.27	0.2094	K
Ratio and Percentage	45	-1.02	1.92	-3.56	0.0009*	1
Fractions	46	-0.83	1.54	-3.64	0.0007*	K
Graphing	46	-1.07	1.70	-4.24	0.0001*	1
Math Games	46	0.00	0.89	0.00	1.0000	K
Software	46	-0.33	1.01	-2.18	0.0341*	K
Learning Center	46	-0.32	0.99	-2.06	0.0460*	K

Table 21 shows the results of the t test which tested if the recommended changes of the participants were statistically significant. All of the topic recommendation changes noted on the sixth day survey were statistically significant except for whole numbers and math games. Both of these math topics had been recommended by the participants to be introduced at the Kindergarten level on the pre/post surveys.

Table 22

Summary Table of Participants' Recommended Introducing Math Topics Over a One Year Period

Day 1 - Day 6 N = 47 — Day 1 - Day 6 - 1 year later

1 year later N = 33 — by Grade level

Algebra	K	1	2	3	4	5	6	7	8
Day 1	17.78	22.22	8.89	15.56	6.67	8.89	2.22	13.33	4.44
Day 6	28.89	31.11	6.67	8.89	13.33	4.44	2.22	2.22	2.22
1 Yr.	25.00	18.80	18.80	12.50	3.10	3.10	6.30	9.40	3.10
Integers									
Day 1	20.45	25.00	6.82	4.55	13.64	13.64	11.36	4.55	-
Day 6	38.64	29.55	9.09	9.09	6.82	4.55	2.27	-	-
1 Yr.	22.60	22.60	3.20	24.80	9.70	6.50	9.70	-	-
Probability									
Day 1	11.11	13.33	15.56	6.37	17.78	8.89	15.56	6.67	4.44
Day 6	22.22	28.89	17.78	6.67	8.89	13.33	-	2.22	-
1 Yr.	25.80	15.10	9.70	9.70	25.80	3.20	-	9.70	-

Table 22 (continued)

	K	1	2	3	4	5	6	7	8
Statistics									
Day 1	8.89	4.44	15.56	4.44	20.10	8.89	15.56	11.11	11.11
Day 6	17.78	20.00	17.78	4.44	15.56	15.56	2.22	2.22	4.44
1 Yr.	16.70	23.20	6.70	6.70	20.00	10.00	6.70	10.00	-
Coordinate Geometry									
Day 1	10.87	17.39	10.87	8.70	13.04	13.04	8.70	13.04	4.35
Day 6	32.61	21.74	10.87	15.22	8.70	4.35	2.17	2.17	2.17
1 Yr.	19.40	29.30	6.50	12.90	9.70	12.90	6.50	-	3.20
Data Collection									
Day 1	32.61	8.70	17.39	10.87	2.17	10.87	4.35	6.52	6.52
Day 6	52.17	26.09	17.39	2.17	-	-	4.35	-	-
1 Yr.	65.60	15.60	-	-	9.40	6.30	-	3.10	-
Whole Numbers									
Day 1	84.78	4.35	6.52	-	2.17	-	2.17	-	-
Day 6	82.61	13.04	2.17	-	-	-	2.17	-	-
1 Yr.	87.50	6.30	-	3.10	-	3.10	-	-	-
Ratio and Percents									
Day 1	8.89	6.67	11.11	11.11	20.00	20.00	20.00	2.22	-
Day 6	13.33	20.00	13.33	17.78	11.11	15.56	8.80	-	-
1 Yr.	9.70	16.10	12.90	9.70	16.10	19.40	12.50	3.20	-

Table 22 (continued)

	K	1	2	3	4	5	6	7	8
Fractions									
Day 1	34.78	21.74	15.22	8.70	10.87	8.70	-	-	-
Day 6	58.70	23.91	4.32	6.52	2.17	4.35	-	-	-
1 Yr.	40.60	21.70	15.60	9.40	9.40	3.10	-	-	-
Graphing									
Day 1	32.61	15.22	15.22	17.39	8.79	6.52	4.35	-	-
Day 6	56.52	26.09	4.32	6.52	4.35	6.52	4.35	-	-
1 Yr.	53.10	18.80	6.30	6.30	6.30	9.40	-	-	-
Math Games									
Day 1	86.96	6.52	-	-	2.17	-	-	-	-
Day 6	84.78	8.70	-	-	2.17	-	-	-	-
1 Yr.	96.90	3.10	-	-	-	-	-	-	-
Computer Software									
Day 1	56.52	21.74	10.87	6.52	2.17	-	2.17	-	-
Day 6	71.74	17.39	4.35	2.17	2.17	-	-	-	-
1 Yr.	75.00	18.80	3.10	-	3.10	-	-	-	-
Learning Center									
Day 1	58.54	14.63	12.20	12.20	-	2.44	-	-	-
Day 6	63.41	24.39	7.32	2.44	2.44	-	-	-	-
1 Yr.	71.00	16.10	9.70	3.20	-	-	-	-	-

The data from Table 22 indicate that a trend developed in which over the course of a year's time all of the participants readjusted their recommendations of when to introduce elementary math topics. Generally, participants did recommend that by the

4th grade 11 of the math topics featured in the MCIP program should be introduced into the elementary mathematics curriculum.

Statistics and ratio and percents were the only two math topics that a few of the participants appeared to recommend introducing during the fifth through seventh grades as noted from the data on the post survey assessment.

Table 23

Summary of Recommendations of First Time Participants Over a One Year Period

*Significance .05

VARIABLE	N	MEAN	SD	t	PR>T
Algebra					
Day 1	14	4.14	2.71	5.17	0.0001
1 Year	15	2.53	2.80	3.50	0.0035
Degree of Freedom	14	-1.50	2.14	-2.62	0.0210*
Integers					
Day 1	14	3.71	2.55	5.44	0.0001
1 Year	14	2.71	2.09	4.86	0.0003
Degree of Freedom	14	-1.00	2.15	-1.74	0.1052
Probability					
Day 1	14	5.00	2.25	8.30	0.0001
1 Year	14	2.64	2.44	4.06	0.0014
Degree of Freedom	14	-2.36	2.71	-3.26	0.0062*
Statistics					
Day 1	14	5.36	2.02	9.91	0.0001
1 Year	14	3.21	2.61	4.61	0.0005
Degree of Freedom	14	-2.14	2.66	-3.02	0.0099*

Table 23 (continued)

VARIABLE	N	MEAN	SD	t	PR>T
Coordinate Geometry					
Day 1	14	5.21	2.46	7.95	0.0001
1 Year	14	2.79	2.29	4.55	0.0005
Degree of Freedom	14	-2.43	2.71	-3.35	0.0052*
Data Collection					
Day 1	14	3.79	2.75	5.15	0.0002
1 Year	15	1.53	2.29	2.59	0.0275
Degree of Freedom	14	-2.21	2.39	-3.46	0.0042*
Whole Numbers					
Day 1	14	0.43	1.60	1.00	0.3356
1 Year	15	0.47	1.30	1.39	0.1868
Degree of Freedom	14	0.00	0.39	0.00	1.0000
Ratio and Percentage					
Day 1	14	4.50	2.18	7.74	0.0001
1 Year	14	3.29	2.33	5.27	0.0002
Degree of Freedom	14	-1.21	2.19	-2.07	0.0585
Fractions					
Day 1	14	2.57	1.95	4.93	0.0003
1 Year	15	1.47	1.51	3.77	0.0021
Degree of Freedom	14	-1.07	1.59	-2.52	0.0257*

Table 23 (continued)

VARIABLE	N	MEAN	SD	t	PR>T
Graphing					
Day 1	14	2.43	1.91	4.76	0.0004
1 Year	15	1.33	1.84	2.81	0.0139
Degree of Freedom	14	-1.07	1.59	-2.52	0.0257*
Math Games					
Day 1	14	0.07	0.27	1.00	0.3356
1 Year	15	0.07	0.26	1.00	0.3343
Degree of Freedom	14	-0.07	0.27	-1.00	0.3356
Computer Software					
Day 1	14	0.93	1.73	2.01	0.0659
1 Year	15	0.20	0.41	1.87	0.0824
Degree of Freedom	14	-0.79	1.85	-1.59	0.1355
Learning Center					
Day 1	13	0.85	1.21	2.51	0.0273
1 Year	15	0.27	0.46	2.26	0.0406
Degree of Freedom	13	-0.69	1.18	-2.11	0.0564

Table 23 is a summary of *t* test results of the first time participants' recommendations of when to introduce mathematics topics into the elementary school curriculum.

All of the first time participants lowered their recommendations of when to introduce math topics. The recommendation changes were statistically significant for algebra, probability, statistics, coordinate geometry, data collection, fractions, and graphing. Two math topics, integers and ratio and percents were rated to be introduced into earlier elementary grades but these recommendations were not found to be statistically significant at the .05 alpha level. Whole numbers, math games, computer software, and use of learning center activities/materials were recommended by these participants to be introduced to students during Kindergarten and these recommendations remained the constant after one year.

Table 24

Summary of Recommendations of Experienced Participants Over a One Year Period

*Significance .05

VARIABLE	N	MEAN	SD	t	PR>T
Algebra					
Day 1	17	2.00	2.00	4.12	0.0008
1 Year	17	2.47	2.24	4.55	0.0003
Degree of Freedom	16	0.63	1.15	2.18	0.0457*
Integers					
Day 1	16	2.63	2.22	4.74	0.0003
1 Year	17	2.06	1.89	4.50	0.0004
Degree of Freedom	15	-0.60	1.50	-1.55	0.1442
Probability					
Day 1	17	2.74	2.33	5.20	0.0001
1 Year	17	2.41	2.09	4.75	0.0002
Degree of Freedom	16	-0.69	1.99	-1.38	0.1874
Statistics					
Day 1	17	3.65	2.29	6.57	0.0001
1 Year	16	2.75	2.14	5.13	0.0001
Degree of Freedom	15	-1.20	1.82	-2.55	0.0230*

Table 24 (continued)

VARIABLE	N	MEAN	SD	t	PR>T
Coordinate Geometry					
Day 1	18	2.67	2.03	5.58	0.0001
1 Year	17	2.24	2.17	4.26	0.0006
Degree of Freedom	17	-0.47	1.59	-1.22	0.2388
Data Collection					
Day 1	18	1.83	1.98	3.93	0.0011
1 Year	17	0.65	1.50	1.78	0.0938
Degree of Freedom	17	-1.18	1.47	-3.30	0.0045*
Whole Numbers					
Day 1	18	0.39	0.78	2.12	0.0488
1 Year	17	0.18	0.73	1.00	0.3322
Degree of Freedom	17	-0.12	0.86	-0.57	0.5795
Ratio and Percentage					
Day 1	18	3.33	1.78	7.93	0.0001
1 Year	17	3.35	1.90	7.27	0.0001
Degree of Freedom	17	-0.06	1.68	-0.14	0.8867
Fractions					
Day 1	18	1.61	1.54	4.44	0.0004
1 Year	17	1.24	1.52	3.35	0.0041
Degree of Freedom	17	-0.35	1.54	-0.95	0.3583

Table 24 (continued)

VARIABLE	N	MEAN	SD	t	PR>T
Graphing					
Day 1	18	1.94	1.80	4.59	0.0003
1 Year	17	1.12	1.65	2.79	0.0132
Degree of Freedom	17	-0.82	1.42	-2.38	0.0299*
Math Games					
Day 1	18	0.56	1.10	2.15	0.0463
1 Year	17	0.00	0.00	-	-
Degree of Freedom	17	-0.47	1.07	-1.82	0.0879
Computer Software					
Day 1	18	0.89	1.08	3.50	0.0028
1 Year	17	0.53	1.07	2.04	0.0577
Degree of Freedom	17	-0.29	1.26	-0.96	0.3513
Learning Center					
Day 1	16	1.38	1.54	3.56	0.0028
1 Year	16	0.63	1.02	2.44	0.0276
Degree of Freedom	14	-0.86	1.56	-2.05	0.060

Table 24 is a summary of *t* test results of the experienced participants' recommendations of when to introduce mathematics topics into the elementary school curriculum

The data from Table 24 show the experienced MCIP participants had initially recommended that the 13 math topics featured in MCIP should be introduced into the elementary math curriculum by the 4th grade. These recommendations remained constant over a one year period. At the conclusion of the MCIP/88 training, the experienced participants recommendations to introduce statistics, data collection, and graphing earlier into the elementary math curriculum were statistically significant at the .05 alpha level.

To summarize the evaluation question up to this point the participants did change their opinion of when to recommend introducing mathematics topics featured in the MCIP workshop training. Most of the changes proved to be statistically significant. The first time MCIP participants lowered their recommendations (after six days of training) of when to introduce math topics into the elementary math curriculum. The experienced MCIP participants expressed during the first day of the workshop that they believed that the math topics featured in the MCIP training should be introduced by the fourth grade. One year later both groups recommended introducing the featured math topics by the fourth grade except for statistics and ratio/percents.

As the data clearly point out the participants had a statistically significant attitude change of when to introduce mathematics topics into the elementary math curriculum. This researcher therefore used a multivariate analysis of variance (MANOVA) to test whether there was an interaction of group membership, MCIP training, and time that could have influenced these recommendation changes.

Tables F-1 through F-26 (Appendix F) provide a detailed summary of the MANOVA results to detect interaction and a listing of all of the means and the standard deviations of the math topic recommendations.

Table 25

Summary Table of MANOVA Testing of Group Membership Effecting and Influencing Mathematics Topic Recommendations

Algebra		
	** $F(2, 28) = 2.46$	Prob> $F = 0.1283$
Integers		
	** $F(2, 27) = 2.13$	Prob> $F = 0.1562$
Probability		
	** $F(2, 28) = 2.25$	Prob> $F = 0.1448$
Statistics		
	** $F(2, 27) = 1.65$	Prob> $F = 0.2100$
Coordinate Geometry		
	** $F(2, 29) = 4.86$	Prob> $F = 0.0355$*
Data Collection		
	** $F(2, 29) = 4.38$	Prob> $F = 0.0452$*
Whole Numbers		
	** $F(2, 29) = 0.30$	Prob> $F = 0.5881$
Ratio and Percents		
	** $F(2, 29) = 1.05$	Prob> $F = 0.3131$
Fractions		
	** $F(2, 29) = 1.75$	Prob> $F = 0.1966$
Graphing		
	** $F(2, 29) = 0.88$	Prob> $F = 0.3572$
Math Games		
	** $F(2, 29) = 1.29$	Prob> $F = 0.2662$

Table 25 (continued)

Computer Software

** $\underline{F}(2, 29) = 0.00$ Prob> $\underline{F}$ = 0.9603

Learning Center Materials

** $\underline{F}(2, 25) = 1.26$ Prob> $\underline{F}$ = 0.2729

** (Hotelling-Lawley Trace)

Table 25 is a summary Table of MANOVA Testing of Group Membership Effecting and Influencing Mathematics Topic Recommendations. The results demonstrate that the effect of group membership did influence the recommendations of coordinate geometry and data collection only. The effect of group membership did not influence the participants recommendations for the other 11 math topics.

Table 26

Summary Table of MANOVA Testing of Time Effecting and Influencing Mathematics Topic Recommendations

Algebra

** $\underline{F}(2, 27) = 3.21$ Prob> $\underline{F}$ = 0.0561*

Integers

** $\underline{F}(2, 26) = 6.28$ Prob> $\underline{F}$ = 0.0060*

Probability

** $\underline{F}(2, 27) = 10.42$ Prob> $\underline{F}$ = 0.0004*

Statistics

** $\underline{F}(2, 26) = 12.11$ Prob> $\underline{F}$ = 0.0002*

Coordinate Geometry

** $\underline{F}(2, 28) = 11.57$ Prob> $\underline{F}$ = 0.0002*

Table 26 (continued)

Data Collection			
	** $F(2, 28) = 12.90$	Prob> F =	0.0001*
Whole Numbers			
	** $F(2, 29) = 1.18$	Prob> F =	0.3232
Ratio and Percents			
	** $F(2, 29) = 1.05$	Prob> F =	0.0142*
Fractions			
	** $F(2, 28) = 5.69$	Prob> F =	0.0085*
Graphing			
	** $F(2, 28) = 9.23$	Prob> F =	0.0008*
Math Games			
	** $F(2, 28) = 4.07$	Prob> F =	0.0281*
Computer Software			
	** $F(2, 28) = 4.56$	Prob> F =	0.0192*
Learning Center Materials			
	** $F(2, 24) = 4.75$	Prob> F =	0.0182*

** (Hotelling-Lawley Trace)

Referring to Table 26 the data listed on this table are a condensed summary of the MANOVA procedure used to test for the effect of time influencing the participants math topic recommendations. The F statistics listed are all statistically significant except for the math topic of whole numbers. The time ranges of Day One to Day Six and Day One to One year are shown to be significant (Appendix F). Therefore, the effect of time was a significant influence on the participants' recommendations of when to introduce mathematics topics into the elementary school mathematics curriculum.

Table 27

Summary Table of MANOVA Testing For Interaction of Group Membership And Time Influencing Mathematics Topic Recommendations

Algebra		
	** $F(2, 27) = 5.98$	Prob> F = 0.0071*
Integers		
	** $F(2, 26) = 0.28$	Prob> F = 0.7546
Probability		
	** $F(2, 27) = 2.01$	Prob> F = 0.1534
Statistics		
	** $F(2, 26) = 0.88$	Prob> F = 0.4269
Coordinate Geometry		
	** $F(2, 28) = 3.05$	Prob> F = 0.0633
Data Collection		
	** $F(2, 28) = 1.43$	Prob> F = 0.2569
Whole Numbers		
	** $F(2, 28) = 1.18$	Prob> F = 0.3232
Ratio and Percents		
	** $F(2, 28) = 1.56$	Prob> F = 0.2282
Fractions		
	** $F(2, 28) = 0.82$	Prob> F = 0.4502
Graphing		
	** $F(2, 28) = 0.28$	Prob> F = 0.7593

Table 27 (continued)

Math Games					
** $F(2, 28)$	=	0.91	Prob> F	=	0.4145
Computer Software					
** $F(2, 28)$	=	1.63	Prob> F	=	0.2134
Learning Center Materials					
** $F(2, 24$	=	0.72	Prob> F	=	0.4970

** (Hotelling-Lawley Trace)

Referring to Table 27 the data listed in this table are a condensed summary of the MANOVA procedure used to test for interaction of the effects of group membership and time. The F statistics listed are not statistically significant at the .05 alpha level except for the topic of algebra. Therefore, the recommendations for algebra were influenced by the interaction of the effects of group membership and time. There was no interaction of group membership and time influencing the rest of the recommendations of when to introduce math topics into the elementary school curriculum.

Question 7

Did the participants change their opinion regarding what mathematics topics they plan to introduce the next school year as measured by a pre and post assessment?

Table 28

Summary Table of Mathematics Topics Participants Planned Introduction Before MCIP/88 Training Compared to What They Planned One Year Later in Their Math

Classes	N	No	Yes
Algebra			
Day 1	47	34.04	65.96
1 Year	33	19.40	80.60
Integers			
Day 1	47	38.30	61.45
1 Year	33	22.60	77.40
Probability			
Day 1	47	63.82	36.17
1 Year	33	22.60	77.40
Statistics			
Day 1	47	59.57	40.43
1 Year	33	32.30	67.70
Coordinate Geometry			
Day 1	47	46.81	53.19
1 Year	33	19.40	80.60
Data Collection			
Day 1	47	46.81	53.19
1 Year	33	6.50	93.50
Whole Numbers			
Day 1	47	19.15	80.85
1 Year	33	9.70	90.30

Table 28 (continued)

Classes	N	No	Yes
Ratio & Percents			
Day 1	47	48.30	61.71
1 Year	33	19.40	80.60
Fractions			
Day 1	47	23.41	76.59
1 Year	33	12.90	87.10
Graphing			
Day 1	47	27.66	72.34
1 Year	33	6.50	93.50
Math Games			
Day 1	47	31.91	68.09
1 Year	33	6.50	93.50
Computer Software			
Day 1	47	57.45	42.55
1 Year	33	26.70	73.30
Learning Center			
Day 1	47	80.86	19.15
1 Year	33	43.30	56.70

Referring to Table 28 the yes column reveals an overall pattern one year after the MCIP/88 training that the participants did increase their plans to include more coverage of math topics in their mathematics lessons. The topics of probability, data collection, use of learning center activities/materials, statistics, coordinate geometry, graphing, math games, and the use of math computer software had the largest gains of participants who indicated they planned to incorporate these topics into their math classroom offerings during the 1989-90 school year.

