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Library Usage as a Staff Development Component of a Mathematics Curriculum Improvement Project

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LIBRARY USAGE AS A STAFF DEVELOPMENT COMPONENT OF A MATHEMATICS CURRICULUM IMPROVEMENT PROJECT

by

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VITA

The author, Denise Geraldine Dwyer, is the daughter of the late Richard S. Dwyer and Elizabeth (Galvin) Dwyer. She was born January 8, 1941, in Oak Park, Illinois.

Her elementary education was obtained in the parochial schools of Chicago. Her secondary education was completed in 1958 at Providence High School, Chicago, Illinois. At that time she received a four year tuition scholarship to Mercyhurst College, Erie, Pennsylvania, from which she received the degree of Bachelor of Arts in history in 1962. While attending Mercyhurst, she was active in the Great Books Discussion Group, a delegate for the National Federation of Catholic College Students, a Glee Club member, and an officer of the Senior Class. She was awarded the "Carpe Diem" prize and nominated for the Who's Who in American Colleges and Universities in 1962.

After graduation, Ms. Dwyer taught French and History for the Houston County (Georgia) Board of Education. While doing this she worked toward a Masters in Education (French) degree from Georgia College at Milledgeville (1968). The course work included two N.D.E.A. summer institutes, one of which was held in Lyon, France. A second summer in Dijon, France, was sponsored by the Georgia State Board of Regents. During this period, 1962 - 1969, she was active in the Warner Robins (Georgia) Branch of the American Association

of University Women (Outstanding Young Woman of the Year Award 1966), in local and state professional organizations, and in church activities. For the latter she received the "Pro Deo et Juventute" award from the Diocese of Savannah for her work with the Catholic Youth Organization.

From 1969 to the present Ms. Dwyer has been employed by the Chicago Board of Education at six sites--three elementary and three secondary. She has taught and been a librarian for students in grades K-12. In 1970 she was awarded an Illinois State Library Scholarship to attend Rosary College from which she graduated with a Masters in Library Science degree in 1972. She has been a member of the American Library Association since 1972. While working at DuSable High School she became a teacher-manager of an E.S.E.A. Staff Development Laboratory. During the summer of 1975 she was one of the authors of units and criterion reference tests for this project's publication The Human Resource Laboratory Teaching Training Units, Pacific Learning Services of Illinois, 1975.

During recent years she has been pursuing a Ph.D. in Curriculum from Loyola University, Chicago, Illinois. While doing this she has also been actively involved in preparing and often presenting various in-service sessions for colleagues whether on staff or in her professional affiliations, eg. High School Library Media Association.

She is currently Department Chairperson of the Kenwood Academy Library Media Center in Chicago.

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CHAPTER I

INTRODUCTION

Statement Of The Problem

The Commission on the Education of Teachers of Mathematics has prepared a set of guidelines for the preparation of mathematics teachers. One section of this document is concerned with prospective teachers' use of the library and encourages making appropriate mathematics resources available in the library. It emphasizes the need for providing both print and non-print materials for independent study by both students and faculty.[1] Blazek (1975) proposes that a pattern of library involvement by the teacher could be studied adequately using a six step model which focuses on the following factors:

1. Teacher's background and experience with the media center
2. Teacher's attitude toward the media center
3. Teacher's participation in media center activities
4. Teacher's utilization of the center's resources
5. Teacher's influences on students as measured by student use
6. Student benefits derived from use of the media center.

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[1] Guidelines for the Preparation of Teachers of Mathematics (Reston, Va.: The National Council of Teachers of Mathematics, Inc., 1981), p. 20.

His study combined steps 4 and 5 of the model and illustrated the importance of teacher influence on student use of the media center.[2] However, more than fifteen years after Blazek's original study[3] (1971) informal observations by librarians, university personnel involved in teacher training, and administrators indicate that library resources are still under-utilized by both mathematics students and their teachers.

The need for providing library support materials for mathematics and training the teachers to use them is underscored by a pilot study conducted in Spring, 1986, with teachers from twenty-five Chicago Archdiocesan Schools. The pilot study consisted of a questionnaire (Appendix A) in which students were asked about library related assignments given by their teachers as well as how often they used their school and public libraries. A cover letter (Appendix B) with instructions for the MCIP Phase I teachers was included with the packet of questionnaires.

The following tables summarize the results of the pilot study. As can be seen in Table 1, the most positive responses (23%) were found at the primary level. The results indicate that overall, from primary through junior

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[2] Ron Blazek, Influencing Students Toward Media Center Use, ALA Studies in Librarianship, no. 5 (Chicago: American Library Association, 1975), p. 4-5.

[3] Ronald D. Blazek, "Teacher Utilization of Nonrequired Library Materials in Mathematics and the Effect on Pupil Use," (A Ph.D. dissertation, University of Illinois at Urbana-Champaign, 1971).

high, only 66% of the students ever sought library materials to help them do math assignments and that 22% did sometimes. At all levels, the responses were evenly divided between the boys and the girls for the "yes," "no," and "sometimes" responses. In response to the Social Studies question on use of atlases and encyclopedias, 19% of the intermediate level and 23% of the junior high level responded positively. For all three levels 51% answered "sometimes" to this question. The highest response total in the category of using the library for social studies "sometimes" fell at the junior high level with 30% for boys and 31% for girls. These results may indicate that by the time students had reached junior high they were at least acquainted with atlases and encyclopedias. (Table 2)

In response to the question about whether students used the library for book reports required in English and Reading, 42% responded "yes;" 27% responded "no;" and 31% responded "sometimes." The responses were evenly divided between the boys and girls so that sex of respondent was not a factor. (Table 3)

In response to a general question on library use of books on sports, more boys than girls gravitated toward sports books with 29% of the boys and 9% of the girls answering "yes." (Table 4)

A question on statistics was included to see if the students applied mathematical concepts such as percentages to a content subject area such as geography. The lower

Table 1

Percentage of Student Responses in the Pilot Study to:

When my teacher sends me to the library, I look for books about numbers and shapes to do my Math assignments.

		Yes %		No %		Sometimes %	
	Number	Boy	Girl	Boy	Girl	Boy	Girl
Primary	211	11	12	21	31	12	13
Intermediate	455	6	5	35	32	11	11
Junior High	316	3	3	39	35	11	9
Total N =	982						
Total % =		6	6	33	33	11	11

Yes %	No %	Sometimes %
12	68	22

Table 2

Percentage of Student Responses in the Pilot Study to:

When my teacher sends me to the library, I use atlases and encyclopedias to do my Social Studies assignments.

		Yes %		No %		Sometimes %	
	Number	Boy	Girl	Boy	Girl	Boy	Girl
Primary	209	4	3	26	37	13	16
Intermediate	465	9	10	16	14	28	24
Junior High	308	12	11	8	5	32	31
Total N =	982						
Total % =		9	9	16	16	26	25

Yes %	No %	Sometimes %
18	32	51

Table 3

Percentage of Student Responses in the Pilot Study to:

When my teacher sends me to the library, I take out fiction books to do book reports for English and Reading.

		Yes %		No %		Sometimes %	
	Number	Boy	Girl	Boy	Girl	Boy	Girl
Primary	206	18	23	13	18	14	15
Intermediate	477	23	19	15	14	16	14
Junior High	305	21	21	11	8	20	16
Total N =	988						
Total % =		21	23	11	8	20	16

Yes %	No %	Sometimes %
42	27	31

Table 4

Percentage of Student Responses in the Pilot Study to:

When my teacher sends me to the library, I read books about sports.

		Yes %		No %		Sometimes %	
	Number	Boy	Girl	Boy	Girl	Boy	Girl
Primary	209	26	10	11	31	11	15
Intermediate	454	30	9	9	19	14	18
Junior High	310	31	8	7	23	14	17
Total N =	973						
Total % =		29	9	9	23	13	17

Yes %	No %	Sometimes %
38	32	30

positive response from the junior high students could mean that these youngsters weren't assigned these tasks as often as the 3rd through 6th graders who had the highest responses. The composite for the "yes" response across levels was only 23%. (Table 5).

Another purpose of the pilot study was to discover what type of libraries were visited and how often. (Table 6) The students' responses to Question 6 on school library usage indicated that 69% of the students did go to the school library once a week but 15% never went. In some of the pilot schools there was no library but, perhaps, there was instead a resource room. Responses showed that 50% of the students did go to the public library once a month, while 28% went weekly.

The last question referred to parents taking their children to the public library. Reponses are again grouped by levels. The responses to this question at the primary level reveal that 32% of primary children go once a week, 38% go once a month to the public library, and that 43% are not accompanied by a parent. At the intermediate level, 31% go once a week, 45% once a month; 46% of their parents do not accompany them. Some of them may be old enough to go by themselves. Perhaps older brothers or sisters take their younger siblings to the library. At the Junior High level, 60% responded "Never" to the question about parent accompaniment, probably going to the library most often by themselves or with peers. Across all levels 50% go to the

Table 5

Percentage of Student Responses in the Pilot Study to:

When my teacher sends me to the library, I look up statistics on countries of the world.

		Yes %		No %		Sometimes %	
	Number	Boy	Girl	Boy	Girl	Boy	Girl
Primary	228	11	11	20	28	14	17
Intermediate	474	16	12	19	17	19	17
Junior High	305	9	8	25	17	18	24
Total N =	977						
Total % =		13	10	21	19	18	19

Yes %	No %	Sometimes %
23	40	37

Table 6

Percentage of Student Responses in the Pilot Study

I use the school library.
I use the public library.
My parent takes me to a library.