Table 29

Summary Table of McNemar Test of Symmetry Results

Are the Participants Planning Their Mathematics Curriculum Offerings Differently One Year Later?

Topic	McNemar Statistic
Algebra	0.4054
Integers	0.4386
Probability	0.7815
Statistics	0.0522*
Coordinate Geometry	0.1317
Data Collection	0.3657
Whole Numbers	0.7630
Ratio and Percents	0.7630
Fractions	0.7630
Graphing	1.0000
Math Games	0.7630
Computer Software	0.3657
Learning Center Materials	0.7389

A McNemar test of symmetry was used to detect if the planning behaviors listed in Table 29 were statistically significant. The results of the McNemar test on Table 29 indicates the participants' change of planning to include more math topics into the classroom curriculum was statistically significant at the .05 alpha level only for the topic of statistics.

Analysis of Participants' Performance as Staff Developers

The performance of the participants to act as staff developers at their home school sites will be examined from the following two questions.

Question 8

Did the participants show evidence of wanting to participate differently in curriculum decision making after MCIP/88 training?

Table 30

Summary of Pre/Post Wish to Participate in Mathematics Curriculum Decision Making

	Greater Participation	Do Not Participate
Pre-Training	89.4%	10.6%
Post-Training	97.0%	3.0%

	Classroom	Grade Level	School-Wide	District-Wide
Pre-Training	26	24	35	13
Post Training	27	26	28	6

An analysis of the data on Table 30 reveals that before MCIP/88 training 89.4% of the participants wanted to participate more actively in curriculum decision-making. After the training and during the 1988-89 school year the figure rose to 97.0%. Only 3% of the participants did not want to participate more actively in decision-making after the training year. The participants were evenly divided in their choice of wanting to make decisions at the classroom, grade level, and school-wide. Only six teachers indicated they were interested in making curriculum decisions that would impact their school district.

Table 31

Summary of Where Participants Wanted to Make Mathematics Curriculum Decisions

N = 33	Yes	No
Classroom		
Day One	51.52	48.48
One Year Later	81.82	18.18
Grade Level		
Day One	48.48	51.52
One Year Later	78.79	21.21
School-Wide		
Day One	78.79	21.21
One Year Later	84.85	15.15
District-Wide		
Day One	21.21	78.79
One Year Later	18.18	81.82

Referring to Table 31 the post data summary indicates the areas of classroom and grade level had the largest percentage increase of where participants wished to make mathematics curriculum decisions.

Table 32

Summary of t test Results for Curriculum Decision Making

N = 33

Significance *.05	Mean	SD	t	PR>T
Classroom Level				
Day One	0.52	0.51	5.83	0.0001
One Year Later	0.82	0.39	12.00	0.0001
Degree of Freedom	0.30	0.53	3.19	0.0025*
Grade Level				
Day One	0.48	0.51	5.49	0.0001
One Year Later	0.79	0.42	10.90	0.0001
Degree of Freedom	0.30	0.47	3.73	0.0007*
School-Wide				
Day One	0.79	0.42	10.90	0.0001
One Year Later	0.85	0.36	13.39	0.0001
Degree of Freedom	0.06	0.50	0.70	0.4880
District-Wide				
Day One	0.21	0.42	2.94	0.0061
One Year Later	0.18	0.39	2.67	0.0119
Degree of Freedom	-0.03	0.39	-0.44	0.6617

Table 32 contains the results of the t test which tested if the participants' wishes to participate more actively in decision-making were statistically significant. The increased interest of the participants to be decision- makers in the classroom and at grade level was statistically significant. The areas of school-wide and district level decision-making were not statistically significant.

Table 33

Summary of First Time Participants' Interest in Decision Making

N = 15	Yes	No
Classroom		
Day One	60.00	40.00
One Year Later	73.33	26.67
Grade Level		
Day One	46.67	53.33
One Year Later	66.67	33.33
School-Wide		
Day One	80.00	20.00
One Year Later	03.33	6.67
District Wide		
Day One	20.00	80.00
One Year Later	13.33	86.67

Referring to Table 33 the data summary shows first time participants were interested in increasing their decision-making in the classroom, at their grade level, and school-wide. After one year, interest in curriculum decision making increased for the classroom and grade levels but decreased for school and district levels..

Table 34

Summary of t test of First Time Participants' Interest in Decision Making

N = 15

Significance *.05	Mean	SD	t	PR>T
Classroom Level				
Day One	0.60	0.51	4.58	0.0004
One Year Later	0.73	0.46	6.20	0.0001
Degree of Freedom	0.13	0.52	1.00	0.3343
Grade Level				
Day One	0.47	0.52	3.50	0.0035
One Year Later	0.67	0.49	5.29	0.0001
Degree of Freedom	0.20	0.41	1.87	0.0824
School-Wide				
Day One	0.80	0.41	7.48	0.0001
One Year Later	0.93	0.26	14.00	0.0001
Degree of Freedom	0.13	0.52	1.00	0.3343
District-Wide				
Day One	0.20	0.41	1.87	0.0824
One Year Later	0.13	0.35	1.47	0.1643
Degree of Freedom	-0.07	0.26	-1.00	0.3343

Table 34 contains the results of the t test which tested if the first time participants' wishes to participate more actively in decision-making was statistically significant. The results indicate that the first time participants' increased wishes to make decisions at various levels of school was not statistically significant at the .05 alpha level.

Table 35

Summary of Experienced Participants' Interest in Decision Making

N = 18	Yes	No
Classroom		
Day One	44.44	55.56
One Year Later	88.89	11.11
Grade Level		
Day One	50.00	50.00
One Year Later	88.89	11.11
School-Wide		
Day One	77.78	22.22
One Year Later	77.78	22.22
District-Wide		
Day One	22.22	77.78
One Year Later	22.22	77.78

Referring to Table 35 the data summary shows experienced participants were interested in increasing their decision-making in the classroom and at their grade level only. There was no apparent change over the period of one year for decisions to be made school-wide or for the district.

Table 36

Summary of t test of Experienced Participants' Interest in Decision-Making

N = 18

Significance *.05	Mean	SD	T	PR>T
Classroom Level				
Day One	0.44	0.51	3.69	0.0018
One Year Later	10.89	0.32	11.66	0.0001
Degree of Freedom	0.44	0.51	3.69	0.0018*
Grade Level				
Day One	0.50	0.51	4.12	0.0007
One Year Later	0.89	0.32	11.66	0.0001
Degree of Freedom	0.39	0.50	3.29	0.0043*
School-Wide				
Day One	0.78	0.43	7.71	0.0001
One Year Later	0.78	0.43	7.71	0.0001
Degree of Freedom	0.00	0.49	0.00	1.0000
District-Wide				
Day One	0.22	0.43	2.20	0.0416
One Year Later	0.22	0.43	2.20	0.0416
Degree of Freedom	0.00	0.49	0.00	1.0000

Table 36 contains the results of the t test which tested if the experienced participants' wishes to participate more actively in decision-making was statistically significant. The results show the increased decision-making in the classroom and at grade-level were statistically significant. Decision-making activities that occurred school-wide and at the district level were not significant.

Question 9

Were the participants active as staff developers in their home schools as they participated in MCIP during the 1988-89 school year?

Table 37

Post Survey Summary of Participants' Performing as Staff Developers

AS A RESULT OF MCIP TRAINING I HAVE	
Given inservice to other teachers in grade level	97.0%
Given inservice to my school faculty	84.0%
Worked with parent groups in my school community	45.5%
Given inservice to teachers outside my school	36.4%
Attended math conferences to keep current	60.6%
Attended university math classes to gain new skills	33.3%
Other activities:	20.0%
- given inservice to two/more districts	
- integrated new math into curriculum	
- pursuing masters degree	
- see more relationships in math	
- used more parent volunteers in math class	

Table 37 summarizes the results of a self assessment completed by the participants regarding how they performed as staff developers during the MCIP training year. Ninety-seven percent of the participants indicated they provided inservice training to other teachers in their grade level. Eighty-four percent stated they provided MCIP inservicing to the entire school faculty. Forty-five percent worked with parent groups. Thirty-six percent provided inservice training to teachers outside of their home schools. Sixty percent continued professional development in mathematics education by attending other math inservice programs and workshops. Thirty-three percent continued professional training by attending university mathematics courses. Twenty percent of the participants indicated other math related activities that they pursued to continue professional growth and development. To summarize the data above, participants overwhelmingly performed as staff developers at their home school sites and began the process of institutionalizing the components of MCIP into their school culture to begin the challenge of restructuring elementary mathematics curriculum.

Qualitative Data and Analysis

The next portion of this chapter will be a synthesis of qualitative data collected during the MCIP/88 workshop and the preceding five months of the implementation phase of the project. During the MCIP workshop five participants were selected as representative members to be monitored during the first semester of the 1988-89 school year. Two of the teachers were experienced MCIP participants, and the remaining three teachers were new to the workshop and the program. The purpose of selecting these participants and monitoring their work with MCIP was to obtain in-depth information about their perceptions, successes, failures, suggestions, needs and ideas of MCIP on an individual basis as well as from the teachers each trained during the 1988-89 school year.

Procedure

During the workshop each participant was interviewed to obtain information about his/her background, MCIP goals for the semester, budget plans, and staff development plans. Throughout the semester, follow-up information was obtained via telephone conversations, school site visits, written reports and assignments, as well as through staff and self evaluation assessments.

During the course of the semester, the participants conducted a minimum of ten hours of MCIP in-service with 27 teachers and/or administrators. Four of the participants presented an overview of the MCIP program to the entire faculty of their respective schools. One participant also conducted two district in-service meetings using a hands-on approach to introduce MCIP to seventy teachers. These district-wide staff development meetings were requested by the assistant superintendent who had received positive feedback about MCIP from teachers and administrators.

Needs Assessment and Training

Each participant conducted a needs assessment at their home school site to identify what mathematical needs were necessary to address to begin the process of improving mathematics curriculum offerings in the classroom. The following topics and areas were identified by the home school teams:

problem solving
software for math problem solving
fractions
card games to teach math
math pentathlon games
integrating math, reading and writing
whole numbers
integers
coordinate geometry
decimals

Each training participant determined with his/her teachers when the ten hour inservice would be scheduled. Times agreed upon ranged from once a week lunch meetings, to after school workshops, to evening gatherings, as well as training sessions held during released school time. In addition to the formal training sessions, each training participant met individually with his/her teachers and in some instances went into the classroom to model appropriate teaching behaviors to assist in the successful implementation of training.

Budget Analysis

Budget decisions were part of the training participants duties. Expenditures were as follows:

Categories	Dollar Amount	% of budget
teaching materials	$860	33%
teacher stipends	$1420	55%
refreshments	$280	11%
prizes, awards	$15	1%

Evaluations

During the first semester of the 1988-89 school year the participant trainers and their teachers conducted evaluations of their performance as they attempted to improve the mathematics curriculum in their classrooms. They also completed an overall evaluation of the MCIP program. The following is a capsulized profile of these evaluations:

The home school teachers receiving MCIP inservice training taught in grades K-8 in public and private schools. The administrators who were involved in the training were also from K-8 public and private schools. The teaching experience of the home school teachers ranged from first year teacher to a veteran teacher of 30 years. The math background of the teachers included a minimum college undergraduate requirements of two courses to teachers with math endorsements and graduate math classes completed. The majority of the teachers were first introduced to MCIP through the training they were receiving from the onsite trained MCIP participant.

The MCIP curriculum used by these newly trained teachers to MCIP included:

- art and math
- AIMS materials
- card games
- parent involvement math activities
- number lines
- graphs and art
- data collection
- integers
- fractions
- multiplication
- division
- estimation
- whole numbers
- problem solving
- calculator units
- math pentathlon activities
- special education packets
- algebra
- coordinate geometry

Components consistently listed that were successful included:

- manipulatives
- card games
- AIMS materials
- math pentathlon activities
- whole number chapter
- coordinate geometry
- home learning activities
- graphing activities
- data collection
- fractions
- estimating
- math and art

Teachers comments regarding the success of incorporating these MCIP components into their math curriculum offerings included:

"They all have been very successful because many use hands-on techniques, and most interest the students."

"Components that are hands-on have been successful because of the manipulatives."

"Card games because all of the students like to play cards."

"The estimating and cards were most successful because they were very motivational. The questions for discussion are right there!"

"AIMS was especially good."

"Children learn concepts that could be difficult to learn in a fun and interesting way."

"Home learning activities...parents love them!"

"Everything I've used has been successful."

A question posed to the teachers regarding if they would recommend MCIP to others received the following replies:

"Yes, because it has many excellent ideas and activities that involve math."

"Yes, but not without some inservice."

"Yes, the children liked it."

"Yes, because of the children's' high degree of interest."

"Yes. It has added a lot to my math program. Most of the activities involve more than one area or skill in math. I liked that."

"Yes. I have loaned my materials to other teachers and they are copying portions."

"Yes, great enrichment."

"Yes, the information is a valuable teaching tool and is important as a supplement to the textbook. Also there are good activities for parental involvement/home learning."

"Yes, it is a great way to learn math concepts. The family is involved with home learning activities. The activities are fun for the children as well as the teacher."

"Yes, as an addition to regular curriculum. I liked the hands-on activities for the older students."

"Yes! It has helped me to enjoy teaching math more. Kids enjoy math more as a result."

The teachers evaluated the strengths of the MCIP program as follows:

The teacher can deviate from the text.

The hands-on activities.

There are specific directions for the teachers.

There are numerous activities for all age levels.

The variety.

The practice of skills through exploration.

It can be adapted to various ability groups.

The strong, student-involved activities.

Its application to every day living and strengthening of concepts taught.

Teachers working with teachers.

Money for materials.

Adaptability of units.

The incorporation of math into other subject areas.

The use of higher level thinking skills.

The availability of home learning activities.

The teachers evaluated the weaknesses of the MCIP program as follows:

Directions could be clearer in many of the activities.

The activity sheets should be written and developed "ready to use."

Many of the worksheets need to be rewritten and made to look more attractive to the eye.

Too much material presented at once.

More worksheets needed for the same idea. Once a sheet is used what will the teacher who has the students the following year do?

Some of the chapters really need polishing.

More copies need to be made available or be offered for sale.

More activities are needed for younger students. Teachers lose motivation and excitement having to adapt everything all the time.

Some activities are dull.

Suggestions are needed on how to get better parental response.

How can the excellent home learning ideas be made more effective? Aid for evaluation is needed.

To summarize the evaluation from the teachers it is evident that they suggested a much more formal and professional appearance of the MCIP materials was needed. They also recommended using some of the grant money to professionally publish the materials and offer them for sale to interested teachers.

The teachers were asked for suggestions of how to improve the MCIP materials. The following is suggested advice:

Section for each chapter to challenge gifted students.

Plenty of inservice available for the different units throughout the year.

More activities using manipulatives are needed.

A listing of materials needed should be listed at the beginning of the lessons.

More suggestions for evaluation are needed.

More home learning activities would be appreciated.

More card games would be welcomed.

Suggested teaching materials that supplement MCIP activities would be helpful.

Summarization

The following summary was written and shared with this researcher from the doctoral graduate student who was assigned to observe the five target MCIP participants and the teachers they trained at their home school site.

> Enthusiasm ran high for MCIP. All of the teachers using MCIP, will continue to use the materials and will recommend MCIP to their colleagues. All of the teachers expressed a desire to have a more professional product and would be willing to pay for the improvement. The teachers were very interested in having ready made materials available to them. They would welcome new math ideas and are willing to try new teaching methods. They were honest and frank in their evaluations. Most of them appreciated and valued the fact that through MCIP the teachers had an opportunity to work with their peers and share ideas. MCIP has made an impact in the participating schools. MCIP will remain in the math curriculum of most of the teachers because it was fun, motivational and highly successful.

Chapter V

FINDINGS, CONCLUSIONS, IMPLICATIONS AND RECOMMENDATIONS

Introduction

The purpose of this study was to evaluate the MCIP/88 staff development training of participants by measuring if the participants could change their attitudes about when to introduce new mathematical concepts into the elementary school curriculum. Also, the study examined if participants could change two instructional behaviors, namely, how they planned for and how they taught mathematics to their students. The evaluation was based upon quantitative data collected from a pre/post survey administered the first day of the MCIP/88 workshop and 12 months after the participants attempted to implement the components of MCIP into their classroom, and at their grade level or throughout their school with selected colleagues who agreed to be trained with MCIP materials. Qualitative data were collected via school site visits, written reports and assignments, self and staff assessments and phone conversations during the first semester of the 1988-89 school year. The findings of this study are intended to substantiate if:

> ...MCIP/88 builds upon the success of the 1986 and 1987 programs. Activities that were highly rated in 1987 were kept and/or expanded. In two years MCIP has shown that eighty-four talented and dedicated teachers can change their mathematics curriculum. MCIP/88 attempts to show that these were not unique events. (Schiller,. 1988)

Summary of Findings

The questions on the pre/post surveys were written to address five areas of evaluation of MCIP/88. The five areas were: (a) a measurement of each participant's attitude regarding their confidence to teach mathematics and an analysis of their ratings of the importance, difficulty, and enjoyment of teaching math topics; (b) an analysis of each participant's recommendation of when to introduce mathematics topics into the elementary school curriculum; (c) an analysis of how each participant instructed his/her students; (d) an analysis of the math curriculum offerings that each participant included in his/her lessons; and (e) an examination of how each participant performed as a staff developer at his/her home school site in their initial efforts to institutionalize the components of MCIP into the school culture.

The data collected to address these questions were presented in chapter four. This section of chapter five will present the findings of each question and a discussion of research to support and assist in the interpretations of the findings.

Findings of Attitude Changes

Questions 1 and 2 were written to analyze the attitudes of participants who trained in the project. A measurement of the participants' attitudes assisted this researcher in the development of a profile of the participants perception of themselves as mathematics teachers. The profile also suggests how the participants rated the importance and ease of teaching elementary math topics. From this profile this researcher can evaluate if the participants began to restructure their mathematics lessons to provide better student learning outcomes.

Sarason (1971) states that educational change depends on what teachers do and think. Huberman and Miles (1984) have found that change in practice must be preceded by change in beliefs and understanding.

Questions 1 & 2

Did participants gain more confidence in their ability to teach mathematics during the year they participated in MCIP?

Did the attitude of participants change in terms of how they rated the importance, difficulty and enjoyment of teaching mathematics topics over a one year period?

The data indicate that 26% of the participants exhibited a decline in their confidence as mathematics teachers during participation in the MCIP training year. This may indicate that their confidence in teaching mathematics was based upon the success of using a traditional approach to teaching. This approach incorporates extensive teacher-directed explanation and questioning in the context of whole-group instruction followed by students working on paper and pencil assignments at their seats. (Carpenter and Romberg, 1986) This may also indicate that the MCIP training encouraged these teachers to begin to restructure their mathematics curriculum offerings by increasing hands-on activities, incorporating more problem solving and higher order thinking skills into their lessons, and increasing student interaction and cooperative learning into the classroom. As the teachers began to restructure their lessons it may have become more challenging to teach mathematics. Hence, their confidence level dropped. As the SIMS report states, teaching mathematics is a difficult, demanding enterprise.