	School Library						Public Library						Parents Take/Library					
	Once/Week		Once/month		Never		Once/Week		Once/month		Never		Once/Week		Once/month		Never	
	Boy	Girl	Boy	Girl	Boy	Girl	Boy	Girl	Boy	Girl	Boy	Girl	Boy	Girl	Boy	Girl	Boy	Girl
Primary	39	42	4	3	3	9	15	17	16	22	12	17	6	15	15	20	21	22
	N = 210						N = 209						N = 208					
Intermediate	31	30	10	11	13	5	16	15	24	21	13	11	6	15	15	20	21	22
	N = 457						N = 454						N = 449					
Junior High	38	33	10	7	7	5	9	9	34	32	12	4	3	3	17	18	33	27
	N = 301						N = 306						N = 296					
Totals	35	34	9	8	9	6	14	14	25	25	13	10	6	9	18	17	26	24
	69		17		15		28		50		23		15		35		50	
	N = 958						N = 969						N = 953					

public library once a month and 50% are not accompanied by a parent. Thus the pilot study gave an indication of teachers', students' and parents' library usage.

The pilot study underscores the under-utilization of the library, especially for mathematics. While 2/3 of the students use it for social studies or language arts, only 1/3 use it for mathematics. From 15-23% of the students never go to the library for any purpose.

The library media center can be an effective and inexpensive resource for mathematics teachers, but the major problem is how to get teachers to use that material. Can staff development open the great treasure house of knowledge to our elementary students?

Aaron (1973) developed a model of inservice in which a teacher and a school library media specialist collaborated in preparing instructional units.[4] Students whose teachers followed the model scored significantly higher than a control group on academic achievement.[5] In a speech given at the Chicago Area Reading Association Conference in October, 1981, William Durr stated that the research overwhelmingly supports the position that the teaching of

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[4] Shirley L. Aaron, "A Prescriptive Model Illustrating a Method of Developing a Flexible Staffing Pattern for Professional School Library Media Center Personnel Based on their Instructional Role in the School," (A Ph.D. dissertation, Florida State University, 1973).

[5] Shirley L. Aaron, Personalizing Instruction for the Middle School Learner: The Instructional Role of the School Library Media Specialist (Tallahassee: Florida Department of Education, 1975).

specific skills facilitates increases in comprehension, giving further support to the efficacy of teacher inservice.[6]

In a report of the American Association of School Librarians' Dallas Action Research Preconference in 1979, Loertscher posed challenges for school library media specialists who attempt to maximize library contributions to the instructional program in the school. One of the most difficult problems faced by the Dallas participants was to narrow broad generalized problems into viable action research; that is, planning research studies which could be carried out by a librarian in the library in a practical way. In the practice sessions many persons got involved in a "chain study." The pattern was:

-the school library media specialist performs a service,
-that service causes something to happen,
-which causes something else to happen,
-which causes something else to happen,
-which raises children's scores on standardized tests.[7]

One of the conclusions reached by Loertscher and the conference participants was that more action research studies needed to be done so that there would be many kinds of building blocks to look at when constructing media center programs. Loertscher (1982) gave an overview of the basic

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[6] William Durr, Untitled presentation for Chicago Area Reading Association Conference, Chicago, 21 October 1981.

[7] David V. Loertscher, "The Dallas Action Research Preconference--A Report," School Media Quarterly 8 (Fall 1979): 51-52.

components of research in the school library field. His summary of the library research showed that there was an emphasis on library skills development rather than on the librarian's involvement in instructional design.[8]

In An Agenda for Action: Recommendations for School Mathematics of the 1980's, the National Council of Teachers of Mathematics list as two of their priorities

> -The success of mathematics programs and student learning be evaluated by a wider range of measures than conventional testing.
> -Mathematics teachers demand of themselves and their colleagues a high level of professionalism.[9]

Studies of expert teachers suggest that content knowledge is critical but also that effective management of time and academic engagement is a prior condition for expert teaching. This information should be used for planning inservice education for teachers.[10] The teacher-librarians must look at other subject areas because very little library inservice has been done for math teachers. The Blazek (1971) study thoroughly detailed the history of librarian/classroom teacher involvement in the utilization of library resources in the content areas. He found that

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[8] David V. Loertscher, "A School Library Research Program for Today and Tomorrow: What, Why, How," School Library Media Quarterly 10 (Winter 1982): 112.

[9] Changing School Mathematics: A Responsive Process (Reston, Va.: The National Council of Teachers of Mathematics, Inc., 1981), p. 201.

[10] Gaea Leinhardt, "Expertise in Mathematics Teaching," Educational Leadership 43 (April 1986): 33.

very little had been done in the field of mathematics. Therefore, he went a step further--he worked with a classroom teacher to prepare bibliographies of library related mathematics materials suggested for student use by the math teacher. He found that sustained use of these materials did not continue when the teacher no longer reminded the students about the items.[11] The real problem, therefore, is to help the classroom teachers of mathematics to incorporate the use of library related materials into their teaching repertoires.

PURPOSE

The purpose of the present study is to explore two questions. First, would teachers presented with library materials parallel to their curriculum incorporate library use into their math instruction? Secondly, was there a difference in the utilization of library resources by teachers who had received the library component treatment from a library media specialist and those who had received the library component from teachers trained by the library media specialist? In other words, are there differences traceable to the specialist? Evidence from a variety of sources, including teacher self-reports and student questionnaires, was collected to study the effects of use of

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[11] Ronald D. Blazek, "Teacher Utilization of Nonrequired Library Materials in Mathematics...", p. 239.

selected library mathematics materials with teachers and their students.

This study's population includes thirty-seven participants involved in the Mathematics Curriculum Improvement Project (MCIP), one hundred fifty-four volunteer teachers whom they trained and approximately thirty-five hundred students. Teachers who received math training in Phase I but not the library component served as part of the comparison group. Eight more teachers from a school not involved in the MCIP became the second part of the comparison group.

MCIP combines the resources of Loyola University, the Chicago Archdiocesan School System and the Illinois Board of Higher Education to:

1. Improve the math competencies of existing Archdiocesan teachers;
2. Develop and pilot the "Mathematics Curriculum Activities Manual;"
3. Insure the implementation of the revised mathematics curriculum objectives by developing a core of teacher leaders; and
4. Develop an internship program for excellent elementary education students.

The MCIP workshop took place during a four week period with one day-long session each week. A series of presentations were incorporated into the mathematics and staff development instruction for the MCIP participants. Each day's session consisted of two hours of math instruction, twenty minutes of library related activities, and two and a half hours of staff development instruction.

Elementary school teachers exposed to the library component were introduced to library mathematics resources and activities for instructional enrichment in the classroom. The library component comprised about 5% of the instructional time of the workshop sessions. The investigator modelled behaviors such as:

1. the use of general reference tools to teach applied math skills;
2. a method of developing math questions by using statistical information found in library resources;
3. the ways in which general reading materials about mathematics--fiction and non-fiction--could be incorporated into the MCIP's three content units: algebra, probability, and data collection.
4. awareness of professional journals, eg. Arithmetic Teacher, and how to incorporate information from them into their class presentations.

In the on-site training component of the project, the participants in the workshop sessions decided what materials and activities to use for their presentations to their colleagues. Each workshop participant was expected to work with at least three teachers in her own school, or a neighboring one, for six to ten hours during the month of September. They were required to use a minimum of one MCIP activity and at least one other activity. Participants may or may not have chosen the library materials for classroom use and/or for the training of their colleagues. These trainees were paid $50 for the work; the participants, $200.

In Blazek's 1971 study, the investigator worked with one teacher and his seventeen students plus a control group

which did not receive the treatment. The total sample was fifty. This allowed Blazek to know the students and their habits almost as well as the teacher did. The present study adapted some of Blazek's techniques but concentrated on developing a more cost effective staff development training program.

To find out if the library component had any effect, research question #1 asks:

1. Will there be any difference between the student survey responses of MCIP participants who received the library component treatment and the student questionnaire responses of teachers who did not receive the library component treatment?

To find out if trained teachers could successfully deliver library instruction as well as a library media specialist could, research question #2 asks:

2. Will there be any difference between the level of library activity of the MCIP workshop participants who received inservice from the library media specialist and the level of library activity of the elementary classroom teachers who received their inservice from the MCIP workshop participants?

SIGNIFICANCE OF THE STUDY

In order to make a contribution to the fields of mathematics and library science through the present study,

it is important to determine if elementary teachers can be influenced to incorporate library resources into the mathematics curriculum.

Burns (1986) reported on an arithmetic teacher who asked her students what they were doing and why. Most of the students could tell the "what" but not the "why."[12] Elementary grade children spend ninety percent of their class time doing pencil and paper computation practice.[13] Teaching the "why" is more difficult than presenting appropriate procedures which yield correct answers.

> Not all teachers understand the difference between teaching procedures and teaching reasoning in arithmetic. Teachers cannot teach what they do not truly understand themselves.[14]

Willoughby (1987) gives a preliminary report of the Second International Mathematics Study (SIMS) in which it appears that textbooks still dominate the mathematics curriculum in the United States and that most classroom activities are seatwork and tests, with the teacher doing most of the talking. More importantly, American children are not exposed to as much mathematics in their first nine years of schooling as are the children in other developed

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[12] Marilyn Burns, "Teaching 'What to Do' in Arithmetic vs. Teaching 'What to Do and Why'," Educational Leadership 43 (April 1986): 37.

[13] Ibid., p. 34

[14] Ibid., p. 37.

countries.[15] In a study of 3 major textbooks, Usiskin found that new content in mathematics steadily declines from 3rd to 8th grade. Only 30% is new content in regular 8th grade mathematics, but the percentage of new material rises to 88% in 9th grade algebra. Clearly there is room in the mathematics curriculum for new ideas.[16] If the United States is to be able to compete with other nations in the future, the American students must be given a more vitalized mathematics curriculum. The present study can serve as a staff development model to provide students with teachers who can do more than teach the textbook, i.e., teachers able to teach students the "why."

Cost effectiveness is an essential consideration of staff development programs. The aim of the MCIP is to ultimately train all the teachers of the Archdiocese's 395 schools and upgrade their mathematics skills and teaching techniques. Blazek's approach would be too costly to implement in many schools both in teacher time and money.

This study will contribute to the fields of mathematics education and library science by expanding previous work, by building a foundation for other studies that will investigate the relationships of student interest and

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[15] Stephen S. Willoughby, "Mathematics," Educational Leadership 44 (December 1986-January 1987): 84-85.

[16] James R. Flanders, "How Much of the Content in Mathematics Textbooks is New?" Arithmetic Teacher (September 1987):

achievement with the use of library mathematics resources, and by adding to the research about collegial modelling and the effects of teacher modelling behaviors on students. Therefore, this present study can serve as a beginning for the development of an inservice program for incorporating library activities in elementary mathematics instruction.

LIMITATIONS AND ASSUMPTIONS

The primary limitation of this study is that the participants have not been randomly selected but are self-selected by their willingness to participate in the Mathematics Curriculum Improvement Project. A general limitation in this study therefore is selection bias.[17]

Originally, the long term effect of treatment was not to be measured. Because of time constraints of the funding organization, there was a short period, thirty days, for implementation. Since the time period for the implementation occurred at the busy beginning weeks of a new academic year, and since many of the school libraries had not opened, it was decided that more data should be collected eight months later.

The comparison group was composed of 1) respondents of Phase I of the MCIP who participated in the Pilot Study, and

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[17]Donald T. Campbell and Julian C. Stanley, Experimental and Quasi-Experimental Designs for Research (Boston: Houghton-Mifflin 1963) p. 5.

2) a comparable group which had no connection with the MCIP. Consequently, generalizability was limited due to the small number of participants.

Further, the investigator assumed that the questionnaire items were valid measures of the construct. There were the usual assumptions to be made with respect to the honesty and capacity to recall on the part of the respondents. It was not known what library skills the teachers had and used in other subject areas, nor to what extent they had been involved with libraries and librarians in the areas of staff development and instructional design in other content areas.

Although some teacher participants in this study had school libraries which were not staffed by professional librarians, it was assumed that all did have some access to their local public libraries. The investigator sent a letter to inform the Chicago Public Library branches and the suburban public libraries what schools would have students doing library related mathematics assignments. (Appendix C) Although there are many audio-visual materials and manipulatives available for mathematics, the emphasis in this study was on print materials.

CHAPTER II

REVIEW OF THE LITERATURE

Both the library media specialists and the classroom teachers with whom they work must become more involved in cooperatively developing the instructional potential of the school library media center. This study took a staff development approach to attain the cooperation of those who are mathematics teachers in some elementary schools in the Chicago metropolitan area. It was necessary to investigate four areas: curriculum, mathematics, staff development and use of school library media centers. Comprehensive literature searches (ERIC, LISA, CJIE, and Education Index) were carried out by using such descriptors as: Mathematics--Curriculum and Bibliographies; Mathematics-Library--Book/Collection/Curriculum; Mathematics Instruction; Staff/Staff Development--Mathematics; Library Instructional Services; Library--Materials and Mathematics Instruction; Library--Materials and Elementary--School--Mathematics. With few exceptions, these inquiries covered the time period since 1970.

CURRICULUM

Tyler's Basic Principles of Curriculum and Instruction

raises the question for subject specialists to consider: "What can this subject contribute to the education of young people who are not going to specialize in it?"[14] He also states that "The essential means of education are the experiences provided, not the things to which the student is exposed."[15] In the present study the MCIP workshop participants brought varying attitudes toward mathematics, a range of years' teaching experience and an enthusiasm for improving their ability to teach mathematics. The library component followed Tyler's suggestion to create situations in which the "intensity of impression and the variety of impressions of the information will increase the likelihood of remembering these important items."[16] In this study, that meant for the teachers, the exposure to, and use of, library resources for the teaching of mathematics and for the students, the use of mathematics related library materials in order to apply what they had learned in math.

As part of the MCIP, the library component was an example of Taba's inverted curriculum in which the production of pilot units was done by groups of teachers and

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[14] Ralph W. Tyler, Basic Principles of Curriculum and Instruction (Chicago: University of Chicago Press, 1949), p. 27.

[15] Ibid., p. 64.

[16] Ibid. p. 74.

put into practice in their classrooms.[17] Goodlad indicated that most teachers depend very little on state and local curriculum guides but on their own experience and professional training. He questioned whether the undergraduate education of our teachers was giving them the "breadth and depth of preparation required for teachers to be professional and not merely technicians."[18]

MATHEMATICS

The history of mathematics education at the elementary school level has evolved from a focus on developing computational skills to drill theory to meaning theory. The movement in the 1950's and 1960's emphasized meaning but from a content point of view, the so-called "modern Math," which was replaced by an emphasis on "basic skills."[19] The National Council of Teachers of Mathematics (NCTM) has stated that its top priority for the 1980's is problem solving.[20] For today and the 1990's learning Mathematics has to be more than "acquiring behavior or getting right

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[17] Robert S. Zais, Curriculum: Principles and Foundations (New York: Harper & Row, 1976), p. 455.

[18] John I. Goodlad, What Schools Are For (Bloomington, Ind.: Phi Delta Kappa Educational Foundation, 1979), p. 110-111.

[19] Donald J. Dessart, "Curriculum," in Mathematics Education Research: Implications for the 80s, ed. Elizabeth Fennema (Reston, Va.: ASCD, 1981), p. 6-7.

[20] Ibid., p. 18.

answers, it is learning to think."[21]

Kaplan, Yamamoto and Ginsberg explored the mental framework children use to "invent" mathematical knowledge. Before kindergarten, children actively invent ways to add and substract. This informal knowledge serves as a foundation for the mathematical concepts they will encounter in school.[22] Sometimes the students cannot modify their informal mental framework with the standard procedures that are taught. "Children do not learn mathematics merely through exposure to a curriculum, operating in isolation from what they already know."[23] Therefore strategies for mathematics instruction have to include activities which "build on children's own construction of mathematical relationships."[24] Textbook publishers are responding to the recommendations of the NCTM by adding sections or chapters on problem solving. Seemingly then, the teacher, the student, and the publisher, are following the NCTM's suggested curricular changes.

However, the textbook still determines the mathematics

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[21]Rochelle G. Kaplan, Takashi Yamamoto, and Herbert P. Ginsberg. "Teaching Mathematics Concepts," in Toward the Thinking Curriculum: Current Cognitive Research, ed. Lauren B. Resnick and Leopold E. Klopfer (Reston, Va.: ASCD, 1989), p. 63.

[22]Ibid., p. 60-61.

[23]Ibid., p. 64.

[24]Ibid., p. 80.

curriculum in many schools today.[25] At a time when we need a more mathematically literate population, many of our students are still being "exposed to unprepared teachers using uninspiring textbooks and . . . demonstrating minimal competency on outmoded standardized tests."[26] Often, if a topic is not in the book, it is not taught.

Another study, The Underachieving Curriculum: Assessing U.S. School Mathematics from an International Perspective discovered that when compared to students in other countries, the students of the United States rank near the middle in most mathematical disciplines but in the lower quarter in geometry and calculus. Kenneth Travers, study coordinator from the University of Illinois, observed that the mathematics curriculum for American students must be given a new focus and vitality.[27] Good and Grouws (1977) have used process-product studies of teacher behaviors in a study of fourth-grade mathematics instruction. This study and others indicate a need for further research to study mathematics instruction by using outcome measures other than

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[25]Dessart, p. 18.

[26] Stephen S. Willoughby, "Mathematics for 21st Century Citizens," Educational Leadership 41 (December 1983-January 1984): 46.

[27] "U.S. Math Curriculum Needs Overhaul, New Study Says," Phi Delta Kappan, 68 (March 1987): 559.

standardized tests.[28]

In the University of Chicago School Mathematics Project, begun in 1983 and on-going, the emphasis is on developing mathematics curriculum for grades K-12 in order to motivate the middle-ability students. Usiskin states that "it is widely recognized that students do not read mathematics books and, thus, are not ready to learn mathematics on their own outside of school."[29] He suggests that future mathematics textbooks should contain more reading and that the University of Chicago School Mathematics Project's materials provide more reading "to relate material from a lesson with previous content, to introduce examples, and to provide motivating information."[30]

Improvement or changes in teaching behaviors have often failed because the suggested reforms have not considered the political realities of education or the need for the process to begin with the individual teacher at the local school level.

> Teachers want and need training in new ideas and techniques that not only is rich in information but

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[28] Thomas L. Good and Douglas A. Grouws, "Process-Product Research," in Mathematics Education Research: Implications for the 80s, ed. Elizabeth Fennema (Reston, Va.: ASCD, 1981), p. 89.

[29] Zalman Usiskin, "The UCSMP: Translating Grades 7-12 Mathematics Recommendations into Reality," Educational Leadership 44 (December 1986-January 1987): 31-32.

[30] Ibid., p. 32.

> also provides support for trying out the new techniques in their classrooms.[31]

After making such a statement, Lieberman and Miller go on to report on the study of Tikunoff, Ward and Griffin (1980) who developed an action research strategy which consisted of a team of teachers, a researcher, and a developer trainer. The team prepared an action research plan, carried it out with students in the classroom, and then analyzed the results. The next step was for teachers on the team to provide coaching/staff development for their peers.[32]

In 1984, Horn and Walberg reported on their analysis of the achievement and interest scores of a National Assessment of Educational Progress sample of seventeen year-olds during the 1977-78 academic year. "Interest is nearly uncorrelated with achievement, which surprisingly suggests that students who pursued mathematics voluntarily achieve little more on average than those who do not."[33]

STAFF DEVELOPMENT

In 1983 Sparks presented research on staff development

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[31] Ann Lieberman and Lynne Miller, "Supporting Classroom Change," in Changing School Mathematics: A Responsive Process, eds. Jack Price and J.D. Gawronski (Reston, Va.: The National Council of Teachers of Mathematics, Inc., 1981), p. 53.

[32] Lieberman and Miller, p. 59.