An analysis of the data from Question 2 reveals that the attitude of the participants changed regarding how they rated the importance, difficulty, and ease of teaching featured math topics in the MCIP project. After one year of MCIP/88 training, the importance rating for data collection and math games had the greatest gains. Participants overwhelmingly agreed that these two topics were much more important and easier to teach after one year of MCIP training. The topics of math computer software and use of learning center materials remained the same in importance on the pre/post surveys, but participants indicated on the post survey that these two topics were easier to incorporate into their lessons and enjoyed doing so. The topics of probability and statistics increased in importance on the post-survey; however, 40% of the participants acknowledged they did not have the training or knowledge to incorporate them into their own classroom math offerings. The rest of the topics remained constant in importance, difficulty, and ease of teaching on the pre/post survey.

The data suggest that the attitudes of the participants did change as they received workshop and follow-up training. The participants recognized the importance of many of the topics featured in the MCIP project and attempted to incorporate them into their math lessons during the training year. This fact may also account for the decline in confidence on the part of some of the participants. Marris (1975) and Sarason (1981) state change is a difficult personal and social process of unlearning old ways and learning new ones. Deeper meaning and solid change must be born over time; one must struggle through ambivalence before one is sure for oneself that the new version is workable and right (Fullan, 1982).

Findings of Recommendations to Introduce Math Topics

The following evaluation question was written to analyze the participants' recommendation of when to introduce math topics into the elementary mathematics curriculum. This question is the heart of the evaluation study because a major goal of MCIP/88 was to train participants with new skills and methodology to introduce the full gamut of elementary math topics into the early grades of elementary school.

Grouws (1988) states that teachers determine: (a) how much time is allocated to a subject, such as math over the course of a year; (b) what topics are taught; (c) what topics are taught to what students; and (d) to what standards of achievement a topic is taught. Collectively these four factors determine student opportunity to learn; they are a major influence on student achievement. He also states mathematics is a basic skill learned primarily in school. Because of the many important math topics and the limited amount of school time allotted for them, decisions about what content to include in the curriculum are critical.

Question 5

Did the opinion of the participants change when recommending at what grade level to introduce mathematics topics into the elementary school curriculum as measured by a pre- and post-assessment?

The data indicate that on the first day of MCIP/88 training, all of the experienced participants recommended the math topics featured in MCIP should be introduced into the elementary math curriculum by the fourth grade. At the end of the workshop, six days later, all of the experienced participants had lowered their recommendations of when to introduce these math topics to the second grade.

At the end of the workshop the first time participants also lowered their recommendations of when to introduce math topics into the elementary curriculum to the second grade. One year later both groups showed a regression of means of when to recommend introducing math topics. All of the participants indicated on the post-survey that they would recommend introducing these math topics by the fourth grade year except for ratio/percents and statistics. These two topics were recommended to be introduced at the fifth and sixth grades respectively.

The participants' recommendations are important to the evaluation of the MCIP/88 project. They clearly provide evidence that the workshop training and subsequent follow-up activities were effective in changing the thinking of these classroom teachers regarding how to structure math curriculum offerings for their students. Grouws (1988) states that teachers are likely to follow their own repertoires and convictions. They will teach what they have taught before, what they feel comfortable with, and/or what they deem appropriate for their students. It is apparent these teachers believed it was appropriate to restructure their math curriculum offerings in order to introduce a variety of math topics into the math curriculum by the fourth grade. They preferred not to be tied to traditional curriculum dictates which limit the introduction of these topics to later elementary years.

Findings of Instructional Methodology Changes

The following questions were written to analyze the instructional methodology changes implemented by the participants as they participated in the MCIP/88 training year. A goal of MCIP/88 was to improve how teachers taught mathematics to their students. The SIMS report states that the problem with mathematics instruction in the U.S. is that the majority of student in-class time is spent listening to teacher talk or doing individual work with minimal interaction with the teacher. These two types of activities often occupy distinct phases of the class period. There has been little or no emphasis placed on guided, active discovery learning, in which students can generate high level questions and in which there is more of a balance between teacher and student subject-related talk.

The 1986 NAEP report describes current mathematics instruction as dominated by teacher explanation, extensive use of the chalkboard, and lessons designed exclusively around textbooks and workbooks. Innovative forms of instruction which may include small group activities, laboratory work, and special projects are non-existent.

Questions 4 & 6

Did the frequency of manipulative activities increase in the participants' mathematics lessons after MCIP training?

Did the participants change the frequency of use of instructional activities in the areas of classroom discussion, cooperative learning, home learning activities, worksheets, drilling activities, calculators, problem solving, use of textbooks, manipulatives, and use of learning center materials during the MCIP training year?

The data clearly indicate that the participants increased their usage of manipulatives during the MCIP/88 training year. All of the participants who responded to the post-survey indicated they were using manipulative materials and activities in their math lessons. The usage remained constant for teachers who elected to use manipulatives 1-2 days per week (62.5%) and 5 days per week (6.3%). There was an increase of usage in the 3-4 day range by 8.6% (31.3%). It is apparent more workshop training is necessary in the future to teach participants how to incorporate manipulative materials and activities into their lessons on a daily basis.

The data for Question 7 demonstrate that a majority of the participants changed their instructional activities as they taught mathematics during the MCIP/88 training year. In summary of the findings: 58% decreased the use of textbooks in their lessons; 48% decreased the use of worksheets; 57% used the same amount of learning center materials in their math lessons; 54% continued to use the same amount of drilling activities; 87% increased their use of cooperative learning; 83% increased their use of manipulatives; 80% increased problem solving in their lessons; 70% used more calculators; and 64% provided more home learning activities throughout the year.

The summary of this post-survey data provides strong evidence that the participants restructured their presentation and pedagogic styles to meet the needs of their students in a variety of ways. The SIMS report suggests professional development programs should provide teachers with a repertoire of strategies and knowledge that will enable them to more effectively respond to the increasing challenges of the contemporary school mathematics classroom. MCIP/88 appears to have successfully addressed this issue for all of the participants.

Findings of Math Curriculum Changes

The following questions were written to analyze changes made by the participants in their math curriculum offerings during the MCIP/88 training year. A goal of MCIP/88 was to train teachers to not rely exclusively on their textbook to provide all of the curriculum for their math lessons. To begin this process, participants were encouraged not to follow the sequential order of their text and to skip around as they used the text in their planning and teaching mathematics. The SIMS report found in most U.S. schools' commercially published textbooks serve as the primary guides for curriculum and instruction. Any significant reform would need to take this fact into account. The textbook, as reported in the SIMS study, defines "boundaries" for mathematics taught by U.S. teachers. Limited use is made of resources beyond the textbook for either content or teaching methods.

Questions 3 & 7

Did the participants change their opinion regarding the importance of following the sequential order of their textbook topics when planning for and teaching mathematics as they participated in MCIP/88?

Did the participants change their opinion regarding what mathematics topics they plan to introduce the next school year as measured by a pre-and post-assessment?

The data addressing the question of following the sequential order of the text indicate that the participants did change their opinion of the importance of following the sequential order of textbook topics as they planned for and taught mathematics to their students. On the first day of the workshop training, 48% agreed it was not at all important to follow the sequence of the math text closely. One year later 64% agreed it was not important. This was a gain of 15% of participants who appeared comfortable changing the order in which they use the textbook in their mathematics lessons.

Participants' use of alternate order in following the text was another factor by which to measure if they could deviate from rote usage of their math text. On the first day of the workshop, 89% of the participants indicated they skipped around as they used their math text. On the post-survey one year later, 93% indicated that they skipped around as they used their mathematics textbook.

The data from these two questions indicate that MCIP training freed these participants to deviate and use their math textbook in a creative fashion. This was the first step for these participants to be weaned from rote usage of their text and to begin using other resources and materials in their lessons.

The question addressing if the participants changed their opinion regarding what math topics they planned to introduce the next school year was designed to measure if the participants followed through with the plans they made at the end of the workshop training and began to implement a revised math curriculum for their students. The post-survey data suggest that the participants did increase their plans to include more coverage of math topics in their math lessons. The topics of probability, data collection, use of learning center activities/materials, statistics, coordinate geometry, graphing, math games, and use of math computer software had the largest gains of participants who indicated that they planned to incorporate these topics into their math classroom offerings one year after MCIP training. The response to these two questions makes it apparent that the MCIP participants altered their use of their textbooks when planning for and teaching mathematics. They followed through with plans made after the workshop training to revise their math curriculum offerings and began to restructure their math curriculum.

The 1986 NAEP study addresses the issue of revising math curriculum in our schools with the following recommendation:

> ...to retain a prominent place in today's technological world, our nation clearly needs to increase the percentage of secondary school students taking advanced mathematics classes. However, care should be taken to implement reforms at all grades, not just at the high school level. Increased course requirements at the upper grade levels will ensure that fewer students reject the opportunity to take

> more mathematics, but it will not address the fact that students in elementary and middle schools, also need more challenging curricula. (p. 120)

<u>Findings of the Participants' Role as Staff Developers</u>

The following questions were written to analyze how the participants performed as mathematics staff developers at their home school sites and in other settings during the MCIP/88 training year. Berman and McLaughlin (1978) find that successful educational change requires the serious and active participation of the classroom teacher. Fullan (1982) states that if change is to happen, it will require that teachers understand themselves and be understood by others. He also believes that the notion of change is a highly personal experience in which each teacher who is affected by the change must be given the opportunity to work through the experience so that the rewards at least equal the cost. Stallings (1980) suggests when teachers are trained as staff developers, they can very effectively work with other teachers. Fullan (1982) believes that successful staff development programs combine concrete teacher specific training activities, ongoing continuous assistance and support during the process of implementation, and regular meetings with peers and others.

The change process is influenced and supported by peer relationships which emerge in the school (Fullan, 1982). With change defined as a process of resocialization, interaction is the primary basis for social learning. New meanings, new behaviors, new skills depend significantly on whether teachers are working as isolated individuals (Lortie, 1975; Sarason, 1971) or exchanging ideas, support, and positive feelings about their work (Little, 1981; Rutter et al., 1979). Fullan (1982) has found in his research that the quality of working relationships among teachers is strongly related to implementation (Berman & McLaughlin 1979; Rosenblum & Louis, 1979; Miles et al., 1978).

Questions 8 & 9

Did the participants show evidence of wanting to participate differently in curriculum decision making after MCIP/88 training?

Were the participants active as staff developers in their home schools as they participated in MCIP during the 1988-89 school year?

The post-survey data regarding the question of participants wanting to make curriculum decisions differently reveal the following: before the MCIP/88 training, 89% of the participants wanted to participate more actively in curriculum decision making. After the training and during the 1988-89 school year the figure rose to 97%. Only 3% of the participants did not want to participate more actively in decision making after the training year. The participants were evenly divided in their choice of wanting to make decisions in the classroom, at their grade level, and schoolwide. Only six teachers indicated they were interested in making curriculum decisions that would impact their school district.

The post-survey results which measured if participants were active as staff developers at their home school site reveals 97% of the participants provided inservice training to other teachers in their grade level. Eighty-four percent stated they provided MCIP inservice to the entire school faculty. Forty-five percent worked with parent groups. Thirty-six percent provided inservice training to teachers outside of their home schools. Sixty percent continued professional development in mathematics education by attending other math inservice programs and workshops. Thirty-three percent continued professional training by attending university mathematics courses. Twenty percent of the participants indicated other math related activities that they pursued to continue professional growth and development.

The response to these questions indicates that the participants overwhelmingly performed as staff developers at their home school sites and began the process of institutionalizing the components of MCIP into their school culture to begin the challenge of restructuring elementary mathematics curriculum.

The next portion of this chapter contains a conclusion of the findings, implications, limitations of the study and recommendations.

Conclusion of the Findings

By reviewing the summary of findings, several conclusions are drawn from this study:

1. The vision of MCIP/88 was achieved. The research data presented in chapter four support:

- the mathematics competencies of classroom teachers in the program were improved;
- the trained MCIP teachers implemented more of an activities-oriented curriculum based upon the recommendations of the Archdiocesan Education Office Curriculum Committee, the Illinois State Board of Education, and the National Council of Teachers of Mathematics; and
- a group of teacher-leaders who could provide mathematics inservice at local school sites were trained and did implement training to interested colleagues, parents, and administrators.

2. MCIP/88 provided technical assistance to remedy four concerns identified by the Chicago Archdiocesan Education Office that needed to be addressed in order to improve mathematics curriculum at the elementary school level namely;

- the provision of workshops and institutes for professional development of classroom teachers and subject area specialists;
- the provision of consultation services for curriculum and/or instructional problems at individual school sites;
- the provision of consultation services for short and long range planning and research for innovative program development; and
- the provision of resources to develop an innovative program.

3. MCIP/88 met its three major goals for the summer workshop training, specifically,

- to improve the mathematics competence of the participants;
- to train teachers to become staff developers to provide math inservice at their home school site; and
- to acquaint all of the participants with the most effective and successful mathematics materials available as identified by current mathematics research.

4. MCIP/88 accomplished five of the six following objectives developed for the training project:

- Twenty-five participants from the 1987 summer workshop will have expanded their leadership skills by extending the MCIP project to a total school effort.
- Twenty-five new participants will be selected for the summer training. These participants will increase their competencies in teaching mathematics.
- Participants will learn staff development skills so they may become mathematics leaders at their home school site, and within their school

system. They will work towards institutionalizing major components of MCIP.

- Participants will implement the MCIP project at their home school site and train at least three colleagues with MCIP materials and activities.
- Participants will continue to implement MCIP in their schools during the remaining academic year.

Conclusion of the Research Problem

The results of this evaluation study of MCIP/88 support the fact that participants did change their attitudes about when to introduce new mathematical concepts into the elementary school curriculum. An analysis of the data provides strong evidence that the participants began to restructure and improve their mathematics curriculum by introducing the featured MCIP math topics earlier into their curriculum offerings. During the training year the participants also used less of their mathematics textbooks and worksheets and increased their usage of manipulatives, calculators, and hands-on activities. They reported using more cooperative learning in their classrooms and facilitating more student discussions in their lessons. Many of their lessons during the training year focused on problem solving activities and applications of math to real life situations. Over half of the participants reported that they provided home learning activities which promoted the cooperation of students and their parents working to apply math to everyday life situations.

The MCIP/88 participants also performed as mathematics staff developers at their home school sites and trained colleagues at their grade level as well as in their schools-at-large with MCIP materials and activities. Thus, the staff development activities began the process of institutionalizing the components of MCIP into local school cultures and began to address the challenge of restructuring and improving elementary mathematics curriculum.

Implications

This research study provides evidence that the MCIP staff development project was successful in its third year of implementation. To better understand how the MCIP/88 project successfully influenced teachers to change their attitudes, improve upon their teaching behaviors, and increase their staff development leadership skills at their home school sites, this researcher will turn to four educational researchers who have identified factors that lead to or hinder change and effective innovations by teachers. The factors identified by Stallings, Miles, Fullan, and Pink will act as a screening device to allow this researcher to identify the strengths and weakness of the MCIP project.

Stallings (1989) states that teachers are more likely to change their behavior and continue to use new ideas under the following conditions:

Figure 2. Stallings' nine factors that affect teacher change

1. they become aware of need to improve through self analysis;
2. they have a written commitment to try new ideas in their classroom the next day;
3. they modify workshop ideas to work in their classrooms and school;
4. they try the ideas and evaluate the effect;
5. they observe in each others's classrooms and analyze their own data;
6. they report their success or failures to their group;
7. they discuss problems and solutions regarding individual students and or teaching subject matter;
8. they need a wide variety of approaches: modeling, simulations, observations, critiquing video tapes, presenting at professional meetings;
9. they learn in their own way continuity to set new goals for professional growth (Stallings, 1989).

The cornerstones of the model, according to Stallings, are:

- Learn by doing-try, evaluate, modify, try again.
- Link prior knowledge to new information.
- Learn by reflecting and solving problems.
- Learn in a supportive environment-share problems and successes. (p. 4)

Miles (1986) has identified 14 key factors that are necessary for successful change projects:

Figure 3. Miles' fourteen factors for successful change projects

Initiation	Implementation	Institutionalization
- Linked to high profile need	- Coordination	- Embedding
- Clear model of implementation	- Shared control	- Linked to instruction
- One or more strong advocates	- Pressure and support	- Widespread use
- Active initiation	- Ongoing technical assistance	- Removal of competing priorities
	- Early rewards for teachers	- Continuing assistance

Miles (1986) states these factors and processes of implementation can be used to analyze staff development projects and to guide implementation planning and monitoring. Stallings and Miles have identified that teachers are the key to successful change at the school level. Teachers must be actively involved in identifying major issues and concerns, and they must be willing to make a personal commitment to assist in solving problem situations. To assist these teachers, effective staff development programs are needed to provide ongoing technical assistance and initiate a network to allow teachers to articulate their concerns, brain storm solutions, and support each other as they attempt to implement new ideas and strategies in their classroom.

Stallings and Miles agree that effective staff development programs must link prior knowledge to new concepts teaching, provide ongoing technical assistance, and allow teachers to share in the ownership of the training and the implementation.

Miles addresses the issue of institutionalization and believes teachers need to be trained to perform as staff development leaders to implement widespread use of new curriculum and teaching concepts within their school setting.

Fullan (1982) found that staff development is typically unsuccessful due to a lack of understanding that implementation, whether voluntary or imposed, is really a process of resocialization. Resocialization is interaction. Learning by doing, concrete role models, meetings with resource consultants and fellow implementors, practice of behavior, ambivalence and gradual self-confidence all constitute a process directed toward the meaning of change more clearly. He further states that successful staff development programs combine concrete teacher specific training activities, ongoing continuous assistance and support during the process of implementation, and regular meetings with peers and others.

Pink has identified 12 barriers to change and innovative effectiveness. Pink (1989) states that staff development, implementation of innovation, and student outcomes are closely interrelated, but they are unlikely to succeed in many situations because they require such sophisticated, persistent effort to coordinate. Any success that does occur is unlikely to be sustained beyond the tenure or energy of the main initiators of the project.

Figure 4. Pink's twelve factors identified as barriers to innovative effectiveness

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1. An inadequate theory of implementation, including too little time for teachers to plan for and learn new skills and practices.
2. District tendencies toward faddism and quick-fix solutions.
3. Lack of sustained central office support and follow-through.
4. Underfunding the project, or trying to do too much with too little support.
5. Attempting to manage the projects from the central office instead of developing school leadership and capacity.
6. Lack of technical assistance and other forms of intensive staff development.
7. Lack of awareness of the limitations of teacher and school administrator knowledge about how to implement the project.
8. The turnover of teachers in each school.
9. Too many competing demands or overload.
10. Failure to address the incompatibility between project requirements and existing organizational policies and structures.
11. Failure to understand and take into account site-specific differences among schools.
12. Failure to clarify and negotiate the role relationships and partnerships involving the district and the local university - who in each case had a role, albeit unclarified, in the project. (Pink 1989, pp. 22-24)

Using the factors identified by Stallings, Miles, Fullan and Pink as a screening device, this researcher considers the following as the strengths of the MCIP/88 project:

Strengths of MCIP/88

1. Participants who were selected for training were interested in curriculum development and felt they worked well with their colleagues.

2. Each participant made a personal commitment to the project and received a stipend for their participation.

3. Participating schools made a commitment to support their newly trained MCIP staff developers as they trained others at the school site with MCIP materials and activities.