[33] Elizabeth A. Horn and Herbert J. Walberg, "Achievement and Interest as Functions of Quantity and Level of Instruction," Journal of Educational Research 74 (March/April 1984): 229.

for effective teaching, and revealed that most school districts with one or two days of inservice each year are not providing the time necessary for their staffs to share new ideas on teaching or to try out the new techniques in the classroom. Teachers need to receive the content in "chunks" spaced over time, preferably two or three sessions separated by at least a week.[34] Also in 1983, Joyce and Showers reported that the development of a skill alone does not ensure transfer even though teachers are and can be wonderful learners. They refer to "horizontal transfer" in which the learner can shift the learned skill directly from the training session to implementation in the classroom. However, with "vertical transfer" the new skill "cannot be used to solve problems unless it is adapted to fit the conditions of the workplace. An extension of learning must occur before the learner can solve problems effectively,[35]

Leinhardt and Putnam reported on what research was carried on to identify expert teachers of elementary mathematics and to analyze their teaching performance in order to help all teachers improve. Studies at the University of Pittsburgh, Stanford University and the University of Arizona have revealed a profile of such

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[34] Georgea Mohlman Sparks, "Synthesis of Research on Staff Development for Effective Teaching," Educational Leadership 41 (November 1983): 65-72.

[35] Bruce R. Joyce and Beverly Showers, Power in Staff Development Through Research on Training (Reston, Va.: ASCD, 1983), p. 2-5.

teachers. Some traits of the expert as opposed to the novice or pre-service teacher are:

- to show greater depth in reports and plans ...
- to have specialized knowledge about the specific topics they are teaching...
- to give explanations with the precise use of terms and avoidance of multiple meanings...
- to have curriculum scripts, which they continuously refine, for topics they teach often[36]

It is often helpful for teachers to observe their colleagues and to share good ideas and new techniques they have seen in action. Too seldom do teachers get this chance to observe, however. Suydam reported that in a study of preferred inservice activities by Bany and Carbno in 1981 that a group of elementary math teachers listed the inter-school visitations as the highest of nine activities.[37] Sparks describes Oja's review of the literature on adult development in which a strong case was made for staff development activities which would help teachers grow in maturity on both the personal and cognitive levels.[38] In

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[36] Gaea Leinhardt and Ralph R. Putnam, "Profile of Expertise in Elementary School Mathematics Teaching," Arithmetic Teacher, 34 (December 1986): 28-29.

[37] Marilyn N. Suydam and J.G. Weaver, "Research on Mathematics Education Reported in 1981," Journal for Research in Mathematics Education 13 (July 1982): 245.

[38] Sparks, p.70.

1982 Joyce and Showers discovered that when a coaching component is added and implemented effectively, most teachers will be able to transfer and to incorporate new techniques and strategies into their repertoire.[39] Later, Showers revealed evidence that many positive changes in a school can occur if the school supports the development of peer coaching teams.[40] In a similar study, Guskey set up a model of teacher change in which the staff development activities brought about a change in the teachers' classroom practices which resulted in a change in the students' learning outcomes. These, in turn, resulted in a change in the teachers' beliefs and attitudes.[41] Rodriguez and Johnstone propose a collegial support model in which teachers, along with their administrator, will assess their strengths and weaknesses, plan activities to help themselves improve their skills, and provide skills needed for peer coaching.[42] Strother reports that coaching must take place in a non-threatening atmosphere, that it should be a collaborative process. An important issue is to separate

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[39] Bruce R. Joyce and Beverly Showers, "The Coaching of Teaching," Educational Leadership 40 (October 1982): 5.

[40] Beverly Showers, "Teachers Coaching Teachers," Educational Leadership 42 (April 1985): 43.

[41] Thomas R. Gusky, "Staff Development and Teacher Change," Educational Leadership 42 (April 1985): 58.

[42] Sam Rodriguez and Kathy Johnstone, "Staff Development through a Collegial Support Group Model," in Improving Teaching: 1986 ASCD Yearbook, ed. Karen K. Zumwalt (Alexandria, Va.: ASCD, 1986), p. 88.

coaching from evaluation. The use of the term "peer" has led to some confusion. In peer coaching the relationship between teachers is designed to improve practice (formative) whereas in peer evaluation, teachers form judgements to advise administrators in making personnel decisions (summative).[43]

Trent reported on a survey on Junior High Mathematics Teacher Preparation sent to the State Departments of Education for which he reported a 68% return[44] and to forty state university colleges of education with a 70% return.[45] His analysis of the results indicate that many of the junior high math teachers have a minor or less in math and "fear" math courses; and, these teachers are not receiving adequate education in either content or methods. Therefore, adequate and relevant pre- and in-service education for them should be provided by the school districts and colleges of education.[46] The primary task of the National Research Council's Committee on the Mathematical Sciences in the Year 2000 is to strengthen college math preparation especially

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[43] Deborah Burnett Strother, "Peer Coaching for Teachers: Opening Classroom Doors," Phi Delta Kappan 70 (June 1989): 824.

[44] John H. Trent, "Needed: More Better Prepared Junior High School Mathematics Teachers," School Science and Mathematics 87 (February 1987): 103.

[45] Ibid., p. 105.

[46] Ibid., p. 106.

for those who are to become math teachers.[47]

Another approach to supplying needed mathematics teachers is the Mathematics and Science Re-Licensing Program created by the New York City Board of Education. The object is to retain veteran teachers from overstocked fields e.g. English, History, by retraining them in math or science through local colleges and universities.[48] Candidates volunteer, and although one-third have dropped out of the program, eighty-eight newly licensed mathematics teachers passed the certification exams given in 1985-1986. Over one thousand teachers participated in the program during its first three years. Many were women and minorities who now had the chance to upgrade themselves and qualify for better job opportunities. It was also very important that more children in New York's Public Schools System now had teachers licensed and trained in mathematics.[49]

SCHOOL LIBRARY MEDIA CENTERS

In Alliance for Excellence, which is the librarians' response to the national report A Nation at Risk, the library community recommended that the elementary and secondary curricula be strengthened so that students would

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[47] National Research Council,"Math Education Reform," The Education Digest 54 (May 1989): 32.

[48] Bruce S. Cooper, "Retooling teachers: The New York Experience," Phi Delta Kappan 68 (April 1987): 606.

[49] Ibid., p. 609.

be taught the use of information sources "keyed directly to . . . specific subjects,"[50] and that "students should spend time in the school library media center to learn and practice information skills coordinated with class work."[51] This means that the library media specialist and the classroom teacher must work together to provide learning experiences for students. Grazier described the role of the media specialist in curriculum development. First, the traditional role is one in which the media specialist responds to specific requests for resources for a particular topic or unit. However, she offers a second role in which the media specialist is involved in the stages of curriculum development: 1) planning, 2) implementation and 3) evaluation. To be accepted as part of the curriculum team, the media specialist must have competencies in the areas of media, curriculum, management, and human relations.[52]

Aaron reported an increased interest in school library media research from 1972 through 1981. More studies regarding the role of the school library media professional in future educational settings could explain questions such as: What potential contributions can library media

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[50] Alliance for Excellence: Librarian Response to a Nation at Risk (U.S. Department of Education, 1984), p.11.

[51] Ibid.

[52] Margaret Hayes Grazier, "A Role for Media Specialists in the Curriculum Development Process," School Media Quarterly 4 (Spring 1976): 200.

specialists make to planning, implementing and evaluating instruction? What features are possible, probable, or desirable for programs? What factors promote or inhibit diffusion of innovation in the school media area? These questions require answers.[53]

Greenberg presented an overview of the availability of materials which libraries must have in order to give effective service. This study not only used a checklist of titles but measured the capability of the library to deliver the item to the patron in terms of time intervals. This included the length of time it took for an inter-library loan request to be filled.[54]

In 1966 Schmitz developed a checklist of mathematics and science materials. Some fifty-four schools in the state of Michigan participated. She found that less than ten per cent of the 551 titles were a part of each library's holdings. Almost eighty per cent of the teachers surveyed used the mathematics or science materials very little or not at all. Thus, most of these collections were under utilized by both teachers and students.[55]

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[53] Shirley L. Aaron, "What's Being Measured: Research Trends in Library Media Services," School Library Media Quarterly 4 (Spring 1984): pp. 246-247.

[54] Marilyn W. Greenberg, "Measuring the Availability of Library Materials," School Library Media Quarterly 14 (Spring 1986): 152.

[55] Eugenia E. Schmitz, " A Study of the Library Book Collections in Mathematics and the Physical Sciences in Fifty-Four Michigan High Schools Accredited by the North

Blazek, in his study in 1971, developed a list of sources in mathematics for the classroom teacher and with the classroom teacher. This bibliography of print and non-print materials was incorporated into the classroom presentations by the teacher. The teacher suggested the use of the non-required library materials to the students while Blazek evaluated their use by the students with the help of the school librarian and through interviews and observation.[56] A summary of some results of the Blazek study were charted by Brandt in a research brief. In the Concluding Remarks for LMS (Library Media Specialist) one finds:

1. Teacher promotion of LMC materials is a critical factor in the amount of use the materials receive.
2. LMS should not underestimate the importance of influencing teachers who will in turn influence students to use LMC materials.
3. Use of LMC materials in any curricular area can be improved with carefully planned and executed promotional campaigns.
4. Advertising works![57]

and one of the items under Concluding Remarks for Teachers is:

3. The amount of use made by students of supplementary materials will vary with the intensity of promotion and the personal

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Central Association of Colleges and Secondary School" (Ph.D. dissertation, University of Michigan, 1966).

[56] Blazek, p. 63-104.

[57] Joan Brandt, "Influencing Students to Use Media Center Materials: A Research Study by Ron Blazek," School Library Media Quarterly 10 (Winter 1982): 150.

importance expressed by the teachers.[58]

and under the Concluding Remarks for Administrators is a very important finding:

> 4. Administrators must encourage and allow joint planning by teachers and library media specialist.[59]

However, the present study was not a replication of Blazek's study. The investigator, a library media specialist, worked directly with the teachers, not the students. In this study, varied instructional materials and techniques were provided as well as mathematics bibliographies. Both the media specialist and the MCIP participants were viewed as potential motivators in the use of library media materials.