4. Participants were trained with hands-on, activity based math materials and resources developed jointly by classroom teachers and university instructors.

5. Participants were trained to use a wide variety of instructional strategies as they implemented MCIP activities in their classrooms.

6. Participants formed small group networks and utilized them during the first semester of implementation to solve problems, brainstorm, share ideas, and report personal successes and failures.

7. Participants were encouraged to adapt, extend and creatively use all of the MCIP materials and activities to meet the needs in their own classroom.

8. Participants received a budget to purchase resources, materials, books, and provide a stipend to teachers they trained with MCIP activities.

9. Participants were invited to participate in ongoing workshops and training sessions. Many of the experienced participants took leadership roles in these training sessions by sharing their experiences and modeling teaching strategies for new participants.

10. The MCIP project has received on going funding from the State of Illinois and the Archdiocese of Chicago to continue to develop math resource materials and implement ongoing staff development training for experienced and new teachers who join the project.

Using the factors identified by Stallings, Miles, Fullan and Pink as a screening device, this researcher considers the following as the weaknesses of the MCIP/88 project.

Weaknesses of MCIP/88

1. Fourteen MCIP/88 participants did not follow-through and return their post-surveys which may indicate they did not follow through with MCIP/88 for the entire academic year. Better communication is needed to follow all of the participants closely after training has been completed and implementation is started.

2. Participants indicated that the materials used during the workshop and later at the home school sites lacked a professional appearance. Some of the grant monies should be dedicated to professionally designing and printing the M.A.T.H. handbook and other materials and handouts.

3. Participants indicated the need for more training in the area of evaluation to measure student learning outcomes as they incorporated MCIP components into their math curriculum.

4. Participants wanted more training throughout the academic year as they began to implement MCIP into their mathematics lessons. The summer workshop training and the follow-up meetings during the first semester of the 1988-89 school year did not provide enough technical assistance to complete the entire cycle of MCIP for the length of the school year.

5. Permanent multi-year funding is needed to allow MCIP to expand and improve upon its successes and strengths. The need to annually pursue a funding source limits the quality and, potentially, the life span of the project. This annual process also depletes energy and time that could be devoted to enhancing the quality of the projects activities.

Limitations of the Study

There were three limitations in this evaluation study of the MCIP/88 staff development training that will not allow the findings to be generalized to other educational situations:

1. The findings of this study are limited to the performance and attitudes of teachers who participated in MCIP/88. The results cannot be generalized to other MCIP workshop training sessions, or to other staff development math training situations.

2. The majority of the participants were from the Chicago Archdiocese Schools. The archdiocese is limited in staff development funds and resources, and, therefore, the norm for Archdiocesan classroom teachers has been to take a very active role in curriculum decision-making and promoting grass root staff development projects.

3. All of the participants received a stipend and optional course credit for their participation in the workshop training and for their role as staff developer at their home school site.

Recommendations

The following recommendations are based upon the findings of this study, the literature review, and input from the directors of this project.

1. Future evaluations to measure the successes and failures of MCIP should be done minimally over a one to two year span of time. The research on change and implementation done by Fullan and others supports the notion that initiation of a project like MCIP can be done in a short period of time but implementation takes one to two years and institutionalization can take three to five years.

2. The MCIP workshop training session should not be held exclusively during summer months when teachers do not have an opportunity to implement and adapt new concepts and teaching strategies immediately in their classroom. The workshop training should occur during the school year allowing for participants to practice use of new materials and ideas with the opportunity to return to the ongoing workshop for continued technical assistance and support.

3. The process of MCIP training has been found to be effective and professional but the teaching/resource products (materials, M.A.T.H. Resource Guide, etc.) lack professional appearance. Money needs to be used to develop and print materials professionally and offer them for sale to interested teachers and administrators.

4. Permanent funding needs to be secured for the MCIP project from the Archdiocese of Chicago to allow MCIP to become a permanent, ongoing staff development training program for all of the classroom teachers in the school system.

Impact of MCIP on This Researcher's School

As a primary building principal, this researcher had the opportunity to involve some of my teachers in the MCIP/88 training process and begin to implement the components of MCIP into the mathematics curriculum from grades K-3. The district had just completed a NCA year-long study to review and improve mathematics curriculum. A review and study of mathematics textbooks had just been completed and it was decided we would continue to use the Addison-Wesley mathematics textbook because it had been revised and contained a lot of hands-on math activities and promoted lessons using cooperative learning and teacher facilitation. Math Their Way activities were also featured in the revised edition and the teachers agreed this text would provide a fresh approach to teaching elementary mathematics. To complement the new textbook adoption the teachers involved with MCIP/88 provided inservice to our staff sharing graphing activities, use of manipulations, problem-solving activities, estimation and probability. Card games were introduced to provide an alternative approach to drill and practice of basic facts. Math games were also introduced to provide a creative and motivating approach to address teaching basic facts in the math curriculum.

As I observed in classrooms during the 1988-89 school year it was immediately apparent that mathematics lessons had become a very enjoyable time not only for the students but for the teachers. The teachers shared with me on many occasions that their students did not realize they were having a math lesson and requested more activities from the M.A.T.H. handbook. On days the students worked in the traditional mode of using the text and working through math problems they remarked they missed working in cooperative groups and doing hands-on problem solving activities dealing with real life situations.

During the 1988-89 school year I observed many of my teachers working in informal collegial groups sharing new ideas, brain-storming and developing a plan to use less of their textbook and more of the MCIP materials. Many of my teachers shared with me they previously had not enjoyed teaching math in their classroom and were quite surprised how well cooperative learning enhanced their lessons and increased better student learning outcomes. They also shared they enjoyed deviating from their math textbook and had not done so in the past because they did not have any other resources or quality math materials available to them.

MCIP has made a very positive impact upon my primary building and has been institutionalized within our elementary math curriculum since 1988. The teachers I supervise strongly believe MCIP provides an improved and much more effective means to teach mathematics. As a school we have observed better student learning outcomes in math for a majority of our students. Many of my veteran teachers have candidly expressed the fact they now enjoy teaching mathematics to their students. This had not always been the case.

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APPENDIX A

STATE OF ILLINOIS
BOARD OF HIGHER EDUCATION
500 Reisch Building
4 West Old Capitol Square
Springfield, Illinois 62701

Request for Proposals

Federal Grants For the Improvement of Instruction in Mathematics, Science, Computer Learning, and Foreign Language

Policy Objectives

The Illinois Board of Higher Education in recent years has approved policy objectives and priorities that are designed to assist with efforts to improve elementary/secondary education in the state. Such policy objectives emphasize cooperation between institutions of higher education and elementary/secondary education to achieve the following:

- improve high school preparation for baccalaureate degree programs;
- prepare more minority high school students for baccalaureate degree programs;
- improve the preparation of new teachers;
- improve school curricula and instruction;
- assist with district-defined teacher training, retraining, and in-service training.

Many of these objectives will be met through State-funded programs. In addition, the following Federal program will provide funds to improve elementary/secondary education.

Federal Grants for Programs

Financial assistance will be provided under the authority of the Federal Education for Economic Security Act-Title II for programs that:

-- improve elementary/secondary teacher skills and student learning in math, science, computer learning, and foreign languages;

-- will be implemented cooperatively among the higher education community and the elementary/secondary education community.

Last year, fiscal year 1988 (FY1988), the Illinois Board of Higher Education (IBHE) and the State Board of Education (SBE) jointly applied for and received a total of $3,395,374, of which $1,663,734 was distributed by the State Board of Education to local school districts and $713,028 was designated by the SBE for exemplary programs and other purposes.

The Illinois Board of Higher Education received $50,931 for assessment and administration and allocated $967,681 to higher education programs in two grant categories: (A) teacher training programs and (B) cooperative developmental programs for student learning and performance projects. In the selection of proposals, high priority was given to proposals aimed at meeting the federal objectives and the Illinois Board of Higher Education policy objectives listed above. A total of 52 proposals were submitted, of which 24 were selected and funded.

The IBHE and SBE have received a fourth year of funds under this program totaling $5,018,536, which is a total of $1,623,162 more than last year. The SBE will distribute $2,459,083 to local school districts and allocate $1,053,892 to exemplary programs and other purposes. The IBHE received $1,505,561 of which $1,430,282 is for grants to projects in the same two categories as last year: (A) teacher training programs and (B) cooperative developmental programs for student learning and performance projects. Further information about these categories follows.

Projects previously funded must demonstrate successful results and outcomes achieved. New proposals will also be accepted. The following schedule will be followed for the FY1989 proposals and grants:

November 18, 1988	Postmark date for proposals to be submitted to the Board of Higher Education office
January 10, 1989	Board of Higher Education approval of grants
September 30, 1989	Final date to expend funds

<u>Higher Education Grant Categories</u>

A. Teacher Training Grants

Public and private higher education institutions may submit proposals for one or more of the following types of programs:

1) a traineeship program for new teachers who will specialize in teaching mathematics and science at the secondary level;

2) a retraining program for secondary school teachers who currently specialize in disciplines other than the teaching of mathematics and science to become specialized in the teaching of mathematics, science, or computer learning;

3) an in-service training program for elementary, secondary, or vocational school teachers to improve their teaching skills in the fields of mathematics, science, and computer learning.

To be eligible for consideration, the programs described above must be developed and implemented in cooperation with local school districts to meet school district-defined needs. Since the State Board of Education will distribute grants to local school districts to support teacher participation in retraining and in-service training programs, the higher education program proposals should seek ways to pool resources with local school district resources for this purpose.

B. Cooperative Developmental Grants

Public and private higher education institutions may submit proposals for projects designed to improve elementary/secondary school students' understanding and performance in mathematics, science, computer learning, and foreign languages. Proposals submitted within this category must be based upon cooperative agreements among one or more higher education institutions, local school districts, state or regional education agencies, private industry and private nonprofit organizations.

Approval of Grants:

The IBHE staff will recommend that the IBHE approve proposals selected for grants at the Board's January 10, 1989 meeting. Following approval, grant funds will be distributed to the applicant institutions pursuant to a grant agreement between the IBHE and the applicant institution which, among other things, will include a program completion date, the grant amount, assurance of compliance with federal regulations, and requirements for evaluation and audit reports.

COVER SHEET

STATE OF ILLINOIS
BOARD OF HIGHER EDUCATION
500 Reisch Building
4 West Old Capitol Square
Springfield, Illinois 62701

PROPOSAL

FEDERAL GRANT TO STRENGTHEN ELEMENTARY/SECONDARY INSTRUCTIÓN
IN MATHEMATICS, SCIENCE, AND COMPUTER LEARNING

FEDERAL EDUCATION FOR ECONOMIC SECURITY Act-Title II
(Public Law 98-377)

Program Title: Mathematics Curriculum Improvement Project

Institution: Loyola University of Chicago

Address: 820 N. Michigan Avenue Chicago, Illinois 60611

Grant Category: A. x Teacher training program
(check one)
B. ____ Cooperative Developmental Program

Grant Amount Requested for Current Year: ____________

Signatures:

Campus President/Chancellor:	Program Director:
Signature	Diane Schiller Kay Monroe Smith Signature
Name (Please PRINT or TYPE)	Diane Schiller Kay Monroe Smith Name (Please PRINT or TYPE)
Date	December 28, 1987 Date
Telephone	670-3058 670-3063 Telephone

Attach signature, name, address, and telephone for the Chief Administrative Officer of each cooperating entity.

(PLEASE SUBMIT ORIGINAL AND FOUR COPIES OF THE PROPOSAL)

ATTACHMENT A

STATE OF ILLINOIS
BOARD OF HIGHER EDUCATION

FEDERAL EDUCATION FOR ECONOMIC SECURITY Act-Title II
(PUBLIC LAW 98-377)

ASSURANCES

____
INSTITUTION

hereby assures:

1. that it shall enter into an agreement with a local school district(s) to provide training for elementary/secondary school teachers;

2. that federal funds received under this grant will supplement rather than supplant other sources of funds;

3. that this program will meet the objectives of the Education for Economic Security Act Title II;

4. that this program will take into account the need for students from historically underrepresented and underserved groups and students who are gifted and talented to have greater access to and participation in mathematics, science, and computer learning;

5. that the program management and fiscal administration shall be in accordance with Education for Economic Security Act Title II objectives and accounting procedures which will assure adequate accounting and records of funds.

Signatures:

President:	Program Director:
______________________________	Diane Schiller Kay Monroe Smith
Signature	Signature
______________________________	Diane Schiller Kay Monroe Smith
Name (Please PRINT or TYPE)	Name (Please PRINT or TYPE)
______________________________	December 28, 1987
Date	Date

ABSTRACT

The *MATHEMATICS CURRICULUM IMPROVEMENT PROJECT* (MCIP) combines the resources of excellent teachers from the Cook, DuPage, and Lake County area schools, Loyola University, the Chicago Archdiocesan School system and other interested private and public school districts, and the Illinois Board of Higher Education to:

1) improve the math competencies of existing teachers;
2) expand the group of teachers using an activity focused math curriculum;
3) capitalize on the skills developed by veteran MCIP teachers to help train new mathematics teacher leaders and institutionalize mathematics curriculum improvement; and
4) develop an internship program for excellent elementary education students.

Veteran participants from 25 schools will extend and expand the MCIP in their schools. New participants from 25 schools will improve their own knowledge base in mathematics to prepare them for mathematics curriculum leadership roles in their schools. In addition, they each will train three teachers from their school who will help them institutionalize the improved mathematics curriculum. Twenty-five excellent undergraduate education students are also included in the project to enhance their own professional training and to find role models to emulate.

NEEDS IDENTIFICATION

Evidence from 1987 Mathematics Curriculum Improvement Project

Program Content and Staff Development

Evaluation of the *MATHEMATICS CURRICULUM IMPROVEMENT PROJECT* (MCIP) sponsored by the Illinois Board of Higher Education in 1987 indicated that this type of teacher-leader model of staff development for implementing an activity oriented approach to mathematics curriculum and instruction is needed across both public and private school systems in the Cook, DuPage, and Lake County areas. Six programs, both local and national, were brought to the attention of the education community through the MCIP. This section describes the most pertinent findings about program content and staff development drawn from the 1987 program.

The *Mathematics Activity Teachers Handbook* (M.A.T.H.) is the fundamental component of the program. Teachers report high student interest in the activities. This high student interest has helped attract other teachers in the school to the MCIP program. Teachers report about 75% success rate with the home learning activities section of the handbook. Some parent training is necessary, especially in the lower SES schools. As a result, a proposal, Partners in Education, has been submitted to the Illinois State Board of Education Educational Improvement competitive funding awards.

M.A.T.H. also meets 95% of the mathematics Model Learning Objectives for the end of grades 3, 6, and 8 developed by the state. Teachers reported that the sample evaluation questions in M.A.T.H. have been helpful in developing an assessment instrument for the learning outcomes for mathematics.

During the fall, an additional 83 Chicago Archdiocesan teachers have worked with the handbook and trained one colleague in their school in the use of activities to help students understand fractions, whole numbers, decimals, and integers. This three session workshop was so successful that the Catholic School Office will not only repeat it with additional chapters and appendices, but identify lead teachers who will be assisted to do some staff development work with M.A.T.H. in the local councils.

M.A.T.H. has been expanded to include short chapters on Math and Art, Math and Music, and Math Games. Two publishers, Gorsuch Scarisbrick and Merrill, have indicated interest in publishing the manuscript.

The Mathematics Pentathlon was another MCIP success. In addition to the 97 Archdiocesan participants, administrators, teachers, and parents representing Districts 36, 51, 63, 65, 72, 74, 90, and 97, and Districts 1 and 8 of the Chicago School District attended the programs. The instructional content of the games is excellent for classroom use. However, the administration at Loyola University felt that the $27 tournament entry fee per student might exclude too many children and declined to be a tournament site.

Although Loyola University will not sponsor the Mathematics Pentathlon Tournament, the notion of a mathematics tournament to improve basic skills through games is still interesting to the MCIP participants. Twelve tournament games (grades 1-2, 3-4, 5-6, and 7-8) dealing with whole numbers/decimals, statistics, and integers have been developed. All of the games can be played with regular decks of playing cards, making them inexpensive as well as excellent opportunities for parent/child interaction. It is expected that tournament costs should not exceed $2.00 per student. The Chicago Archdiocese and Loyola University will pilot this program during the spring of 1988. It will be refined and opened to all schools in the Chicago metropolitan area as part of the MCIP program for the next academic year.

The 1987 MCIP summer institute also sponsored a special session with David Page, a nationally known expert on the use of the calculator in the classroom. As a result of the MCIP participants' enthusiastic response, 3 additional workshop programs were offered to 81 teachers. Another workshop is scheduled for spring, 1988. Dr. Page will also work with interested MCIP teachers to develop calculator activities for the M.A.T.H.

At a cost of nearly $1000, the Activities Integrating Math and Science (AIMS) program was brought in from Fresno, California. This NSF disseminated program was received most enthusiastically by the MCIP participants. As a result of their unqualified recommendations, six workshops for 103 teachers were scheduled during the fall by the Catholic School Office and at least 2 more will be held in the spring.

MCIP assisted with additional staff development programs for the Archdiocese. They included: Reading in Science and Mathematics--101 teachers and Computers--69 teachers. In accordance with research findings and MCIP philosophy, all workshops had multiple sessions (2-9). In addition to the 50 summer MCIP participants, 467 teachers in 82 schools have become part of the MCIP. The indirect impact of MCIP is even greater since all workshop participants were required to work with at least one other colleague in their school.

Through the Center for the Study of Private Education at Loyola University and dedicated and committed faculty, MCIP efforts continue. MCIP spring seminars for Archdiocesan teachers include repetitions of Reading in Science and Math, AIMS, M.A.T.H., Calculators, and Computers. Additional spring seminars include Math Their Way, the Library as a Resource for Mathematics Instruction, and How to Build a Rocket. Inservices are scheduled for Council II (District) in the Archdiocese, Districts 86 and 128 in Cook County, and the Lake County Regional Service Center.

Communication is important. MCIP has made our participants aware of the the

Loyola Literacy Lifelines conference, the DePaul University/Chicago Tribune stock market program, the MathCounts competition, and special programs from the Shedd Aquarium, the Museum of Science and Industry, the Field Museum, and Expressways Art Program. The MCIP staff is currently reviewing several projects for possible program content: the Corridor Partnership for Excellence in Education; Project SITE; Resource Problems to Enhance the Teaching of Mathematics; Hands On Science Outreach; and problem solving computer software.

There were three significant outcomes of this project in regard to staff development. One of the most potentially powerful findings deals with the professional development of the participants. Written reports indicate that working with their colleagues has had an empowering effect on these veteran teachers. Eight MCIP participants have been hired by the Catholic School Office to assist with the district wide inservices. Five MCIP participants have been designated as Joyce Scholars and will be employed by the Archdiocese to develop model summer school magnet programs. Other opportunities for professional development furnished by MCIP include: the Foundation for Excellence in Teaching's Golden Apple Awards, the AASA exemplary Staff Development Awards, the Tandy Educational Grants Program, and our own Partners in Education program. Eighteen MCIP participants have entered an administration certification program; two have entered a Ph.D. program. Six participants have taken the program for university credit and are still undecided about a program.

The short-term cost effectiveness of the program funded by the Illinois Board of Higher Education for 1986 was $230/teacher trained or $7.70/student served. The short-term cost effectiveness for the 1987 program was $46/teacher trained or $1.50 per student served. This represents a five fold improvement in the MCIP short-term cost effectiveness. Long-term considerations include school curriculum improvement, development of district personnel as inservice leaders, continued contact with university education faculty, practical experience for graduate students, and training of undergraduate students for an even greater cost effective base. Not only has the teacher-leader model used in the MCIP proved cost effective, it has produced a group of confident, interested professionals who have been energized by the experience, something no amount of money can buy.