Turner discussed the importance of library media specialists in providing inservice programs. He emphasized that the process of defining needs, writing clear objectives, analyzing teachers' learning styles, selecting appropriate materials, implementing and evaluating the inservice programs are as important as planning instruction for one's students. Effective incentives for attending are important since voluntary programs are usually more successful. Repeated sessions are also important. Improved learning as well as changed teacher attitudes will more likely result if workshops are presented over a period of

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[58] Ibid.

[59] Ibid.

time.[60]

The literature indicates that there are many problems in the area of school library media center research. A major one is the competencies required of the library media specialist in curriculum theory and practice, in content expertise, in inaugurating and carrying out staff development activities and, of course, in being current in the trends and practices in the library science field. However, of greater importance is the leadership required of the library media specialist at the local level. Watkins and Craft focus on the importance of the library media specialist's role in assisting the principal to provide instructional leadership through formal and informal staff development programs.[61] Throughout their report they emphasize the unique qualifications of the library media specialist to have an impact on teachers' "effective use of new technologies to enhance instruction."[62] A "one shot" effort is not enough since, just as in the classroom, follow-up activities should be a part of the inservice activity in order to reinforce what has been presented and to provide for evaluation of strategies implemented by

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[60] Philip M. Turner, "In-service and the School Library Media Specialist: What Works and What Doesn't," School Literacy Media Quarterly, 16 (Winter 1988): 107-108.

[61] J. Foster Watkins and Ann Hale Craft, "Library Media Specialist in a Staff Development Role," School Library Media Quarterly 16 (Winter 1988): 112.

[62] Ibid., 113.

teachers. Development of a rapport with the teaching staff is vital as one must be able to persuade them of the importance of using library materials in and out of the classroom. Library users are made, not born.

CHAPTER III

Methodology

The present study investigated elementary teachers' participation in Phase II of the Mathematics Curriculum Improvement Project (MCIP), specifically, the implementation of a library component. The overriding questions of the study were:

1. Will there be any difference between the workshop participants' use of mathematics related library materials and their team members' use?
2. Will there be any difference in the demonstration on use of these materials when given by the library media specialist and when given by the workshop participant?

SAMPLE

The elementary teachers in parochial schools in the Archdiocese of Chicago and selected public schools from Districts Two and Three of the Chicago Board of Education were invited to participate in Phase I of the Mathematics Curriculum Improvement Project (MCIP). This project was designed to prepare activity-oriented material suitable for implementing the Archdiocesan mathematics curriculum goals.

Twenty-five teachers were involved in Phase I in Spring, 1986. The comparison group for the present study was composed of those teachers (17) who responded to the Phase I Pilot Study and eight teachers from a K-8 Archdiocesan school whose staff were not involved in the MCIP at all.

Two treatment groups were included in the population. Thirty-seven teachers from public and private schools were invited to participate in the second phase of MCIP. Invitations were issued on the advice of curriculum consultants and university personnel from the Chicago Archdiocese Catholic School Office. Twenty-nine were from this group. Teachers who participated in Phase I for the piloting of materials were also invited. Eight were from this group. All the workshop participants were females with five to thirty years of teaching experience. These elementary teachers were eager and enthusiastic about learning more about math, staff development and parent involvement in learning activities. They participated in four one-day workshops in which they learned about three mathematics units: Algebra, Data Collection, and Probability. Each of the participants was required to train at least three additional teachers in her own or another school. Most trained more, with the average being four teachers for each workshop participant.

During the one month implementation phase, September, 1986, the participants trained one hundred fifty-four of

their colleagues. Participants selected their staff development activities from a wide range of materials and activities. Each participant had a one hundred fifty dollar budget to implement her staff development program. The workshop participants planned ways to carry out and replicate the workshop sessions with these teachers by using the workshop materials and by having the assistance of the MCIP team. These teachers who were trained by the workshop participants are hereafter referred to as team members. Drs. Schiller and Smith reported that

> Teachers trained in Phase II came from the Chicago Public School System, three suburban public school systems (Lincolnwood, Summit, and Palatine), the Hillel Torah Jewish School System and the Chicago Archdiocesan School System. Twenty-five percent of the teachers worked in schools serving a large minority population; 14% of the participants were minority women. Twenty-two percent of the schools were in Lake County and 78% in Cook County. Distribution of grade levels of elementary school was about equal -- 1/3 primary; 1/3 intermediate; and 1/3 junior high teachers. About 30% of the participants were mathematics specialists in their schools.[17]

Also included in the population were the students of teachers in the project and the comparison group. These students were in kindergarten through eighth grade. The number of student participants was dependent upon the class size of each teacher. There were two hundred nine teachers whose students filled out surveys for this study.

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[17] Diane Schiller and Kay M. Smith, "Final Report: Mathematics Curriculum Improvement Project," Loyola University April 1, 1986 - September 30, 1986, p.2.

MATERIALS

The library media specialist worked with the MCIP university personnel to provide mathematics related library materials and activities for the units on Data Collection, Probability, and Algebra, which were piloted in Phase I and revised for Phase II. The bibliographies listed below were consulted to discover as many items as possible for the three instructional units.

The Approved List of Library materials for Elementary Schools, 1984-85. Chicago Board of Education, 1984.

Best Reference Books, 1970-1980. Libraries Unlimited, 1981.

Bestgen, Barbara J. and Robert E. Reys. Films in the Mathematics Classroom. National Council of Teachers of Mathematics, 1982.

Children's Catalog. 14th ed. H.W. Wilson, 1981.

The Elementary School Library Collection: A Guide to Books and Other Media. Phases 1-2-3. 12th ed. The Bro-Dart Foundation, 1979.

Junior High School Library. Catalog/Supp. 4th ed. H.W. Wilson, 1980.

Matthias, Margaret and Diane Thiessen. Children's Mathematics Books: A Critical Bibliography. American Library Association, 1979.

Media Review Digest 1984 (An Annual)

Schaaf, William L. A Bibliography of Recreational Mathematics. NCTM, 1970-1978. 4 volumes.

Senior High School Library Catalog/Supplements. Twelfth edition. H.W. Wilson, 1982-1984.

Wheeler, Margariete M. and Clarence E. Hardgrove. Mathematics Library: Elementary and Junior High School. 5th ed. NCTM, 1986.

Wynar, Christine Gehrt. Guide to Reference Books for School Media Centers. 2nd ed. Libraries Unlimited, 1981.

Especially useful were the Matthias and Thiessen and Schaaf bibliographies for mathematics trade books. With preliminary lists in hand the investigator went to local public libraries (Riverside, IL; Forest Park, IL, and Oak Park, IL.) to examine and obtain as many titles as possible for demonstration purposes. For reference books and some items on metrics, codes, and games the investigator's school library was a valuable resource. A bibliography (Appendix O) with a cover letter listing names and addresses of professional mathematics associations was distributed to participants at the last of the four fifteen minute presentations. These four sessions included activities using general and specific reference sources, most of which can be found in the general reference collections of public libraries. In addition, the Chicago Public Library branches received a grant to set up core Homework Collections in which textbooks and some reference materials are set aside for student use. The starred items in the Reference section of Appendix O can be found in these Homework Collections.

It was expected that most school libraries would have some of the materials or would use the bibliographies as a selection tool for purchasing them. Each workshop participant received copies of activities, bibliographies, etc., which made up the library component.

PROCEDURES

Since research has indicated that "one-time" in-service activities are not as successful as workshops presented over time, the investigator planned four fifteen-minute presentations, one to be given each week (July-August, 1986), as part of the day-long workshops for math instruction and staff development. The library component was presented after the morning mathematics sessions. Each session was videotaped and made available for the participants to use when giving in-service training to the teachers at their schools. Each participant was required to spend six to ten hours during September and October training at least three of her colleagues.

In the first session July 29, 1986, the library media specialist introduced the teachers to the concept that the library, with its print and non-print resources, can do much to extend the mathematics instruction given in the classroom. Instruction on efficient use of encyclopedias, dictionaries, and special references books was the main thrust for this first presentation. For example, Home

Learning Activity C (Appendix J) was converted into a Treasure Hunt Activity by listing the source, World Book Encyclopedia, and the subject heading for each question. Almost any encyclopedia could be used for this if the teachers did not have access to World Book. An opaque projector and an overhead projector facilitated the presention of these materials. The use of this equipment served as modelling behavior for the workshop participants when planning inservice sessions for colleagues in home schools. Handouts for this session included the "Treasure Hunt" activity and the "Dial-a-Mathematician" (Appendix L) which the presenter demonstrated with transparencies. The latter was developed for math coding and for illustrating the use of biographical tools, e.g., McGraw-Hill Encyclopedia of World Biography, to locate information about famous mathematicians.

Other reference materials introduced in the first session were 1) English language and mathematics dictionaries and statistical resources such as: almanacs, Statistical Abstract of the United States, The Baseball Encyclopedia, and Comparisons (Bibliography, Appendix O). Transparencies were utilized to facilitate discussion of techniques for graphing difficult types of statistical information.

Session II took place on August 5, 1986. During this presentation emphasis was placed on map skills and the

correlation of these skills to students' mathematics skills. A transparency with a chart developed by Muir and Cheek illustrated these correlations and served as a basis for the content of the rest of the session. Uses of atlases, Websters' Geographical Dictionary, Maps on File, and Lands and Peoples (Bibliography, Appendix O) were also introduced. Transparencies of pages from Maps on File were reviewed for the purpose of integrating mathematical questions in subject areas other than mathematics. Maps on File has two sections: 1) maps of countries/states of U.S and 2) statistical information maps for the world including the United States. Transparencies of various maps were shown and sample questions were provided. (Appendix M).

Session III was held on August 12, 1986, at Loyola's Lake Shore Campus. The library media specialist brought boxes of books from various public libraries, a school library and Loyola's Curriculum Library. The overhead and opaque projectors were used to introduce some of the books which were then examined by the participants. Other teaching activities were also modeled. For example, Poems for Counting was presented through leading the group in singing "Baa, Baa Black Sheep." Transparencies of "Book Report Forms" for primary and intermediate/ upper levels were presented and hand-outs of the same were distributed. (Appendix K) Books were made available so teachers could browse during their free time.

These books were primary, intermediate and upper level fiction and non-fiction. Mathias and Thiessen's Children's Mathematics Books: A Critical Bibliography was very helpful in locating books by topic, e.g., Counting, Geometry, Measurement, Number Concepts. The Senior High School Library Catalog and The Junior High School Library Catalog were used to locate other titles. The library media specialist obtained most of the books from Forest Park Public Library and Oak Park Public Library. Also, some books were bought at garage sales. It was suggested to teachers that this was another source for them to consider when setting up room libraries.

Session IV took place at Divine Savior School Hall in Norridge, Illinois, August 19, 1986. The focus for this presentation was availability of professional materials, discussion of the bibliographies, and accessibility of public libraries. A transparency showing all the Chicago Public Library branches was utilized. Each participant was given the opportunity to learn names of the local children's librarian. A special teacher assignment form (Appendix N) was provided to encourage teachers to make librarians aware of school requirements and mathematics assignments. A similar form (Appendix N) was provided for the school librarians. The importance of cooperation between teachers and librarians was also discussed.

Bibliographies (Appendix O) coded by grade and subject

level were distributed and included a page with names and addresses of professional journals in mathematics. Copies of the Arithmetic Teacher, The Mathematics Teacher, and School Science and Mathematics were examined. Other periodicals such as Business Week and Consumer Reports were distributed and their potential use in relation to teaching math was discussed.

Some books included in the professional bibliography were made available in order that the participants would be more aware of recent research in the field of mathematics teaching. The last page of the bibliography (Appendix O) was for them to give to her librarian (if there was one) or to her principal, for help in purchasing books on/about mathematics in order to build her library collections. Field trips for mathematics were suggested -- the grocery store, the Museum of Science and Industry, the public library.

The last session closed with an explanation of the evaluation forms and questions on how to implement the library component in the following weeks. The implementation of the math units was projected to be on-going during the school year although the initial evaluation period for MCIP Phase II had to be completed by September 30, 1986.

The workshop participants were expected to design and implement an eight-hour inservice program throughout the

month of September, 1986, for at least three of their colleagues. They were required to choose one of the three M.A.T.H. chapters and at least two other activities from the twenty hour summer program. They were not required to choose the library component.

In order to determine what mathematics unit was taught, what library materials were used, and the usefulness of the library component, a questionnaire was developed and distributed to the workshop participants and to all their teacher/volunteers, hereafter known as team members. (Appendices F and G) As a cross-check of questionnaire responses of workshop participants and team members, one class of each group was given a revised form of the student questionnaire (Appendix E) developed in the pilot study (Phase I, Spring, 1986). An alphabetical list of team members was drawn up--the first was chosen as the team member whose class would respond to the questionnaires. If there were more than three team members, the fourth and seventh teacher team members were also chosen to have one of their classes respond. There were thirty-seven workshop participants and one hundred fifty-four team members with some 3500 students responding to the surveys. Members of the comparison group were asked to have one of their classes respond to the student survey. There were seventeen MCIP Phase I participants whose student responses were utilized. There were eight teachers in the comparison group for whom

the investigator went to the school and administered the surveys to the lower grades (1 to 4) while the upper grade teachers (grades 5 to 8) administered their own and returned them to the investigator.

The pilot study was developed by the investigator who had first checked the library literature to see if there was an instrument available. When no instrument was found, the writer developed a survey to investigate student use of selected library materials in completing subject-area assignments. The curricular areas of interest included: Social Studies, Mathematics, English/Reading, Statistics/Social Studies and recreational reading. The survey also explored whether students used the school library, how often they used the public library, and whether or not parents accompanied the students to the public library. (Appendix A) After the results of the pilot study were examined, the survey items were refined. That survey (Appendix E) was the instrument given to the students in this study.

TERMS

The library media specialist is the person who presented the library component in the MCIP Phase II workshops. The workshop participants are elementary school teachers, grades 1 - 8, who volunteered to participate in the MCIP Phase II and agreed to give in-service with the

workshop materials to peers in their own schools or nearby schools. The team members are the peers who agreed to work with the workshop participants and to implement at least one of the MCIP math units.

VARIABLES

The dependent variable, student library use, was measured by responses to specific items on the student survey. Questions 2, 4 and 5 inquired about using math-related library materials. Questions 1 and 3 were related to use of library materials for Social Studies and English/Reading. Information about students' actual physical presence in libraries for assignments was sought in Questions 6, 7, and 8.

The independent variables on the student survey were 1) teacher role: workshop participant, team member, or comparison group teacher; 2) the students' grade level; and 3) the students' sex.

The independent variables on the teacher survey were 1) role of the instructor for the library component: library media specialist or the workshop participant; and 2) library materials utilized under each unit of instruction.

The dependent variable on the teacher survey is library use as demonstrated by their responses to assignment sheet questions for both school and public libraries, and book report responses for the unit of instruction chosen.

The coding for the teacher surveys was a simple tally

for each section along with an anecdotal essay of responses to open-ended questions. Some such responses included information about school libraries not opening until October 1st when the data collecting period ended September 30th; or, some teachers noted that it was not safe for their students to go to the public library because of gang problems in the neighborhoods. In order to ensure consistency and enhance ease of interpretation, the independent variables on the student survey were coded by giving a "yes" response two points and a "no" response one point. Therefore, possessing a quality or thing was more desirable than not having it, and was rated higher. This technique provides a positive correlation when a direct relationship in the associations is indicated. Conversely, a negative correlation would mean an inverse relationship in the associations.

RESEARCH DESIGN AND DATA ANALYSIS

The design utilized for this research is a one-shot case study supported by anecdotal data. The unit of analysis was the individual. Randomization of data took place at time of input. Every other student response was chosen to be input into the computer with a resulting N of approximately 3500 studnets. Student survey responses from classes of workshop participants and their team members were compared. Student surveys from the comparison group were

compared to the other two student groups. This procedure was used for Questions 1, 2, 3, 4, and 5 of the student questionnaire. On the other hand, the responses to questions 6, 7, and 8 resulted in interval data.

Anecdotal data with a simple tally of categorized responses was used to explain the workshop participants' and team members' surveys. The categories were broken down into the types of library materials used and the aspect of the library component found to be most useful.

CHAPTER IV

Analysis of the Data

Introduction

An important goal of the Mathematics Curriculum Improvement Project (MCIP) was to improve elementary classroom teacher competency in mathematics instruction. Classroom implementation of workshop instruction was a required component of the inservice. The library component was one developed to provide teachers with an additional approach for enriching mathematics instruction.

An important part of each MCIP program is staff development activity. Participants are expected to share the expertise they develop with others at their home school. Each teacher becomes a continuing resource for inservice training. MCIP empowers teachers to share with the principal the responsibility for instructional leadership in mathematics.

The intent of this study was to explore the power of a staff development program to change teacher behavior in regard to use of the library as a part of the mathematics curriculum. Two research questions were developed for this study. First, can teachers be trained to incorporate the library and its materials into math teaching? Second, can

teachers, trained by a librarian, transfer the training to other teachers? This chapter contains a presentation and discussion of data collected regarding the efficacy of the treatment from the teachers' viewpoints and from their students perspective as well. In order to obtain data concerning these perceptions, three surveys were developed and distributed to the participants and their students involved in the study. There were 166 returns from the teachers sampled. Out of 37 workshop participants, there were 33 returns received. Of 148 team members, 133 returned their surveys. Student responses were approximately 7000 from all the teachers participating in this study. Randomly selected student responses were chosen for the data sample which totaled 3280 (Table 8). This represents a return rate of 89.2%, 86.4% and 100% respectively.

The components of the teacher surveys were as follows: library materials used; most useful aspect of library component; and suggestions for improving library component. The components of the students survey were questions 1-5 and questions 6-8.

Section one of the teacher surveys (Appendix F, G) was designed to address the use of materials. The second section asked what materials were most useful and the last asked what changes would teachers suggest to improve the library component. The student survey (Appendix E) items which were designed to address student use of library

materials were questions 1, 2, 3, 4 and 5. The second section of the survey (Questions 6, 7, 8) was intended to elicit responses relevant to the students' going to libraries.

Both checklists and open-ended questions were used in the teacher surveys. All the respondents did not answer all of the questions. However, in every instance, percentages and totals of the checklist items reflect the actual number of responses received. Percentages reported are rounded to the nearest tenth in both the narrative and the tables. The open ended questions were treated in two ways: responses were tallied and then ordered; and anecdotal responses were listed.

The student responses in the first part of the survey are a direct "yes" or "no." All of the respondents did not answer all the questions. Non-responses were coded as zero. Again, the percentages reflect the actual number of responses for each particular question. The second group of question was designed to collect interval data. The responses included once, twice, and three or more times. In this instance data were tallied with a zero used for no response.

The remainder of Chapter IV includes a description of the population; results of teacher and student responses to the research surveys; a comparison of responses by teacher group; and a summary of the findings presented in this

Table 7

Number of Classes by Grade Level and Teacher Group

September - October, 1986

4 weeks after the Workshop

	Primary Grades				Intermediate Grades			Upper Grades		Total
Teacher Group	K	1	2	3	4	5	6	7	8	
Workshop Participants	0	0	4	3	5	6	4	6	7	35
Team Member	1	3	7	7	8	6	8	3	7	50
Total	1	3	11	10	13	12	12	9	14	85

chapter.

POPULATION

The persons participating in this study, were elementary teachers directly and indirectly involved in the MCIP, 1986, and their students. Profiles of the workshop participants and team members are given in Tables 10 and 14. In addition, the students of teachers in a school not involved in MCIP completed surveys in Spring, 1987.

Table 7 shows the number of classes by grade levels for both the workshop participants and their team members of MCIP, Phase II. These data reflect the teachers whose students completed surveys in October, 1986. In Table 8 section one, one sees the total student responses for Fall, 1986, tallied for this project to be 1323. In the follow-up in Spring, 1987, 21 classes of workshop participants and 24 classes of team members (Table 9) responded.