The MCIP program has acted as a vehicle to keep participants informed of important new research findings in mathematics education. MCIP participants have read and discussed the following articles: "How the Experts Teach Math", U.S. Office of Education; "Solving the Arithmetic Problem", Harvard Educational Letter; " A Japanese Educator's Perspective on Teaching Mathematics in the Elementary School" and "How Much of the Content in Mathematics Textbooks Is New?", Arithmetic Teacher. The MCIP will also print a newsletter to keep participants informed of events, highlight participants' efforts, and summarize important research information. Few teachers belong to professional organizations and even fewer to the National Council of Teachers of Mathematics (NCTM). The MCIP has kept them informed of such things as regional math meetings, "Square One TV", a Children's Television Workshop series about mathematics, materials provided by NCTM such as pamphlets to help parents work with their children at home, and a pamphlet giving ideas on techniques to increase instructional time in mathematics.

Eight undergraduate students participated. They reported that the most valuable experiences were 1) the small group school problem solving discussions and 2) the work they did in the participants' classrooms. Students rated their MCIP participation as one of the most significant professional experiences in their teacher education program. As a result of the program, six of the eight undergraduates have decided to complete the course work necessary to become a mathematics specialist.

The undergraduates worked an average of 10 hours in the schools of different participants. Several teacher participants indicated that this was an essential component of their successful implementation of the program since it gave them some much needed additional time. Scores on the final examination for the undergraduates ranged from 87 - 96%. Oral reports indicated insight into teaching beyond the typical undergraduate education experience.

Evidence from Professional Colleagues

Independent verification of the quality of the MCIP comes from mathematics educators in the Illinois Network of Pre-College Mathematics Programs. MCIP was one of two projects requested to present a formal update at the annual meeting on December 1, 1987. One of the principal investigators of this project has been appointed to the network's board of directors. A subcommittee on staff development has been formed by the network to find successful methods to increase the impact of good programs. Both principal investigators of this project are members of the subcommittee.

MCIP was presented at the Illinois Council of Teachers of Mathematics, October, 1987. It will be presented at the annual Association of Supervision and Curriculum Development meeting, March, 1988. Proposals have been or will be submitted for the following annual meetings: National Council of Teachers of Mathematics; American Educational Research Association; and National Council of Staff Development.

MCIP related articles have appeared in the Illinois Mathematics Teacher, The Arithmetic Teacher and Staff Development. Public relations material has appeared in the Chicago Catholic, the Loyola Alumni News, The Norwood Review, The Brighton Park and McKinley Park Life, and The Southwest News Herald, as well as numerous church and school bulletins.

Evidence from the Cooperating School System

Much of the impetus for this cooperative effort has come from the Chicago Catholic School Office; however, work with teachers from other districts indicates that the need for interesting, motivational, mathematics activities is community wide. The Curriculum Committee of the Archdiocesan Education Office has revised their mathematics objectives according to guidelines from the National Council of Teachers of Mathematics, results from the National Assessment of Educational Progress, and their own local needs. The committee realizes that setting goals is merely the beginning and that classroom application is the real heart of curriculum change. Therefore, the committee has requested the assistance of the School of Education at Loyola University to help with the implementation of the revised mathematics curriculum.

The development of the Archdiocesan curriculum goals is the result of extensive feedback from administrators within the system. The Chapter II Principals' Advisory Committee of the Chicago Archdiocese identified the improvement of teachers in science and mathematics as one of two primary needs in their schools. Principals are also eager to move from a textbook-based curriculum to an activities and problem solving oriented mathematics curriculum. Over 225 school evaluation visitations in the Chicago Archdiocesan schools document the need for teacher training in delivery of mathematics instruction.

Because of scant resources, staff development in the Chi ago Archdiocesan schools is more problematic than in other school systems. Each schoo' is organized as a district but without resources for curriculum or staff development pers nnel. Therefore, teachers need to be trained to act with the principal as curriculum leaders. The principals recognize that teachers have great powers as decision-makers in their classrooms. Their responsibility as leaders is to insure that expertise. A method to train existing personnel is urgently needed.

Additional evidence for teacher training is found in a needs assessment instrument designed by the Chicago Archdiocesan Education Office committee assigned to explore the needs of the elementary schools. The assessment took the form of a priority survey and was distributed to 360 elementary school principals. The Mathematics Curriculum Improvement Project will touch on four needs identified by over half of the principals as having highest priority: 1) workshops and institutes for professional development of teachers; 2) provision of consultation services for curriculum and/or instructional problems at individual schools; 3) provision of consultation services for short and long-range planning and research at individual schools; and 4) provision of resources for innovative programs. More detailed analysis of this data shows that three of these four needs have highest priority among Black and Hispanic schools; have shown little change in priority ratings since 1976; and have been viewed as ineffectively dealt with by over 75% of the principals in the system.

TARGET POPULATION

The target population includes 25 schools from both the public and private school systems in the Cook, DuPage, and Lake County areas who have participated in MCIP and have signed the agreement to make a school-wide effort to implement MCIP (See Objective #1). An additional 25 new teachers from other private and public school districts in

Cook, Lake, and DuPage counties will be recruited. Since additional funding for the development and piloting of the MCIP project has come through The Catholic School Office, 30 (60%) of the available slots will be allocated to teachers working in that system. The Archdiocese of Chicago serves the City of Chicago and the communities of Cook and Lake County. Currently, 2.4 million Catholics (40% of the total population) live in this area. Of these, approximately 550,000 are Hispanic; 100,000 are Black; and the remaining 1.75 million represent a great ethnic diversity.

The Education Office serves the planning, curriculum, and administrative needs of 416 elementary and high schools with an enrollment of nearly 175,000 students. This is the largest private school system in the United States, and the seventh largest of all systems in the nation. There are over 57,000 minority students, and over 38,000 non-Catholic students attending these schools. Just over 35% of the elementary schools within the system are participating in the MCIP program, an increase of 20% since 1986. The MCIP III summer institute program will train teachers in an additional 15% of the elementary schools by October 1, 1988.

No organized or systematic program for the gifted student exists in the Archdiocesan system. The MATHEMATICS CURRICULUM IMPROVEMENT PROJECT will address the needs of gifted students by expanding the mathematics curriculum to include such traditionally advanced topics as probability, statistics, coordinate geometry, and abstract algebra. All children will be exposed to these topics at each grade level. A long term mathematics curriculum goal is to graduate 50-80% of eighth grade students with a high school algebra credit.

MCIP is evidence that talented and dedicated teachers can reform their curriculum. MCIP is further evidence that children can be excited about mathematics.

IMPLEMENTATION OF ILLINOIS BOARD OF HIGHER EDUCATION POLICY OBJECTIVES

The MATHEMATICS CURRICULUM IMPROVEMENT PROJECT attends to three of the five policy objectives of the Illinois Board of Higher Education designed to assist with efforts to improve elementary education in the state:

- to improve preparation of new teacher;
- to improve school curricula and instruction in mathematics; and
- to assist with district-defined teacher training, retraining, and inservice training.

The vision of this program is to combine the resources of Loyola University, the Archdiocesan School System and other interested public and private school districts, talented veteran MCIP teachers, and the Illinois Board of Higher Education to:

- improve the math competencies of teachers;
- implement a mathematics activities oriented curriculum faithful to the objectives outlined by the Archdiocesan Education Office Curriculum Committee, the Illinois State Board of Education, and the National Council of Teachers of Mathematics;
- develop a group of teacher-leaders; and
- develop an internship program for excellent elementary education students.

The Objectives, Activities, and Evaluations which follow operationalize these aims according to the guidelines of the Request for Proposals. The preceding narrative attests to the collaborative nature of this project; a brief review of the literature guiding this proposal will provide evidence of its research base.

LITERATURE REVIEW

It is essential that continued funding be made available to successful projects. Professor Ralph Tyler, national and international expert on curriculum implementation, points out that "it takes six or seven years to get a reform really working as intended. Most implementation plans greatly underestimate the amount of time required" (1987). From the perspective of over 50 years in educational reform, he notes that

> Proposals for education reform often meet an early demise because they lack focus, they are not accompanied by a feasible plan for implementation, and they are not accompanied by the requisite resources for effective implementation. As a result, few individuals can remember the reforms that were adopted in an earlier period (1987).

MCIP has three major goals, improving the mathematics curriculum and instruction, assisting with district staff development efforts, and improving the preparation of new teachers.

Improving School Curriculum and Instruction

At least nine different national commissions have endorsed an improved mathematics curriculum to provide the human resources for high technology and growth industries that will be increasingly important to the Midwest economy. Research on economic growth (Walberg, 1983) suggests that improving instruction in mathematics and science is in our national interest.

The National Council of Teachers of Mathematics (NCTM) issued an "Agenda for Action: Recommendations for School Mathematics of the 1980s" (1980). The recommendations represent action to be taken in this decade to improve mathematics education for our youth. Studies funded by the National Science Foundation, two mathematics assessments by the National Assessment of Educational Progress, and extensive surveys of the opinions of both lay and professional sectors of the society were used to develop these recommendations.

A curriculum without implementation plans is destined to do little more than gather dust. The concerns and needs of teachers must be addressed in every school program. Many curriculum reforms have failed because they did not attend to the structural and institutional factors constraining teachers (Westbury, 1971; Czajkiwski and Peterson, 1980). Several successful school-based projects have utilized an interactive research and development approach that involves collaboration among program planners, researchers, and teachers (Florio and Walsh, 1978; Klausmeier, 1982; Tikunoff, Ward and Griffin, 1980; Schiller, Carroll and Pankake, 1985). Another component of any successful school-based program is principal support and leadership (Hall, 1979; Edmonds, 1979; Berman and McLaughlin, 1979; Brookover and Lazotte, 1979; Liberman and Miller, 1981; and Parish and Aquila, 1982).

Assisting with District-defined Staff Development

Meta-analyses of studies on staff development have found significant components which have been associated with significant gains for teachers and/or students. Among these are semester-long programs, written materials, on-site training, classroom assistance, teacher identified needs, and feedback to participants (Joslin, 1980; Harrison, 1980).

An organizational commitment from teachers, along with their cooperative efforts and active engagement is also needed if the school program is going to be successful (Czajkowski and Patterson, 1980; Liberman and Miller, 1981; Shalaway, 1981). Attention must also be paid to teachers as professional learners: "It is not enough that teachers' work would be studied, they need to study it themselves." (Stenhouse, 1975).

One of the requirements of a profession is that its members continue to learn, grow, and renew themselves so that their interactions with clients are reflective of the best knowledge and skill available to them (Griffin, 1978). Veteran teachers need to find new challenges to keep them from becoming routinized (Tyler, 1985). Various career development programs are now being tested: Charlotte-Mecklenburg Career Development Plan (1980); The California Mentor Teacher Program (1983); The Teacher Advisor Project of the Marin (Ca.) County Office of Education (1981); and the Tennessee Career Ladder Program (1984) are some models. The Council for Basic Education (1986) has posed a new initiative for the 3Rs--a challenge to recognize that the recruitment, renewal, and retention of excellent teachers should be bound together.

Improving the Preparation of New Teachers

The recommendations from the deans of 24 leading research universities --the Holmes Group (Education Week, June 12, 1985)-- to improve the content base of prospective teachers by delaying clinical experience is not in keeping with what we've learned from major studies of teacher education. Both the Commonwealth Teacher Education Study (Charters and Waples, 1929) and the Commission on Teacher Education (Tyler, 1938-1944) showed that the action of teaching is more than presenting selected subject matter. Prospective teachers were involved in teaching/learning experiences from their freshmen year. Seminars with education professors helped them use what they were learning in college courses to gain an understanding of the situations they encountered in classrooms. Thus, they were able to make the necessary connections between theory and practice. This enabled them 1) to understand rather than simply memorize material and

2) to find role models to emulate (Tyler, 1985).

Investigators also found significant contributions of school personnel to the guidance, education, and development of prospective teachers. Without large additional expenditures, teacher education institutions and school systems worked together to identify and solve educational problems. The experience of the principal investigators of MCIP support the findings from these two classic studies.

OBJECTIVES, ACTIVITIES, AND EVALUATION

Objective #1

Twenty-five participants from the 1987 summer workshop will expand their leadership skills developed in the program by extending the MCIP program to a total school effort. The selected schools have agreed to the following:

Analysis of the school mathematics curriculum to provide for

a) schoolwide use of M.A.T.H. chapters on a monthly basis;

b) parent training in home learning strategies for math at monthly PTA or Home/School meetings;

c) at least 2 community math events;

d) a school display of students' M.A.T.H.;

e) timely news releases;

f) weekly sharing sessions for teachers;

g) a math focus for the 1988-89 academic year inservice effort;

h) a summer math take-home activities booklet; and

i) development of a plan to have algebra as the standard 8th grade curriculum within 2 years.

Classroom mathematics instruction will be characterized by:

a) extensive use of problem solving;

b) use of calculators;

c) reading instruction in mathematics;

d) library activities in mathematics;

e) use of instructional games;

f) use of manipulatives;

g) use of computers; and

h) integration of math in other content areas (see M.A.T.H. appendices).

Training for this objective will be completed by September 30, 1988 with funding from the Illinois Board of Higher Education. It is expected that each school will continue to develop its mathematics curriculum along the MCIP guidelines.

Activity 1.1

Participants will attend workshop programs at Loyola during the spring of 1988 according to the following timetable:

March community math events;

April summer activity parent handbook;

May training program for parents; and

June mathematics curriculum modification to include algebra as the standard eighth grade content by fall, 1989.

The program will consist of large group lecture/discussion sessions and small group sharing and support sessions. Each small group will be led by a graduate student who is a long term veteran of the MCIP program.

Activity 1.2

Participants will work with their principals to budget the $1000 allocated for the MCIP program implementation.

Activity 1.3

Participants will work with their principals to develop a school team to implement the MCIP program.

Activity 1.4

The school team will hold on-site workshops each month to plan and implement the activity listed in Activity 1.1.

Evaluation

Formative evaluation of the MCIP school plan will be provided by Loyola faculty, graduate students, and Ralph Tyler, a national education leader in curriculum, instruction and evaluation. Both quantitative and qualitative summative evaluations will be provided.

Participants will report the number of people attending the community math events; the number of parents trained to use the summer activity handbook; and the percent of students scoring 80% or more on various grade level algebra activities. Graduate students in consultation with Loyola faculty, will rate the community math event plans, the summer activity booklet, the parent training plans, and the acceleration of the math curriculum according to the following scale:

5 = outstanding, creative, includes more than required;

4 = impressive, creative plan for accomplishing the required task;

3 = satisfactory plan for accomplishing the required task;

2 = fair plan, some of the required content missing; and

1 = poor plan, 25% or more of the required content missing.

Graduate students will collect anecdotes during the small group sharing sessions. These anecdotes will be categorized and reported. Participants will also be required to provide some type of evaluative feedback for their community math projects, summer activity handbooks, parent training, and math curriculum acceleration. This will be collected and reported.

Objective #2

In addition to the 25 veteran participants mentioned in Objective #1, 25 new participants will be selected for the summer institute. All participants will increase their own competencies in mathematics. The summer institute will focus on problem solving, classroom application of historical mathematics ideas, classroom applications of calculators and computers, and integration of mathematics instruction with science and other subject areas.

This objective will be completed by August 15, 1988 with funding from the Illinois Board of Higher Education.

Activity 2.1

Teacher participants and undergraduate interns will attend a summer institute/course (Curr 309) which will extend their mathematics competencies in the areas described in Objective #2. Teachers may elect to receive course credit; undergraduate interns must take the institute for credit. The institute will meet part of the requirements for the new state 6th-8th grade math certificate program.

Evaluation

All teacher participants and undergraduate interns will complete 100% of the assignments and have at least a 90% attendance rate. Participants will be asked to complete a survey which will indicate if they plan to use the material in their own classrooms and/or in training. Any material which receives less than a 40% rating will be re-evaluated.

Objective #3

New participants will learn staff development skills so that they may become mathematics leaders, first, in their own school, and second, within their school system. They will work towards institutionalizing the improved mathematics curriculum.

This objective will be completed by October, 1988 with funding from the Illinois Board of Higher Education.

Activity 3.1

Veteran participants, graduate students, guests lecturers, and faculty from Loyola University will lead afternoon workshops on staff development. Topics will include incorporating M.A.T.H. chapters into the existing mathematics curriculum, working with colleagues, principals, and parents, utilizing the library for mathematics instruction, a summer activities parent handbook, community math events, and acceleration of an existing mathematics curriculum to include algebra as the standard eighth grade curriculum.

Activity 3.2

Professor Ralph Tyler, author of "Basic Principles of Curriculum and Instruction", will address the whole group on school improvement. He will then meet with the small groups to help teachers respond to specific needs at their school.

Activity 3.3

Professor Herbert J. Walberg, national expert on school productivity, will address the whole group on research. This will give participants an empirical framework for their efforts to increase their school's mathematics curriculum productivity. He will then meet with the small groups to help teachers respond to specific needs at their own school.

Activity 3.4

Dr. Anita Pankake is an assistant professor of educational administration at Kansas State University. She has been an elementary school principal for 5 years and worked on a successful staff development project with the principal investigators. She will address the whole group on instructional leadership and working with the principal. She will then meet with the small groups to help teachers respond to specific needs at their own schools.

Evaluation

Small group discussion sessions have been evaluated as one of the most useful techniques of professional development in five different inservice programs conducted by this Loyola faculty team. Graduate students will report on the progress of their groups and its responses to problems as well as the presentations of the guest speakers and veteran participants at weekly staff meetings. This information will be used as formative evaluations and necessary revisions for the next week's program will be made. It will also be used as summative information and included in the final report.

Objective #4

New participants will implement the MCIP program in their own school and train at least three additional colleagues.

This objective will be completed by December, 1988 with funding from the Illinois Board of Higher Education.

Activity 4.1

Each participant will develop an outline to describe his/her work in the MCIP III summer institute at the first faculty meeting of the 1988-89 school year. Principals will also be requested to allow the participants 5 - 10 minutes on each monthly meeting agenda to update the faculty on MCIP activities.

Activity 4.2

Each participant will work with three or more volunteers from his/her school for a minimum of 10 hours during the beginning of the 1988-89 academic school year to introduce them to some of the ideas from the MCIP summer institute.

Activity 4.3

The school team will work with the principal to develop a draft math inservice plan for the school for the academic year.

Activity 4.4

The school team will work with the principal to develop an outline for a three-year effort to improve mathematics instruction in the school.

Activity 4.5

Small, geographic support groups will be formed. Each group will schedule a meeting in September, October, and November to share their progress, problems, and insights.

Evaluation

Small group leaders will rate participants on a 5 point scale (5 = full implementation with additional ideas; 4 = full implementation; 3 = partial implementation; 2 = unsuccessful implementation; and 1 = no implementation). Group leaders will also recommend participants as leaders for MCIP inservice programs with other schools in their district.

Participants will rate each of their colleague's ability to ··anslate the selected contents of the summer institute. They will use the same scale ꞅ described in the above paragraph. Participants will develop and implement an evalu· ·n procedure for his/her staff development efforts with the volunteer colleagues.

Faculty from Loyola University will review and comment on the outlines for school-site faculty meeting presentations, the three year mathematics curriculum improvement programs, and the evaluation procedure. Suggestions for improvement will be offered when appropriate.

Objective #5

The MATHEMATICS CURRICULUM IMPLEMENTATION PROGRAM will prepare twenty-five undergraduate education majors (both incoming freshmen and advanced standing students) for leadership roles as mathematics teachers. Candidates must be elementary education majors who are minoring in mathematics and have a minimum B+ overall grade point average. These interns will attend the same sessions as the participants and work with them in their schools.

This objective will be completed by September, 1988 with funding from the Illinois Board of Higher Education.

Activity 5.1

The interns will participate in the same sessions as the teachers In addition, they will attend a special seminar every week to discuss their experiences in the schools and how they might apply their learning from college courses to gain an understanding of the processes of education.

Activity 5.2

Each intern will work with two of the participants at their school sites. Interns will be expected to help with the work associated with MCIP. The exact nature of their duties will be determined by the teacher participants.

Evaluation

Interns will be expected to exhibit the same cognitive competencies as the teacher participants and score at least 90% on a final examination. They will also be required to keep a log of their activities and to prepare a report on their learning experience.

Teacher participants will be expected to give continual oral feedback to their student intern and to complete a formal student-teacher evaluation form.

Objective #6

Participants will continue to implement the MCIP in their schools during the remaining academic year.

This will be an ongoing effort, supported by funds from the individual districts and personnel from Loyola University.

Activity 6.1

MCIP personnel will make regular contacts with participating schools.

Activity 6.2

The principal investigators will continue to build contacts with schools and school districts which may be interested in the MCIP. These contacts will be built up through informal communication with Loyola University administration graduate students and other informal networking such as the Illinois Network of Pre-college Programs. MCIP participants from both the 1986 and 1987 summer programs will be matched to schools requesting training.

Activity 6.3

A quarterly newsletter will be sent to MCIP schools. The newsletter will highlight effective MCIP practices, summarize important research in mathematics education, inform readers of activities within the mathematics education community, and describe developments and materials in mathematics curriculum and instruction.

Evaluation

Graduate students will report on progress of the participants at monthly staff meetings. This formative evaluation will allow the team to help solve problems that may arise as well as continue to assure the quality of the program.

Information on the progress of each new participating school will be kept. Principals and lead teachers from these schools will be contacted regularly by Loyola University personnel. The number of schools taking advantage of this inservice training will be an important quantitative measure.

Participants will be asked to fill out a simple survey about the materials they receive. They will be asked if they used each item in their own classroom and/or for continued school-wide training. Teacher attendance, satisfaction, and implementation of co-sponsored MCIP programs will be monitored.

PROGRAM EVALUATION

In addition to the evaluations for each objective, questionnaires will be developed to determine the degree of satisfaction with this program for veteran participants, principals, teacher-leader trainees, teachers, and interns. Another questionnaire will be developed to determine the degree of implementation of activities from M.A.T.H. Student interest and achievement will be measured. Five groups will be randomly selected: MCIP veteran participants, MCIP new participants, MCIP participants' trainees, non-participating teachers in MCIP schools, and non MCIP schools. Data will be analyzed by school and by SES. Achievement will be measured by the California Achievement Test (CAT); attitude will by measured by a locally developed instrument.

JUSTIFICATION AND BACKGROUND INFORMATION

There is no present allocation in the Loyola University budget for programs to enhance the training skills of non-enrolled teachers. However, Loyola University has a commitment to the professional development of teachers in the Chicago metropolitan area. Some examples include the Ralph Tyler Lecture Series (Spring, 1983); the Multicultural Issues Seminar Series (1984-1985); the Quest for Educational Excellence Symposium (1985); meetings of the Loyola Chapter of Phi Delta Kappa, and regular offerings of special seminars and lectures. All Loyola events are widely advertised and open to the public.

Loyola University offers a variety of facilities for meeting project objectives. During the course of this project, meeting rooms, access to the library, media support services, electronic data processing services, and office services (clerical support, document copying, etc.) will be available to participants in this project.

Both of the principal investigators have been involved in prior collaborative work with the Chicago Archdiocesan Office of Catholic Education as well as local public school districts. Two major projects, The Master Teacher Training Project in Math and Science and Improving Content Area Reading Effectiveness, were funded through ECIA money. A measure of their success can be found in three other projects, funded by the Office of Catholic Education as a result of teacher interest in the state funded projects--The School Productivity Training Project, The Science Primer Implementation Workshops, and the Strategies for Improving Reading Comprehension Workshop Series. Evaluations from completed projects indicate over 90% satisfaction and usefulness. Both projects resulted in training material that is currently being used in school systems as well as university graduate and undergraduate instruction.

Graduate assistants who will work on the project are veteran teachers who bring to it special skills in mathematics, science, and special education. These graduate students have been involved in all phases of the MCIP project.

APPENDIX B

OFFICE OF CATHOLIC EDUCATION
ARCHDIOCESE OF CHICAGO

December 15, 1987

James C. Forstall, Ph.D.
Associate Director
Grant Program Administration
Illinois Board of Higher Education
500 Reisch Building
4 West Old Capitol Square
Springfield, Illinois 62701

Dear Dr. Forstall:

Please consider this letter as a statement of our cooperative agreement with Loyola University, School of Education. We have been most pleased with the progress of the Mathematics Curriculum Improvement Project (MCIP) and look forward to continuing the program.

If you need additional information, please contact me directly at (312) 751-5243.

Sincerely,

Joanne Planek

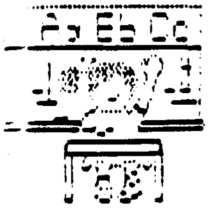
Dr. Joanne Planek
Coordinator, Program Development

JP/ds

M.C.I.P. V

MATH CURRICULUM IMPROVEMENT PROJECT - SUMMER 1983

AUGUST 1, 3, 8, 10, 15, 17



	9:00 - 11:00 SMALL GROUPS	11:00 - 11:30 APPENDICIES	11:30 - 12:30 LECTURES	12:30 - 1:00 LUNCHEON DISCUSSIONS	1:00 - 2:00 M.A.T.H. CHAPTERS	2:00 - 3:00 SKILL DEVELOPMENT AND PROBLEM SOLVING GAMES
MONDAY AUGUST 1, 1983	ALGEBRA MEASUREMENT CALCULATORS	MATH & P.E. MATH & ART	HANDS-ON SCIENCE PAUL ZINGG TEACHER LAKE COUNTY ILLINOIS		COORDINATE GEOMETRY	IT'S IN THE CARDS! MATH CARD GAMES GRADES 1-2
WEDNESDAY AUGUST 3, 1983	ALGEBRA MEASUREMENT STATISTICS	MENTAL MATH TRICKS	HANDS-ON SCIENCE PAUL ZINGG TEACHER LAKE COUNTY ILLINOIS		DATA COLLECTION & GRAPHING	IT'S IN THE CARDS! MATH CARD GAMES GRADES 3-4
MONDAY AUGUST 8, 1983	ALGEBRA MEASUREMENT PROBABILITY	MATH & SOCIAL STUDIES	RESOURCE DAY! PRESENTATIONS BY AREA MUSEUMS, ZOOS, AND OTHER COMMUNITY RESOURCES		WHOLE NUMBERS & DECIMALS	IT'S IN THE CARDS! MATH CARD GAMES GRADES 5-6
WEDNESDAY AUGUST 10, 1983	ALGEBRA AIMS COMPUTERS MATH & MUSIC	PROBLEM SOLVING	STAFF DEVELOPMENT ANITE PANKAKE PROFESSOR KANSAS STATE UNIVERSITY		INTEGERS	IT'S IN THE CARDS! MATH CARD GAMES GRADES 7-8
MONDAY AUGUST 15, 1983	ALGEBRA AIMS COMPUTERS MATH & MUSIC	PRODUCTIVE TEACHING & TIMES TABLE DRILLS	READING IN SCIENCE & MATH SR. MARIA SCATINA MS. DOROTHY GIROUX		FRACTIONS	MATHEMATICS PENTATHLON GAMES DIVISION I-II GAMES GRADES K-3
WEDNESDAY AUGUST 17, 1983	ALGEBRA AIMS COMPUTERS MATH & MUSIC	MATH & THE SPECIAL STUDENT	MATH & THE LIBRARY DENISE [illegible] LIBRARIAN KENWOOD ACADEMY		RATIOS & PERCENTS	MATHEMATICS PENTATHLON GAMES DIVISION III-V GAMES GRADES 4-8

ASSIGNMENT SHEET

AUGUST
FACULTY MEETING PRESENTATION OUTLINE

SEPTEMBER
NOTES/ANECDOTES ON MCIP ACTIVITIES
SAMPLE HOME/SCHOOL COMMUNICATION
NEEDS ASSESSMENT SUMMARY STATEMENT
BUDGET OUTLINE
STAFF DEVELOPMENT OUTLINE PLAN (BE SURE TO INDICATE HOW AT LEAST 7 COMPONENTS FOR SUCCESSFUL INSERVICE HAVE BEEN INCLUDED.)

OCTOBER
PRESS RELEASE
CARD GAME FEEDBACK SHEET
APPENDIX FEEDBACK SHEET
NOTES/ANECDOTES ON MCIP ACTIVITIES

DECEMBER
FEEDBACK SHEET FROM MATH CHAPTER
PICTURES OF MCIP STUDENT INVOLVEMENT
EVALUATION OF TRAINEES USING THE FOLLOWING SCALE:

5 - SUPERIOR, BEYOND EXPECTATIONS
4 - IMPRESSIVE, COMPLETED ALL ASSIGNMENTS WITH SPIRIT
3 - GOOD, COMPLETED ALL ASSIGNMENTS
2 - FAIR, COMPLETED MOST OF THE ASSIGNMENTS
1 - WEAK

SUMMARY STATEMENTS/TRAINEES' EVALUATION OF YOU
NOTES/ANECDOTES ON MCIP ACTIVITIES

*** FULL SCHOOLS MUST ALSO TURN IN EACH MONTH (SEPTEMBER, OCTOBER, DECEMBER):
FEEDBACK SHEET FROM EACH TEACHER FOR DESIGNATED CHAPTER
EVIDENCE OF HOME/SCHOOL OR PTA MEETING ACTIVITY
CALENDAR FEEDBACK SHEETS

*** DON'T FORGET TO PLAN YOUR 2 COMMUNITY MATH EVENTS!

APPENDIX C

MCIP SURVEY NO. 1

1. Have you participated in the MCIP program before?

   ( ) Yes, I have been involved with the MCIP program before this workshop.

   ( ) No, this is my first experience with the MCIP program.

2. What grade level do you teach? ____________________

3. What grade levels have you taught in previous years? ____________________

   ____

4. What type of teaching assignment do you have in the area of mathematics?

   ( ) Self-contained elementary classroom teacher

   ( ) Mathematics subject area teacher

   ( ) Other ______________________________

5. How many years of teaching experience do you have? ____________________

6. In your professional teacher training estimate how many mathematics classes you have taken to date: ______________________________

7. Please check the highest degree you have earned as of this date:

   ( ) Bachelors Degree

   ( ) Masters Degree

   ( ) CAS

   ( ) PH.D/ED.D

Please circle the appropriate response to the following questions:

8. How confident are you in teaching mathematics to your students?

Very Confident	Confident	Not Sure	Somewhat Unconfident	Very Unconfident
1	2	3	4	5

9. How important is it to follow the order of the mathematics textbook in planning and teaching mathematics?

Very Important	Important	Undecided	Not Important	Not At all Important
1	2	3	4	5

10. a. Do you skip around and not follow the order of the math textbook when planning and teaching your lessons?

Yes No

b. When?____

____

____

11. Do you use manipulative activities in your math lessons?

Yes No

How often per week?

1 day 2 days 3 days 4 days 5 days

12. Would you like to be able to have greater participation in making decisions about the math curriculum?

Yes NO

13. Where would you like to make those decisions?

(Check as many as you wish)

_____ classroom level

_____ grade level

_____ schoolwide

_____ districtwide

14. a. How important is it to teach algebra?

Very Important	Important	Undecided	Not Important	Not At All Important
1	2	3	4	5

b. How difficult is it to teach algebra?

Very Easy	Easy	Undecided	Hard	Very Hard
1	2	3	4	5

c. How much do you like teaching algebra?

Like A Lot	Like	Undecided	Dislike	Dislike a Lot
1	2	3	4	5

15. a. How important is it to teach integers?

Very Important	Important	Undecided	Not Important	Not At all Important
1	2	3	4	5

b. How difficult is it to teach integers?

Very Easy	Easy	Undecided	Hard	Very Hard
1	2	3	4	5

c. How much do you like teaching integers?

Like A Lot	Like	Undecided	Dislike	Dislike A Lot
1	2	3	4	5

16. a. How important is it to teach probability?

Very Important	Important	Undecided	Not Important	Not At All Important
1	2	3	4	5

b. How difficult is it to teach probability?

Very Easy	Easy	Undecided	Hard	Very Hard
1	2	3	4	5

c. How much do you like teaching probability?

Like A Lot	Like	Undecided	Dislike	Dislike A Lot
1	2	3	4	5

17. a. How important is it to teach statistics?

Very Important	Important	Undecided	Not Important	Not At All Important
1	2	3	4	5

b. How difficult is it to teach statistics?

Very Easy	Easy	Undecided	Hard	Very Hard
1	2	3	4	5

c. How much do you like teaching statistics?

Like A Lot	Like	Undecided	Dislike	Dislike A Lot
1	2	3	4	5

18. a. How important is it to teach coordinate geometry?

Very Important	Important	Undecided	Not Important	Not At all Important
1	2	3	4	5

b. How difficult is it to teach coordinate geometry?

Very Easy	Easy	Undecided	Hard	Very Hard
1	2	3	4	5

c. How much do you like teaching coordinate geometry?

Like A Lot	Like	Undecided	Dislike	Dislike A Lot
1	2	3	4	5

19. a. How important is it to teach data collection?

Very Important	Important	Undecided	Not Important	Not At All Important
1	2	3	4	5

b. How difficult is it to teach data collection?

Very Easy	Easy	Undecided	Hard	Very Hard
1	2	3	4	5

c. How much do you like teaching data collection?

Like A Lot	Like	Undecided	Dislike	Dislike A Lot
1	2	3	4	5

20. a. How important is it to teach whole numbers?

Very Important	Important	Undecided	Not Important	Not At All Important
1	2	3	4	5

b. How difficult is it to teach whole numbers?

Very Easy	Easy	Undecided	Hard	Very Hard
1	2	3	4	5

c. How much do you like teaching whole numbers?

Like A Lot	Like	Undecided	Dislike	Dislike A Lot
1	2	3	4	5

21. a. How important is it to teach ratios and percents?

Very Important	Important	Undecided	Not Important	Not At All Important
1	2	3	4	5

b. How difficult is it to teach ratios and percents?

Very Easy	Easy	Undecided	Hard	Very Hard
1	2	3	4	5

c. How much do you like teaching ratios and percents?

Like A Lot	Like	Undecided	Dislike	Dislike A Lot
1	2	3	4	5

22. a. How important is it to teach fractions?

Very Important	Important	Undecided	Not Important	Not At All Important
1	2	3	4	5

b. How difficult is it to teach fractions?

Very Easy	Easy	Undecided	Hard	Very Hard
1	2	3	4	5

c. How much do you like teaching fractions?

Like A Lot	Like	Undecided	Dislike	Dislike A Lot
1	2	3	4	5

23. a. How important is it to teach graphing?

Very Important	Important	Undecided	Not Important	Not At All Important
1	2	3	4	5

b. How difficult is it to teach graphing?

Very Easy	Easy	Undecided	Hard	Very Hard
1	2	3	4	5

c. How much do you like teaching graphing?

Like A Lot	Like	Undecided	Dislike	Dislike A Lot
1	2	3	4	5

24. a. How important is it to use math games?

Very Important	Important	Undecided	Not Important	Not At All Important
1	2	3	4	5

b. How difficult is it to teach math games?

Very Easy	Easy	Undecided	Hard	Very Hard
1	2	3	4	5

c. How much do you like teaching math games?

Like A Lot	Like	Undecided	Dislike	Dislike A Lot
1	2	3	4	5

25. a. How important is it to use computer math software?

Very Important	Important	Undecided	Not Important	Not At All Important
1	2	3	4	5

b. How difficult is it to teach with math computer software?

Very Easy	Easy	Undecided	Hard	Very Hard
1	2	3	4	5

c. How much do you like teaching with math computer software>

Like A Lot	Like	Undecided	Dislike	Dislike A Lot
1	2	3	4	5

26. a. How important is it to use the learning center to integrate reading materials with mathematics?

Very Important	Important	Undecided	Not Important	Not At All Important
1	2	3	4	5

b. How difficult is it to use learning center materials with mathematics?

Very Easy	Easy	Undecided	Hard	Very Hard
1	2	3	4	5

c. How much do you like using learning center materials with mathematics>

Like A Lot	Like	Undecided	Dislike	Dislike A Lot
1	2	3	4	5

27. At what grade level would you recommend the following math topics be introduced?

Algebra	K( )	1( )	2( )	3( )	4( )	5( )	6( )	7( )	8( )
Integers	K( )	1( )	2( )	3( )	4( )	5( )	6( )	7( )	8( )
Probability	K( )	1( )	2( )	3( )	4( )	5( )	6( )	7( )	8( )
Statistics	K( )	1( )	2( )	3( )	4( )	5( )	6( )	7( )	8( )
Coordinate Geometry	K( )	1( )	2( )	3( )	4( )	5( )	6( )	7( )	8( )
Data Collection	K( )	1( )	2( )	3( )	4( )	5( )	6( )	7( )	8( )
Whole Numbers	K( )	1( )	2( )	3( )	4( )	5( )	6( )	7( )	8( )
Ratios and Percents	K( )	1( )	2( )	3( )	4( )	5( )	6( )	7( )	8( )
Fractions	K( )	1( )	2( )	3( )	4( )	5( )	6( )	7( )	8( )
Graphing	K( )	1( )	2( )	3( )	4( )	5( )	6( )	7( )	8( )
Math Games	K( )	1( )	2( )	3( )	4( )	5( )	6( )	7( )	8( )
Computer Software	K( )	1( )	2( )	3( )	4( )	5( )	6( )	7( )	8( )
Use of Learning Center to integrate reading materials with mathematics	K( )	1( )	2( )	3( )	4( )	5( )	6( )	7( )	8( )

28. Indicate which topics you have introduc ed to your students last year with a (✓) mark and which topics you plan to introduce during the coming school year with an (*) mark.

	(✓) which topics introduced to your students last year	(*) which topics you plan to introduce this new school year
Algebra	( )	( )
Integers	( )	( )
Probability	( )	( )
Statistics	( )	( )
Coordinate Geometry	( )	( )
Data Collection	( )	( )
Whole Numbers	( )	( )
Ratios and Percents	( )	( )

	(✓) which topics introduced to your students last year	(*) which topics you plan to introduce this new school year
Fractions	( )	( )
Graphing	( )	( )
Math Games	( )	( )
Computer Software	( )	( )
Use of learning center to integrate reading materials with mathematics	( )	( )

MCIP

SURVEY NO. 2

Have you participated in the MCIP program before?

( ) Yes, I have been involved with the MCIP program

( ) No, this is my first experience with the MCIP program.

At what grade level would you recommend the following math topics be introduced?