Table 9 shows the number of classes by grade levels and teacher groups for the follow-up surveys of students completed nine months after the workshop. The data shown in this table indicate that 92 class groups returned responses in May, 1987. The number of students whose surveys were tallied (Table 8) are 779 for the Spring, 1987 group and a total of 1178 for the Comparison Group (Spring, 1986 and Spring, 1987).

Results of Research Question #1

Table 8

Number of Student Responses Tallied
by Level and by Teacher Group Over Time

Fall 1986	Workshop Participants' Students	Team Members' Students	
Primary	122	322	
Intermediate	255	325	
Upper	189	110	
	566	757	T = 1323
Spring, 1987			
Primary	50	144	
Intermediate	198	208	
Upper	122	57	
	370	409	T = 779

(Spring 1986 and Spring 1987)

	Comparison Group's Students	
Primary	278	
Intermediate	549	
Upper	351	T = 1178

Table 9

Number of Classes by Grade Level and Teacher Group

May 1987

Nine Months After Workshop

	Primary Grades				Intermediate Grades			Upper Grades		Total
Teacher Group	K	1	2	3	4	5	6	7	8	
Workshop Participants	0	0	2	1	3	4	4	3	4	21
Team Member	1	2	5	0	4	4	3	2	3	24
Comparison	0	1	4	6	6	6	11	9	4	47
Total	1	3	11	7	13	14	18	14	11	85
N =	22				45			25		92

TABLE 10

MCIP Phase II Workshop Participant Profile

Type of School		Teacher Survey		Student Survey	
Public	Parochial	Returned	Not Returned	Returned	Not Returned
6	25	33	4	32 sets	5 sets

School Library		School Librarian	
Yes	No	Yes	No
28	3	20	10

Teachers Trained by Participants *

# of Participants	:2 :	:3 :	:4 :	:5 :	:6 :	:7 :	: 8-12 :
# of teachers trained	2	13	5	4	2	1	5

* Example = 13 workshop participants trained 3 colleagues

WORKSHOP PARTICIPANTS

The surveys from both workshop participants and their students were analyzed to answer the first research question, can teachers be trained to incorporate the library and its materials into mathematics teaching. The teachers in MCIP Phase II came from thirty-one schools. Six were public schools and twenty-five were parochial schools. Three schools did not have a school library and ten had no librarians (Table 10). This information comes from information cards each participant completed for the investigator. There were thirty-seven teachers in MCIP Phase II. Of these, thirty-three or 89.2% returned the Workshop Participant Survey. Thirty-two or 86.5% of them had their students complete the Student Survey.

One way to answer the research question was to prepare an analysis of the participants' responses to the first section of the Workshop Participant Survey (Appendix F). First, each respondent was asked to check which math unit was chosen: data collection, algebra, probability. Then each was asked to indicate if specific library materials were used in teaching the particular math unit.

Use of the library materials was not mandatory. Participants were required to choose one math unit and one other component of the workshop program. The library was one of seven possible choices. The other components were: Math and Social Studies; Math and Special Education; Math

and Physical Education; Math Multiplication Drills; Math Games; Math and Home Learning. If choices were chosen equally, one would expect seven or eight teachers to have selected the Library Component. Instead, eighteen out of thirty-three participants (54.5%) responded that they had used it. Table 8 presents information about which items of the Library Component were used by the workshop participants during the four week implementation period in the Fall, 1986. The items most often used were the encyclopedia (39%), "Book Report" forms (33%), "Dial-a-Mathematician" worksheet (33%), the "Treasure Hunt" (22%) and the "Bibliography" (22%).

The workshop participants had their students using library materials for other subjects: Science, Social Studies, Reading, etc. Some of these items were dictionaries, encyclopedias, and atlases. The "Maps on File/exercises" were used for both math and social studies.

It can be noted in Table 7 that there were twenty-eight schools with libraries in the building but only twenty had librarians. For this reason the investigator strongly recommended during the summer workshop that the teachers contact the public librarian through the "Assignment Sheet" (Appendix N) and visit the public library itself. Six teachers (33%) informed their school librarians about the math assignments while two (11%) contacted the public librarians by using the "Assignment Sheet"(Table 8).

TABLE 11

Library Materials Used by Workshop Participants Who Chose Library Component (Sept./Oct., 1986)

N = 18

	N	%*	Item
	6	33	Book Report
	7	39	Encyclopedia
	6	33	Dial-a-Mathematician
	4	22	Treasure Hunt
	3	17	Almanac
	4	22	Bibliography
	1	6	Statistical Abstract of U.S. Assignment sheets
	6	33	Given to school Librarian
	2	11	Given to Public Librarian
Total	41	216	

* Responses total more than 100% as some teachers used more than one item.

TABLE 12

Most Useful Aspect of Library Component during Sept./Oct., 1986

Workshop Participants
N = 18

N	%*	Item
11	61.0	Bibliography
7	39.0	Maps on File
6	33.3	Book Report Forms
5	28.0	Teacher Assignment Sheets
2	11.0	Dial-a-Mathematician
2	11.0	Treasure Hunt
7	39.0	Other
Total 40	222.3	

* Responses total more than 100% as some teachers used more than one item.

In the second section of the survey, the workshop participants were asked what they had found most useful in the Library Component. Table 12 shows that the most popular items were the "Bibliography" (61%), the "Maps on File" (39%), the "Book Report Forms" (33.3%) and the "Teacher Assignment Sheets" (28%).

Fifteen teachers (45.5%) did not use the library component during the four week implementation period. They cited the following as reasons: "not enough time," "school library not open yet," or "not applicable to primary students". Some gave no response at all to this question.

When asked what they would change in the library unit or what else was needed, the teachers' comments were mostly favorable. A sampling of these follows:

"I would make two longer sessions, rather than four short, rushed ones."

"I would keep adding to it. I though it was great."

"I wouldn't take anything away ... even though not enough time to implement since school library didn't open until September 29. Materials could be used throughout the year."

"Due to library project, our library will add more books."

"I would like to have on-site visit from the lady who did the library component".

For additional evidence to support the idea that

teachers can be trained to incorporate the library to extend their math instruction, the participants were asked (Appendices D and P) to have their students respond to a survey (Appendix E). At the end of the four week implementation period in the Fall of 1986, and again in the Spring of 1987, the workshop participants' students were surveyed. Thirty-two of thirty-seven teachers (86.5%) returned their student surveys in the Fall and twenty-one of thirty-five (60%) in the spring.

The "yes" responses tallied from the workshop participants' students from Fall, 1986, and from Spring, 1987 can be seen in the first section of Table 13. The data were divided according to the primary, intermediate and upper grade levels.

The questions were prefaced with "since school started..." and then were followed by statements about the class use of library materials (Appendix E). The first question asked about using an atlas or encyclopedia for Social Studies assignments. In the fall, the "yes" responses were 56.9% for the primary level, 79.2% for the intermediate level and 46.6% for the upper level. By spring the usage had increased with "yes" responses of 98% for primary, 88.9% for intermediate, and 73% for the upper level students. Librarians find that students often have this type of assignment when studying about the history or geography of countries of the world. Therefore, such high

Table 13

$\bar{X}$ Percentage of "YES" Responses to Questions 1-5
Over Time by Teacher Group and Student Levels

Workshop Participant	Q_1		Q_2		Q_3		Q_4		Q_5	
	F	S	F	S	F	S	F	S	F	S
	$\bar{X}$ %*	$\bar{X}$ %	$\bar{X}$ %	$\bar{X}$ %	$\bar{X}$ %	$\bar{X}$ %	$\bar{X}$ %	$\bar{X}$ %	$\bar{X}$ %	$\bar{X}$%
Primary	56.9	98	8.9	66	52	96	2.4	28.6	2.5	12
Inter	79.2	88.9	35.5	52.5	83	79.8	5.8	17.2	10.6	31.3
Upper	46.6	73.0	14.3	20.5	67.7	78.7	5.9	3.3	21.7	2.5
Team Member	F	S	F	S	F	S	F	S	F	S
Primary	40.3	45.6	50.9	66.0	44.7	99.3	3.3	.7	6.2	.7
Inter	51.4	86.1	23.2	36.5	68.2	91.8	12.8	1.9	8.3	13.0
Upper	50.0	75.4	48.6	42.1	41.8	57.9	0.0	14.0	0.0	28.1
Comparison	F	S	F	S	F	S	F	S	F	S
Primary		47.9		66.9		79.5		5.6		8.3
Inter		70.4		32.4		61.6		1.4		1.4
Upper		82.7		19.5		74.2		0.0		0.0

* $\bar{X}$% = Mean Percentage

Teacher Groups: Workshop Participants
Team Members
Comparison = Pilot Study Teachers and Teacher group not in MCIP

Time elements: F = Fall, 1986
S = Spring, 1987

Levels: Primary = Grades K-3
Intermediate = Grades 4-6
Upper = Grades 7-8

Q_1 = Social studies/atlas and encyclopedia
Q_2 = Library books - numbers and shapes for Math assigrments
Q_3 = Book reports/English and Reading
Q_4 = Library books for Math homework
Q_5 = Assigned Book reports for Math

"yes" responses are not unexpected.

In Question 2 the students were asked about looking for and using books about numbers and shapes to do math assignments. Many of these types of books had been shown to their teachers and were included on the "Bibliography" (Appendix O). In the fall the primary students responded "yes" to this question 8.9%; the intermediate, 35.5%; and the upper, 14.3%. By spring, the "yes" responses had risen dramatically for the primary to 66%. At the same time the intermediate students responded "yes" 52.5% and the upper level, 20.5%.

For Question 3 the content was taking out library books to do book reports for Reading or English. In the fall the primary students responded "yes" 52%; the intermediate, 83%; and the upper, 67.7%. By spring the primary "yes" responses had risen over 40% to 96%. The intermediate students "yes" had decreased to 79.8% while the upper students responses had risen 11% to 78.7%. Again, these responses are not unusual as teachers are in the habit of assigning book reports to students at all levels so as to encourage them to read.