Algebra	K( )	1( )	2( )	3( )	4( )	5( )	6( )	7( )	8( )
Integers	K( )	1( )	2( )	3( )	4( )	5( )	6( )	7( )	8( )
Probability	K( )	1( )	2( )	3( )	4( )	5( )	6( )	7( )	8( )
Statistics	K( )	1( )	2( )	3( )	4( )	5( )	6( )	7( )	8( )
Coordinate Geometry	K( )	1( )	2( )	3( )	4( )	5( )	6( )	7( )	8( )
Data Collection	K( )	1( )	2( )	3( )	4( )	5( )	6( )	7( )	8( )
Whole Numbers	K( )	1( )	2( )	3( )	4( )	5( )	6( )	7( )	8( )
Ratios and Percents	K( )	1( )	2( )	3( )	4( )	5( )	6( )	7( )	8( )
Fractions	K( )	1( )	2( )	3( )	4( )	5( )	6( )	7( )	8( )
Graphing	K( )	1( )	2( )	3( )	4( )	5( )	6( )	7( )	8( )
Math Games	K( )	1( )	2( )	3( )	4( )	5( )	6( )	7( )	8( )
Computer Software	K( )	1( )	2( )	3( )	4( )	5( )	6( )	7( )	8( )
Use of Learning Center to integrate reading materials with mathematics	K( )	1( )	2( )	3( )	4( )	5( )	6( )	7( )	8( )

Indicate which topics you have introduc ed to your students last year with a (✓) mark and which topics you plan to introduce during the coming school year with an (*) mark.

	(✓) which topics introduced to your students last year	(*) which topics you plan to introduce this new school year
Algebra	( )	( )
Integers	( )	( )
Probability	( )	( )
Statistics	( )	( )
Coordinate Geometry	( )	( )
Data Collection	( )	( )
Whole Numbers	( )	( )
Ratios and Percents	( )	( )
Fractions	( )	( )
Graphing	( )	( )
Math Games	( )	( )
Computer Software	( )	( )
Use of learning center to integrate reading materials with mathematics	( )	( )

MCIP POST SURVEY

NAME ______________________________

ID______________________________

Please circle the appropriate response to the following questions:

1. How confident are you in teaching mathematics to your students?

Very Confident	Confident	Not Sure	Somewhat Confident	Very Unconfident
1	2	3	4	5

2. How important is it to follow the order of the mathematics textbook in planning and teaching mathematics?

Very important	important	Undecided	Not important	Not at all Important
1	2	3	4	5

3.a. Do you skip around and not follow the order of the math textbook when planning and teaching your lessons? YES NO

b. WHEN?

____

____

____

4. Do you use manipulative activities in your math lessons? YES NO
How often per week?
1 day 2 days 3 days 4 days 5 days

5. Would you like to be able to have greater participation in making decisions about the math curriculum? YES NO

6. Where would you like to make those decisions? (Check as many as apply)

_____ Classroom level
_____ Grade level
_____ Schoolwide
_____ Districtwide

7.a. How important is it to teach ALGEBRA ?

Very Important	Important	Undecided	Not important	Not at all Important
1	2	3	4	5

b. How difficult is it to teach ALGEBRA ?

Very Easy	Easy	Undecided	Hard	Very Hard
1	2	3	4	5

c. How much do you like teaching ALGEBRA ?

Like A Lot	Like	Undecided	Dislike	Dislike A Lot
1	2	3	4	5

8 a. How important is it to teach INTEGERS ?

Very important	important	Undecided	Not important	Not At All Important
1	2	3	4	5

b. How difficult is it to teach INTEGERS ?

Very Easy	Easy	Undecided	Hard	Very Hard
1	2	3	4	5

c. How much do you like teaching INTEGERS ?

Like A Lot	Like	Undecided	Dislike	Dislike A Lot
1	2	3	4	5

9 a. How important is it to teach PROBABLITY ?

Very important	Important	Undecided	Not important	Not at all Important
1	2	3	4	5

b. How difficult is it to teach PROBABLITY ?

Very Easy	Easy	Undecided	Hard	Very Hard
1	2	3	4	5

c. How much do you like teaching PROBABLITY ?

Like A Lot	Like	Undecided	Dislike	Dislike A Lot
1	2	3	4	5

10.a. How important is it to teach STATISTICS ?

Very important	important	Undecided	Not important	Not at all Important
1	2	3	4	5

b. How difficult is it to teach STATISTICS ?

Very Easy	Easy	Undecided	Hard	Very Hard
1	2	3	4	5

c. How much do you like teaching STATISTICS ?

Like A Lot	Like	Undecided	Dislike	Dislike A Lot
1	2	3	4	P

11 a. How important is it to teach COORDINATE GEOMETRY?

Very important	important	Undecided	Not important	Not at all Important
1	2	3	4	5

b. How difficult is it to teach CORRDINATE GEOMETRY?

Very Easy	Easy	Undecided	Hard	Very Hard
1	2	3	4	5

c. How much do you like teaching COORDINATE GEOMETRY?

Like A Lot	Like	Undecided	Dislike	Dislike A Lot
1	2	3	4	5

12 a. How important is it to teach DATA COLLECTION?

Very Important	Important	Undecided	Not important	Not at all Important
1	2	3	4	5

b. How difficult is it to teach DATA COLLECTION?

Very Easy	Easy	Undecided	Hard	Very Hard
1	2	3	4	5

c. How much do you like teaching DATA COLLECTION?

Like A Lot	Like	Undecided	Dislike	Dislike A Lot
1	2	3	4	5

13 a, How important it it to teach WHOLE NUMBERS?

Very Important	Important	Undecided	Not important	Not at all Important
1	2	3	4	5

b. How difficult is it to teach WHOLE NUMBERS?

Very Easy	Easy	Undecided	Hard	Very Hard
1	2	3	4	5

c. How much do you like teaching WHOLE NUMBERS?

Like A Lot	Like	Undecided	Dislike	Dislike A Lot
1	2	3	4	5

14 a. How important is it to teach RATIOS and PERCENTS?

Very Important	Important	Undecided	Not Important	Not at all Important
1	2	3	4	5

b. How difficult is it to teach RATIOS and PERCENTS?

Very Easy	Easy	Undecided	Hard	Very Hard
1	2	3	4	5

c. How much do you like teaching RATIOS and PERCENTS?

Like A Lot	Like	Undecided	Dislike	Dislike A Lot
1	2	3	4	5

4

15 a. How <u>important is it to teach</u> FRACTIONS ?

Very important	Important	Undecided	Not important	Not at all important
1	2	3	4	5

b. How <u>difficult it is to teach</u> FRACTIONS ?

Very Easy	Easy	Undecided	Hard	Very Hard
1	2	3	4	5

c. How <u>much do you like teaching</u> FRACTIONS ?

Like A Lot	Like	Undecided	Dislike	Dislike A Lot
1	2	3	4	5

16 a. How <u>important is it to teach</u> GRAPHING?

Very important	Important	Undecided	Not important	Not at all important
1	2	3	4	5

b. How <u>difficult is it to teach</u> GRAPHING ?

Very Easy	Easy	Undecided	Hard	Very Hard
1	2	3	4	5

c. How <u>much do you like teaching</u> GRAPHING ?

Like A Lot	Like	Undecided	Dislike	Dislike A Lot
1	2	3	4	5

17 a. How <u>important is it to use</u> MATH GAMES?

Very important	Important	Undecided	Not important	Not at all important
1	2	3	4	5

b. How <u>difficult is it to use</u> MATH GAMES?

Very Easy	Easy	Undecided	Hard	Very Hard
1	2	3	4	5

c. How <u>much do you like teaching</u> MATH GAMES?

Like A Lot	Like	Undecided	Dislike	Dislike A Lot
1	2	3	4	5

18 a. How <u>important is it to use</u> COMPUTER MATH SOFTWARE?

Very important	Important	Undecided	Not important	Not at all important
1	2	3	4	5

b. How <u>difficult is it to use</u> COMPUTER MATH SOFTWARE?

Very Easy	Easy	Undecided	Hard	Very Hard
1	2	3	4	5

5

c. How much do you like teaching with COMPUTER MATH SOFTWARE?

Like A Lot	Like	Undecided	Dislike	Dislike A Lot
1	2	3	4	5

19 a. How important is it to use the learning center to integrate reading materials with mathematics?

Very important	Important	Undecided	Not important	Not at all important
1	2	3	4	5

b. How difficult is it to use learning center materials with mathematic ?

Very Easy	Easy	Undecided	Hard	Very Hard
1	2	3	4	5

c. How much do you like using learning center materials with mathematics ?

Like A Lot	Like	Undecided	Dislike	Dislike A Lot
1	2	3	4	5

20. AT WHAT GRADE LEVEL WOULD YOU RECOMMEND THE FOLLOWING MATH TOPICS BE INTRODUCED?

ALGEBRA	K( )	1( )	2( )	3( )	4( )	5( )	6( )	7( )	8( )
INTEGERS	K( )	1( )	2( )	3( )	4( )	5( )	6( )	7( )	8( )
PROBABLITY	K( )	1( )	2( )	3( )	4( )	5( )	6( )	7( )	8( )
STATISTICS	K( )	1( )	2( )	3( )	4( )	5( )	6( )	7( )	8( )
COORDINATE GEOMETRY	K( )	1( )	2( )	3( )	4( )	5( )	6( )	7( )	8( )
DATA COLLECTION	K( )	1( )	2( )	3( )	4( )	5( )	6( )	7( )	8( )
WHOLE NUMBERS	K( )	1( )	2( )	3( )	4( )	5( )	6( )	7( )	8( )
RATIOS AND PERCENTS	K( )	1( )	2( )	3( )	4( )	5( )	6( )	7( )	8( )
FRACTIONS	K( )	1( )	2( )	3( )	4( )	5( )	6( )	7( )	8( )
GRAPHING	K( )	1( )	2( )	3( )	4( )	5( )	6( )	7( )	8( )
MATH GAMES	K( )	1( )	2( )	3( )	4( )	5( )	6( )	7( )	8( )

COMPUTER GAMES	K( )	1( )	2( )	3( )	4( )	5( )	6( )	7( )	8( )
USE OF LEARNING CENTER TO INTERGRATE READING MATERIALS WITH MATH	K( )	1( )	2( )	3( )	4( )	5( )	6( )	7( )	8( )

21. INDICATE WHICH TOPICS YOU INTRODUCED TO YOUR STUDENTS LAST YEAR WITH A (✓) MARK AND WHICH TOPICS YOU PLAN TO INTRODUCE DURING THE COMING SCHOOL YEAR WITH AN (*) mark.

	(✓) which topics introduced to your students last year	(*) which topics you plan to intro -duce this new school year
ALGEBRA	( )	( )
INTEGERS	( )	( )
PROBABILITY	( )	( )
STATISTICS	( )	( )
COORDINATE GEOMETRY	( )	( )
DATA COLLECTION	( )	( )
WHOLE NUMBERS	( )	( )
RATIOS AND PERCENTS	( )	( )
FRACTIONS	( )	( )
GRAPHING	( )	( )
MATH GAMES	( )	( )
COMPUTER SOFTWARE	( )	( )
USE OF LEARNING CENTER TO INTERGRATE READING MATERIALS WITH MATH	( )	( )

22. As a result of MCIP do you use more, the same, or less of the following:

CLASSROOM DISCUSSION	MORE	SAME	LESS
COOPERATIVE LEARNING	MORE	SAME	LESS
HOME LEARNING ACTIVITIES	MORE	SAME	LESS
WORK SHEETS	MORE	SAME	LESS
DRILLING ACTIVITIES	MORE	SAME	LESS
CALCULATORS	MORE	SAME	LESS
PROBLEM SOLVING	MORE	SAME	LESS

TEXTBOOK	MORE	SAME	LESS
MANIPULATIVES	MORE	SAME	LESS
USE OF LEARNING CENTER MATERIALS	MORE	SAME	LESS

23. As a result of MCIP, my math classes look more or less like:

_______ look more like my Language Arts classes

_______ less like my Language Arts classes

24. As a result of MCIP, in addition to my classroom responsibilities I have (CHECK AS MANY AS APPLY)

_______ given inservice to other teachers in my grade level
_______ given inservice to my school faculty
_______ worked with parent groups in my school community
_______ given inservice to teachers outside my school
_______ attended math conferences during the past school year to keep current
_______ attended university math classes to gain new skills/update my knowledge
_______ other _______________________________________

THANK YOU

APPENDIX D

May, 1986

Dear Principal:

Funds are available this year for mathematics curriculum improvement. We would like to take this opportunity to improve the mathematics program in our school system and make it a model for other systems across the country.

The first phase of THE MATHEMATICS CURRICULUM IMPROVEMENT PROJECT will be completed in early summer. Thirty teachers worked with faculty and graduate students from Loyola University to develop and pilot an activities handbook that will enable all grade level teachers a chance to expose our students to important mathematics concepts such as data collection and display, coordinate geometry, statistics, abstract algebra, and probability through appropriate classroom activities and home learning activities. This is not a mastery program. Rather, it is our intent to give all of our students an opportunity to study mathematics as well as arithmetic. The activities are designed to reinforce basic skills while introducing higher level mathematics concepts.

Our program design applies the latest research findings to staff development and curriculum implementation. The research suggests that the most effective approach is to train existing school personnel as instructional leaders. We will choose 40 teachers from our schools to serve as mathematics curriculum leaders. Research also tells us that principals are essential links to curriculum implementation. We will hold three seminars throughout the year to get feedback and advice from you.

We would like your school to serve as a pilot for further development and implementation of "The Mathematics Activities Handbook". To be eligible to participate, you would

- -select a teacher from your school who is interested in curriculum development and enjoys the confidence of his/her colleagues;
- -support this teacher's efforts to work with one other teacher in your school and two or three other teachers in another school;
- -reserve 10-15 minutes of each monthly faculty meeting to a discussion of the progress of this program; and

-share information about your school's progress at your monthly council meetings.

The **MATHEMATICS CURRICULUM IMPROVEMENT PROJECT** is a three stage effort. During the second phase of the project, emphasis will focus on improving the teachers' mathematics background in algebra, statistics, probability, geometry and data collection so that they may develop their leadership poetntial beyond implementation of the handbook. Participants will attend a workshop/class that will meet from 9:00 a.m. until 2:00 p.m. for four consecutive Tuesdays, July 29, August 5, 12 and 19 at Loyola University, 820 No. Rush, Room 312 (Marquette Center). Following this workshop, they will schedule 10 hours of training with one teacher from their own school and two or three teachers from another school between August 19 and September 30. These teachers/leaders will have up to 10 hours of assistance from talented, preservice undergraduate students enrolled at Loyola University.

Participants will receive a stipend of $225.00 for their work during this phase. They will also have the option of receiving up to 4 hours of graduate credit at reduced tuition from Loyola University. Teacher trainees will receive a stipend of $50.00 for their participation and implementation of one chapter from the handbook.

The third phase of the program will focus on continued training and implementation of "The Mathematics Activities Handbook." This phase has not yet been funded but we hope that the Illinois Board of Higher Education will award us funds to continue the **MATHEMATICS CURRICULUM IMPROVEMENT PROJECT** from September 30, 1986 to September 30, 1987.

We would like to emphasize that the nominees need not be experts in mathematics, just teachers who like mathematics and would like to take a leadership role in curriculum development.

M C I P I I

MATHEMATICS CURRICULUM IMPROVEMENT PROJECT - - YEAR 2

We have received funding from the Illinois Board of Higer Education to continue our efforts toward improving the mathematics curriculum in the elementary schools in the Chicago metropolitan area. Since you have done such an impressive job in the past, we would like to invite you to participate in the 1987 program. We do have a limited number of positions so we urge you to return this application as soon as possible.

WHAT

The program will be similar to last year's effort. You will improve your own math skills, investigate new classroom materials, and learn how to apply staff development techniques in your school situation. Enclosed is a preliminary program.

WHEN

August	4, 6, 11, 13, and 18	9:00 - 3:00
September	Local meeting	TBA
October	21	3:00 - 5:00
November	18	3:00 - 5:00

WHERE

Loyola University of Illinois - Lake Shore Campus
6525 North Sheridan Road
Chicago, Illinois
Auditorium Crown Center for the Humanities

BENEFITS

$400 stipend
Classroom materials
Continued professional development
Membership in the mathematics education community
10 hours of assistance from Loyola preservice teacher
Development of collegial relationships with other teachers
Opportunity to design and implement a $150 budget for staff development
Optional course credit, reduced tuition for either a graduate course or an undergraduate course leading to the new grades 6 -8 math endorsement
Opportunity to develop a leadership role in a dynamic, developing math program

RESPONSIBILITIES

Improve your own knowledge base in mathematics
Develop a presentation about MCI© for your school
Learn to use different materials for your mathematics instruction
Design, implement, and evaluate a 14 hour staff development program

M C I P I I A P P L I C A T I O N

Name ____________________________________ School ____________________________

Address _________________________________ ____________________________

Phone ___________________________________ ____________________________

Social Security # _________________________ Principal ____________________________

Previous Participation in MCIP (Circle as many as apply)

Pilot	Summer	Summer Trainee	1986 -87 Trainee	Math Pentathlon	AIMS
Spg 86	Aug 86	Sept 86	Oct. -April	February 1987	Jun 87

____I would prefer to find at least three teachers with whom to work.

____Please find me at least three teachers with whom I can work.

____I am not sure if I can find at least three teachers with whom to work but I would like to try.

M.C.I.P PROJECT

LOYOLA UNIVERSITY OF CHICAGO
820 NORTH MICHIGAN AVENUE
CHICAGO, ILLINOIS 60611

M C I P V

MATHEMATICS CURRICULUM IMPROVEMENT PROJECT --- PHASE V

We have received funding from the Illinois Board of Higher Education to continue our efforts toward improving the mathematics curriculum in the elementary schools in the Chicago metropolitan area. Since you have done such an impressive job in the past, we would like to invite you to participate in the 1988 program. We do have a limited number of positions so we urge you to return this application by April 29, 1988.

WHAT:
The program will be similar to last year's effort. You will improve your own math skills, investigate new classroom materials, and learn how to apply staff development techniques to your school situation.

WHEN:
The project will consist of 6 meeting during the month of August. There will also be large and small group follow-up meetings once a month from September 1988 through May 1989.
The summer meeting dates are: August 1, 3, 8, 10, 15, 17.
We will meet from 9 a.m. - 3 p.m.
Small group meetings: September, October, December, January, March, April
Large group meetings: November, February, May

WHERE:
The August meetings and the large group meetings will be held at:
Loyola University's Lake Shore Campus
Crown Center for the Humanities - Auditorium
6525 North Sheridan Road
Chicago, Illinois
Small group meetings will we held at a location determined by the group.

BENEFITS:
There are many benefits in participating in MCIP. Some are:
- $400 Stipend
- Classroom materials
- Continued professional development
- Membership in the mathematics education community
- 18 hours of assistance from Loyola preservice teachers

DR. D. SCHILLER & DR. K.M. SMITH - ASSOCIATE PROFESSORS
DR. J. PLANEK - OFFICE OF CATHOLIC EDUCATION
MS. D. JAGIELSKI - PROJECT DIRECTOR

- Development of collegial relationships with other teachers
- Opportunity to design and implement a $150 budget for staff development
- Optional course credit, reduced tuition for either a graduate course or an undergraduate course leading to the new grades 6-8 math endorsement

RESPONSIBILITIES:
To be a member of this project you will:
- Improve your own knowledge base in mathematics
- Develop a presentation about MCIP for your school
- Learn to use different materials for your mathematics instruction
- Work with 3 additional teachers to implement the MCIP program

HOW TO APPLY:
If you are interested in becoming a member of MCIP V, please fill out and return the enclosed application by April 29, 1988.

Dr. Diane Schiller
Associate Professor

Dr. Kay Monroe Smith
Associate Professor

Dr. Joanne Planek
Office of Catholic Education

Ms. Debbie Jagielski
Project Director

MCIP V APPLICATION

NAME: ____

SOCIAL SECURITY NUMBER: ____________________________

SCHOOL: ____

SCHOOL ADDRESS: ____________________________________

____

____

SCHOOL PHONE: ______________________________________

PRINCIPAL: ____

HOME ADDRESS: ______________________________________

____

____

HOME PHONE: ____

As a member of MCIP you will be asked to train 3 additional teachers. Please check one of the following:

_____ I would prefer to find at least three teachers with whom to work.

_____ Please find me at least three teachers with whom I can work.

_____ I am not sure if I can find at least three teachers with whom to work but I would like to try.

APPENDIX E

M. A. T. H.

TABLE OF CONTENTS

APPENDIX F

Table F-1

Summary of Means and Standard Deviations for Algebra Recommendations

Algebra	N	Mean	Standard Deviation
Day One	30	3.00	2.59
Day Six	30	1.97	2.28
One Year Later	30	2.63	2.50
First Time			
Day One	14	4.14	2.71
Day Six	14	2.71	2.97
One Year Later	14	2.64	2.87
Repeat Participants			
Day One	16	2.00	2.07
Day Six	16	1.31	1.20
One Year Later	16	2.63	2.22

Table F-2

Summary Table - MANOVA for Algebra Recommendations and Respective Univariate ANOVA For Each Effect

Group Membership Effect

** $F(1, 28) = 2.46$ Prob > F = 0.1283

Time Effect

** $F(2, 27) = 3.21$ Prob > F = 0.0561

	Day 1 - Day 6	Day 1 - Year 1	Day 6 - Year 1
DF	1	1	1
SS	142.86	79.25	128.36
MS	5.10	2.83	4.58
F	6.55	2.02	2.51
Prob > F	0.0162*	0.1663	0.1245

Interaction of Time and Group Membership Effects

** $F(2, 27) = 5.98$ Prob > F = 0.0071*

	Day 1 - Day 6	Day 1 - Year 1	Day 6 - Year 1
DF	1	1	1
SS	142.86	79.25	128.36
MS	5.10	2.83	4.58
F	.080	11.91	3.12
Prob > F	0.3776	0.0018*	0.0883

**(Hotelling-Lawley Trace Results)

Table F-3

Summary of Means and Standard Deviations for Integer Recommendations

Integers	N	Mean	Standard Deviation
Day One	29	3.17	2.44
Day Six	29	1.59	1.76
One Year Later	29	2.38	2.03
First Time			
Day One	14	3.71	2.55
Day Six	14	2.14	1.99
One Year Later	14	2.17	2.09
Repeat Participants			
Day One	16	2.67	2.29
Day Six	16	1.07	1.39
One Year Later	16	2.07	1.98

Table F-4

Summary Table - MANOVA for Integer Recommendations and Respective Univariate ANOVA For Each Effect

Group Membership Effect

* * $F(1, 27) = 2.13$ Prob > F = 0.1562

Time Effect

* * $F(2, 26) = 6.28$ Prob > F = 0.0060*

	Day 1 - Day 6	Day 1 - Year 1	Day 6 - Year 1
DF	1	1	1
SS	151.02	91.60	97.42
MS	5.59	3.39	3.60
F	13.02	5.46	4.96
Prob > F	0.0012*	0.0271*	0.0345*

Interaction of Time and Group Membership Effects

* * $F(2, 26) = 0.28$ Prob > F = 0.7546

	Day 1 - Day 6	Day 1 - Year 1	Day 6 - Year 1
DF	1	1	1
SS	151.02	91.60	97.42
MS	5.59	3.39	3.60
F	0.00	0.34	0.37
Prob > F	0.9743	0.5638	0.5488

**(Hotelling-Lawley Trace Results)

Table F-5

Summary of Means and Standard Deviations for Probability Recommendations

Probability	N	Mean	Standard Deviation
Day One	30	3.93	2.50
Day Six	30	2.10	1.99
One Year Later	30	2.47	2.24
First Time			
Day One	14	5.00	2.25
Day Six	14	2.43	2.24
One Year Later	14	2.64	2.44
Repeat Participants			
Day One	16	3.00	2.39
Day Six	16	1.81	1.76
One Year Later	16	2.31	2.12

Table F-6

Summary Table - MANOVA for Probability Recommendations and Respective Univariate

ANOVA For Each Effect

Group Membership Effect

* * $F(1, 28) = 2.25$ Prob > F = 0.1448

Time Effect

* * $F(2, 27) = 10.42$ Prob > F = 0.0004*

	Day 1 - Day 6	Day 1 - Year 1	Day 6 - Year 1
DF	1	1	1
SS	143.86	154.65	120.35
MS	5.13	5.23	4.29
F	22.53	12.53	0.89
Prob > F	0.0001*	0.0014*	0.3545

Interaction of Time and Group Membership Effects

* * $F(2, 27) = 2.01$ Prob > F = 0.1534

	Day 1 - Day 6	Day 1 - Year 1	Day 6 - Year 1
DF	1	1	1
SS	143.86	154.65	120.35
MS	5.13	5.52	4.29
F	2.78	3.77	0.14
Prob > F	0.1064	0.0623	0.7093

**(Hotelling-Lawley Trace Results)

Table F-7

Summary of Means and Standard Deviations for Statistics Recommendations

Statistics	N	Mean	Standard Deviation
Day One	29	4.59	2.29
Day Six	29	2.90	2.30
One Year Later	29	2.93	2.37
First Time			
Day One	14	5.36	2.02
Day Six	14	3.21	2.75
One Year Later	14	3.21	2.61
Repeat Participants			
Day One	15	3.87	2.36
Day Six	16	2.60	1.84
One Year Later	16	2.67	2.19

Table F-8

Summary Table - MANOVA for Statistics Recommendations and Respective Univariate ANOVA For Each Effect

Group Membership Effect

* * $F(1, 27) = 1.65$ Prob > F = 0.2100

Time Effect

* * $F(2, 26) = 12.11$ Prob > F = 0.0002*

	Day 1 - Day 6	Day 1 - Year 1	Day 6 - Year 1
DF	1	1	1
SS	134.64	138.11	190.93
MS	4.98	5.11	7.07
F	16.88	15.82	0.00
Prob > F	0.0003*	0.0005*	0.9467

Interaction of Time and Group Membership Effects

* * $F(2, 26) = 0.88$ Prob > F = 0.4269

	Day 1 - Day 6	Day 1 - Year 1	Day 6 - Year 1
DF	1	1	1
SS	134.64	138.11	190.93
MS	4.98	5.11	7.07
F	1.11	1.26	0.00
Prob > F	0.3004	0.2718	0.9467

**(Hotelling-Lawley Trace Results)

Table F-9

Summary of Means and Standard Deviations for Coordinating Geometry

Recommendations

Coordinating Geometry	N	Mean	Standard Deviation
Day One	31	3.84	2.56
Day Six	31	1.77	2.33
One Year Later	31	2.48	2.20
First Time			
Day One	14	5.21	2.46
Day Six	14	2.50	2.98
One Year Later	14	2.79	2.29
Repeat Participants			
Day One	17	2.71	2.08
Day Six	17	1.18	1.47
One Year Later	17	2.24	2.17

Table F-10

Summary Table - MANOVA for Coordinating Geometry Recommendations and Respective

Univariate ANOVA For Each Effect

Group Membership Effect

** $F(1, 29) = 4.86$ Prob > F = 0.0355*

Time Effect

** $F(2, 28) = 11.57$ Prob > F = 0.0002*

	Day 1 - Day 6	Day 1 - Year 1	Day 6 - Year 1
DF	1	1	1
SS	177.09	136.66	131.79
MS	6.10	4.67	4.54
F	22.64	13.79	3.05
Prob > F	0.0001*	0.0009*	0.0911

Interaction of Time and Group Membership Effects

** $F(2, 28) = 3.05$ Prob > F = 0.0633

	Day 1 - Day 6	Day 1 - Year 1	Day 6 - Year 1
DF	1	1	1
SS	177.09	135.66	131.79
MS	6.10	4.67	4.54
F	1.77	6.29	1.01
Prob > F	0.1944	0.0180*	0.3233

**(Hotelling-Lawley Trace Results)

Table F-11

Summary of Means and Standard Deviations for Data Collection Recommendations

Data Collection	N	Mean	Standard Deviation
Day One	31	2.71	2.55
Day Six	31	0.77	1.23
One Year Later	31	1.06	1.97
First Time			
Day One	14	3.79	2.75
Day Six	14	1.07	1.59
One Year Later	14	1.57	2.38
Repeat Participants			
Day One	17	1.82	2.04
Day Six	17	0.53	0.80
One Year Later	17	0.65	1.50

Table F-12

Summary Table - MANOVA for Data Collection Recommendations and Respective Univariate ANOVA For Each Effect

Group Membership Effect

* * $F(1, 29) = 4.38$ Prob > F = 0.0452*

Time Effect

* * $F(2, 28) = 12.90$ Prob > F = 0.0001*

	Day 1 - Day 6	Day 1 - Year 1	Day 6 - Year 1
DF	1	1	1
SS	162.38	108.82	83.26
MS	5.59	3.75	2.87
F	22.03	23.52	1.02
Prob > F	0.0001*	0.0001*	0.3207

Interaction of Time and Group Membership Effects

* * $F(2, 28) = 1.43$ Prob > F = 0.2569

	Day 1 - Day 6	Day 1 - Year 1	Day 6 - Year 1
DF	1	1	1
SS	162.38	108.12	83.26
MS	5.59	3.75	2.87
F	2.77	2.20	0.39
Prob > F	0.1071	0.1485	0.5367

**(Hotelling-Lawley Trace Results)

Table F-13

Summary of Means and Standard Deviations for Whole Number Recommendations

Whole Number	N	Mean	Standard Deviation
Day One	31	0.35	1.17
Day Six	31	0.29	1.10
One Year Later	31	0.29	1.04
First Time			
Day One	14	0.43	1.60
Day Six	14	0.43	1.60
One Year Later	14	0.43	1.34
Repeat Participants			
Day One	16	0.29	0.69
Day Six	16	0.18	0.39
One Year Later	16	0.18	0.73

Table F-14

Summary Table - MANOVA for Whole Number Recommendations and Respective Univariate ANOVA For Each Effect

Group Membership Effect

* * F(1, 289 = 0.30 Prob > F = 0.5881

Time Effect

* * F(2, 29) = 1.18 Prob > F = 0.3232

	Day 1 - Day 6	Day 1 - Year 1	Day 6 - Year 1
DF	1	1	1
SS	1.76	13.76	8.00
MS	.060	0.474	0.275
F	1.75	0.22	0.00
Prob > F	0.0967	0.6392	1.0000

Interaction of Time and Group Membership Effects

* * F(2, 28) = 1.18 Prob > F = 0.3232

	Day 1 - Day 6	Day 1 - Year 1	Day 6 - Year 1
DF	1	1	1
SS	1.76	13.76	8.00
MS	0.060	0.474	0.275
F	1.75	0.22	0.00
Prob > F	0.1967	0.6396	1.0000

**(Hotelling-Lawley Trace Results)

Table F-15

Summary of Means and Standard Deviations for Ratio and Percent Recommendations

Ratio and Percent	N	Mean	Standard Deviation
Day One	31	3.90	2.02
Day Six	31	2.77	1.84
One Year Later	31	3.32	2.07
First Time			
Day One	14	4.50	2.18
Day Six	14	3.21	1.81
One Year Later	14	3.29	2.33
Repeat Participants			
Day One	17	3.41	1.80
Day Six	17	2.41	1.84
One Year Later	17	3.35	1.90

Table F-16

Summary Table - MANOVA for Ratio and Percent Recommendations and Respective Univariate ANOVA For Each Effect

Group Membership Effect

** $F(1, 29) = 1.05$ Prob > F = 0.3131

Time Effect

** $F(2, 28) = 4.98$ Prob > F = 0.0142*

	Day 1 - Day 6	Day 1 - Year 1	Day 6 - Year 1
DF	1	1	1
SS	112.85	107.29	93.86
MS	3.89	3.69	3.23
F	10.31	3.36	2.43
Prob > F	0.0032*	0.0770	0.1297

Interaction of Time and Group Membership Effects

** $F(2, 28) = 1.56$ Prob > F = 0.2282

	Day 1 - Day 6	Day 1 - Year 1	Day 6 - Year 1
DF	1	1	1
SS	112.85	107.29	93.86
MS	3.89	3.69	3.23
F	0.16	2.77	1.79
Prob > F	0.6911	0.1068	0.1908

**(Hotelling-Lawley Trace Results)

Table F-17

Summary of Means and Standard Deviations for Fraction Recommendations

Fraction	N	Mean	Standard Deviation
Day One	31	2.03	1.80
Day Six	31	1.00	1.55
One Year Later	31	1.35	1.52
First Time			
Day One	14	2.57	1.95
Day Six	14	1.36	1.86
One Year Later	14	1.50	1.56
Repeat Participants			
Day One	17	1.59	1.58
Day Six	17	0.71	1.21
One Year Later	17	1.24	1.52

Table F-18

Summary Table - MANOVA for Fraction Recommendations and Respective Univariate ANOVA For Each Effect

Group Membership Effect

** $F(1, 29) = 1.75$ Prob > F = 0.1966

Time Effect

** $F(2, 28) = 5.69$ Prob > F = 0.0085*

	Day 1 - Day 6	Day 1 - Year 1	Day 6 - Year 1
DF	1	1	1
SS	86.12	70.81	63.94
MS	2.96	2.44	2.20
F	11.36	6.38	1.57
Prob > F	0.0021*	0.0173*	0.2197

Interaction of Time and Group Membership Effects

** $F(2, 28) = 0.82$ Prob > F = 0.4502

	Day 1 - Day 6	Day 1 - Year 1	Day 6 - Year 1
DF	1	1	1
SS	86.12	70.81	63.94
MS	2.96	2.44	2.20
F	0.28	1.62	0.52
Prob > F	0.5976	0.2128	0.4765

**(Hotelling-Lawley Trace Results)

Table F-19

Summary of Means and Standard Deviations for Graphing Recommendations

Graphing	N	Mean	Standard Deviation
Day One	31	2.16	1.86
Day Six	31	0.97	1.47
One Year Later	31	1.23	1.75
First Time			
Day One	14	2.43	1.91
Day Six	14	1.36	1.74
One Year Later	14	1.36	1.91
Repeat Participants			
Day One	17	1.94	1.85
Day Six	17	0.65	1.17
One Year Later	17	1.12	1.65

Table F-20

Summary Table - MANOVA for Graphing Recommendations and Respective Univariate ANOVA For Each Effect

Group Membership Effect

* * F(1, 29) = 0.88 Prob > F = 0.3572

Time Effect

* * F(2, 28) = 9.23 Prob > F = 0.0008*

	Day 1 - Day 6	Day 1 - Year 1	Day 6 - Year 1
DF	1	1	1
SS	84.45	65.39	88.23
MS	2.91	2.25	3.04
F	14.75	12.22	0.56
Prob > F	0.0006*	0.0015*	0.4608

Interaction of Time and Group Membership Effects

* * F(2, 28) = 0.28 Prob > F = 0.7593

	Day 1 - Day 6	Day 1 - Year 1	Day 6 - Year 1
DF	1	1	1
SS	84.45	65.39	88.23
MS	2.91	2.25	3.04
F	0.13	0.21	0.56
Prob > F	0.7203	0.6508	0.4608

**(Hotelling-Lawley Trace Results)

Table F-21

Summary of Means and Standard Deviations for Math Games Recommendations

Math Games	N	Mean	Standard Deviation
Day One	31	0.29	0.82
Day Six	31	0.31	0.75
One Year Later	31	0.00	0.00
First Time			
Day One	14	0.07	0.27
Day Six	14	0.29	0.83
One Year Later	14	0.00	0.00
Repeat Participants			
Day One	17	0.47	1.07
Day Six	17	0.35	0.70
One Year Later	17	0.00	0.00

Table F-22

Summary Table - MANOVA for Math Games Recommendations and Respective Univariate

ANOVA For Each Effect

Group Membership Effect

** $F(1, 29) = 1.29$ Prob > F = 0.2662

Time Effect

** $F(2, 28) = 4.07$ Prob > F = 0.0281*

	Day 1 - Day 6	Day 1 - Year 1	Day 6 - Year 1
DF	1	1	1
SS	34.12	19.16	16.73
MS	1.17	0.660	0.577
F	0.06	3.41	5.43
Prob > F	0.8060	0.0749	0.0270*

Interaction of Time and Group Membership Effects

** $F(2, 28) = 0.91$ Prob > F = 0.4245

	Day 1 - Day 6	Day 1 - Year 1	Day 6 - Year 1
DF	1	1	1
SS	34.12	19.16	16.73
MS	1.17	0.66	0.577
F	0.72	1.85	0.06
Prob > F	0.4034	0.1841	0.8080

**(Hotelling-Lawley Trace Results)

Table F-23

Summary of Means and Standard Deviations for Computer Software Recommendations

Computer Software	N	Mean	Standard Deviation
Day One	31	0.87	1.38
Day Six	31	0.32	0.83
One Year Later	31	0.35	0.84
First Time			
Day One	14	0.93	1.73
Day Six	14	0.50	1.16
One Year Later	14	0.14	0.36
Repeat Participants			
Day One	17	0.82	1.07
Day Six	17	0.81	0.39
One Year Later	17	0.53	1.07

Table F-24

Summary Table - MANOVA for Computer Software Recommendations and Respective Univariate ANOVA For Each Effect

Group Membership Effect

** $F(1, 29) = 0.00$ Prob > F = 0.9603

Time Effect

** $F(2, 28) = 4.56$ Prob > F = 0.0192*

	Day 1 - Day 6	Day 1 - Year 1	Day 6 - Year 1
DF	1	1	1
SS	27.31	69.88	39.09
MS	0.94	2.40	1.34
F	9.43	3.71	0.00
Prob > F	0.0046*	0.0638	0.9921

Interaction of Time and Group Membership Effects

** $F(2, 28) = 1.63$ Prob > F = 0.2134

	Day 1 - Day 6	Day 1 - Year 1	Day 6 - Year 1
DF	1	1	1
SS	27.31	69.88	39.09
MS	0.941	2.40	1.34
F	0.39	0.77	2.87
Prob > F	0.5376	0.3875	0.1009

**(Hotelling-Lawley Trace Results)

Table F-25

Summary of Means and Standard Deviations for Learning Center Materials

Recommendations			
Learning Center Materials			Standard
	N	Mean	Deviation
Day One	27	1.15	1.43
Day Six	27	0.67	1.04
One Year Later	27	0.37	0.79
First Time			
Day One	13	0.85	1.21
Day Six	13	0.62	1.04
One Year Later	13	0.15	0.38
Repeat Participants			
Day One	14	1.43	1.60
Day Six	14	0.71	1.07
One Year Later	14	0.57	1.02

Table F-26

Summary Table - MANOVA for Learning Center Materials Recommendations and Respective Univariate ANOVA For Each Effect

Group Membership Effect

** $F(1, 25) = 1.26$ Prob > F = 0.2729

Time Effect

** $F(2, 24) = 4.75$ Prob > F = 0.0182*

	Day 1 - Day 6	Day 1 - Year 1	Day 6 - Year 1
DF	1	1	1
SS	27.16	48.48	44.94
MS	1.08	1.93	1.79
F	5.54	8.34	1.37
Prob > F	0.0267*	0.0079*	0.2529*

Interaction of Time and Group Membership Effects

** $F(2, 24) = 0.72$ Prob > F = 0.4970

	Day 1 - Day 6	Day 1 - Year 1	Day 6 - Year 1
DF	1	1	1
SS	27.16	48.48	44.94
MS	1.08	1.93	1.79
F	1.45	0.09	0.38
Prob > F	0.2398	0.7612	0.5428

**(Hotelling-Lawley Trace Results)

APPROVAL SHEET

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The final copies have been examined by the director of the dissertation and the signature which appears below verifies the fact that any necessary changes have been incorporated and that the dissertation is now given final approval by the Committee with reference to content and form.

The dissertation is therefore accepted in partial fulfillment of the requirements for the degree of Doctor of Education.

Date ______________________ Director's Signature ______________________