In Question 4 the students were asked if they had used library books to do math homework. Here the "yes" responses are low - 2.4% for primary students: 5.8% for intermediate level; and 5.9% for upper level students. By spring, however, 28.6% of the primary students had responded "yes."

This was an increase of 26.2%. The intermediate "yes" responses also increased by 11.4% to 17.2%. The upper level students went from 5.9% to 3.3% "yes" responses, a decrease of 2.6%. These results show that the primary and intermediate teachers continued to implement the library component during the school year.

In Question 3 the students reported doing book reports for English and Reading. In Question 5, however, the book reports assigned were for math. In the fall, the primary students did math book reports 2.5%, but by spring, their "yes" responses had risen to 12%. The intermediate level responded "yes" 10.6% in the fall and 31.3% in the spring for an increase of 20.7%. Yet the upper level students responded "yes" 21.7% in the fall but only 2.5% in the spring, for a decrease of 19.2%. The older students may have responded negatively if they perceived these books to be for primary students, not for them. The teachers had reported using the special "Book Report Forms" (Appendix K) and their students did respond that they had done math book reports. This data supports the idea that primary and intermediate teachers continued to incorporate the library into their math instruction.

In Questions 6, 7, and 8 the students were asked how often they went to libraries, either school or public, and if their parents accompanied them. Question 8 asks if parents took the student to the library. At the junior high

levels most students could take themselves. In subsequent discussion with teachers several reported that many took Question 8 too literally. Many of the younger children might go to the public library with their older siblings, not a parent.

This section of the student survey did not give concrete results. One reason is that the questions did not ask if the students were going to the library to do math related assignments. The data received from these questions were inconclusive.

TEAM MEMBERS

Each workshop participant was required to train at least three teachers in her own school or one nearby. Seventeen participants trained more than three. Table 14 shows a profile of these teachers or team members. There were
154 team members with each workshop participant working with two to ten team members. Two schools had more than one workshop participant so that most of the faculty were involved in MCIP Phase II in those schools. The team members worked in seven public schools and twenty-five parochial schools. In these schools twenty-nine had school libraries but only twenty-one had librarians. Of the 154, 133 (86.4%) returned the team member surveys. Randomly selected team members from each school were chosen to have

TABLE 14

MCIP Phase II Team Member Profile

Type of School		Teacher Survey		Student Survey	
Public	Parochial	Returned	Not Returned	Returned	Not Returned
7	25	133	21	46 sets	0 sets

School Library		School Librarian	
Yes	No	Yes	No
29	3	21	11

their students respond to the Student Survey. Fourteen schools had more than three teachers on the mathematics curriculum team. For these schools the first, fourth, and possibly seventh team members were randomly chosen to administer the student survey (Appendix E) to their math students. All forty-six team members selected returned sets of student responses for a return rate of 100%.

The first research question concerned training teachers to incorporate library materials into their mathematics teaching. Data were collected for this question, and for a second question: "Can the librarian's training be transferred by the workshop participants to their team members?".

As with the workshop participants, team members first chose a math unit to teach: data collection, algebra, or probability. On their survey, the team members then indicated what, if any, library materials were used in conjunction with the math unit. Again, the library component was one of seven which the team member could choose. If choices were selected equally one could expect about 20% to choose the library component. Instead, fifty-seven or 42.9% of the 133 team members responding indicated that they selected the library unit. This was 11.6% fewer than the workshop participants.

Table 15 are shows the team member responses as to what library materials they used during the implementation

TABLE 15

Library Materials Used by
Team Members Who
Chose Library Component
Sept./Oct., 1986

N = 57

	N	% *	Item
	11	19.3	Book Report Forms
	17	29.8	Encyclopedia
	0	0.0	Dictionary
	12	21.1	Dial-a-Mathematician
	9	15.8	Treasure Hunt
	6	10.5	Almanac
	5	8.8	Bibliography
	4	7.0	Statistical Abstract of U.S.
	9	15.8	Atlas
	2	3.5	Maps on File/Exercises
			Assignment sheets
	16	28.1	given to school Librarian
	7	12.3	given to Public Librarian
Total	98	162.0	

* Responses total more than 100% as some teachers used more than one item.

period, Sept.-Oct., 1986. The fifty-seven team members who used the library unit chose the encyclopedia (29.8%), the "Dial-a-Mathematician" (21.1%), the "Book Report Forms" (19.3%), "Treasure Hunt" and "Atlas" (15.8%).

The team members also had their students using library materials for other subjects such as Science, Reading, Social Studies. The materials used included dictionaries, encyclopedias, atlases and almanacs. As with the workshop participants, the team members used the Maps on File exercises for both math and social studies. The assignment sheets (Appendix N) were given to the school librarians by 16 (28.1%) of the team members. Seven (12.3%) gave these assignment sheets to their public librarians.

The team members were also asked what they found most useful about the library component. They indicated that the "Bibliography" (39%) was most useful. The terms "other" (44%) included statistical information as well as liking the ideas of using the library for math. The "Book Report Forms" (14%) were also listed (See Table 16).

Seventy-six (57.1%) of the team members responded that 1) they did not choose the library unit or 2) they could not use it during the implementation period but were looking forward to trying it later in the year.

When asked what, if any, changes they would suggest for the Library Component, the team members responded in a variety of ways. A sampling of their responses follows:

TABLE 16

Most Useful Aspect of Library
Component during 4 week period
Sept./Oct., 1986

Team Members
N = 57

N	%*	Item
22	39	Bibliography
2	4	Maps on File
8	14	Book Report Forms
4	7	Teacher Assignment Sheets
8	14	Dial-a-Mathematician
1	2	Treasure Hunt
25	44	Other
Total 70		

* Responses total more than N/100% as some teachers used more than one item.

"More time and more direction about using the library but I have made arrangements for the librarian to order more math oriented books for us to use later in the school year."

"Need more information on exercises geared to the primary level."

"A list of public libraries where materials are available."

"Give me more ideas for use of story books in primary classroom."

"Use this component at a different time of the school year."

"Would like to try audio-visual materials".

From the data already presented it can be seen that the workshop participants had some effect on some of their team members regarding library usage for math instruction. To reinforce this, the data from the team members' students must be examined. At the end of the four week implementation period in the Fall of 1986 and again in the Spring of 1987, their students were surveyed.

Table 13 displays the "yes" responses tallied for the team members' students from Fall, 1986, and from Spring, 1987. The data were divided according to the primary, intermediate and upper grade levels.

In the student survey (Appendix E) the questions began "Since school started ..." and were followed by statements

about using different kinds of library materials. The first question asked the students if they had used atlases or encyclopedias to do Social Studies assignments. In the fall, the primary students responded "yes" 40.3% while the intermediate levels "yes" responses were 51.4% and the upper levels' 50%. By spring the "yes" responses had increased at all levels with the greatest change at the intermediate level - from 51.4% to 86.1%, a 25.3% change. The team member teachers had indicated their use of library materials for more than math. Therefore, both students and teachers responded positively about using library materials for Social Studies assignments.

Question 2 was concerned with whether or not students had looked for or used books about numbers and shapes in order to do math assignments. A number of these kinds of books were included on the "Bibliography" (Appendix O). In the fall, the primary students' "yes" responses were 50.9%: the intermediate level responses, 23.2%: and the upper level students responses were 48.6%. By spring, the primary students' "yes" responses had increased to 66%. The intermediate levels responses were 36.5%, an increase of 13.3% while the upper level's responses decreased 6.5% (Table 13).

The next question asked about book reports for Reading and English. The changes from fall to spring for the primary level (44.7% to 99.3%) and the intermediate level

(68.2% to 91.8%) would be considered normal over time. Most teachers do have their students go to the library to get books to read for oral and/or written reports. At the upper level the percentages are low for this question - 41.8% in the fall, 57.9% in the spring.

In Question 4 the students were asked if they had used library books to do math homework. As with the workshop participants' students, the team members' students did not answer affirmatively very often. At the primary level, the range was 3.3% "yes" in the fall to .7% "yes" in the spring. The intermediate level students responded "yes" 12.8% in the fall and 1.9% in the spring. The greatest change is seen at the upper level where no students answered "yes" in the fall but 14% did so in the spring.

Question 5 asked if the students had done book reports for math. Here again there is a tremendous change at the upper level where no students responded "yes" in the fall but 28.1% did so in spring. The intermediate level students also showed a positive change, from 8.3% "yes" responses in the fall to 13% in the spring. Only at the primary level did the "yes" response decrease, from 6.2% in the fall to .7% in the spring. Looking back at the data for the upper level, Question 3 (book reports for English and Reading) and then examining this level's responses to Question 5 (book reports for Math), one can see that they were doing book reports for math.

The data collected for Questions 6, 7, and 8 (library usage) were inconclusive and confounding. Students were asked how often they went to school libraries or public libraries, or if a parent took them to a library. These questions did not ask if they were doing math-related assignments. Therefore the student responses are not being used especially since so few of their teachers had contacted the school or public librarians about math assignments given.

COMPARISON GROUP

In order to more fully evaluate the potency of the treatment, a comparison group was formed. It was composed of MCIP Phase I teachers and teachers from a non-MCIP school.

There were twenty-five teachers in MCIP Phase I. Of these, seventeen participated in the Pilot Study (Spring, 1986) by returning student surveys from two of their math classes. Of these seventeen teachers, ten were asked to become a comparison group for the MCIP Phase II study. Of these ten teachers, one never received the student questionnaires and one was no longer teaching. Eight of the teachers returned data which confounded the data returned by the MCIP Phase II teachers. The data from these eight teachers were not reported for this study since it was felt that they had been sensitized by their participation in

phase I of the MCIP, even though it had not contained a library component.

The student responses from the seventeen schools which had participated in the Pilot Study in May, 1986, became the first component of a comparison group. In addition, a school which had no information about, or connection with, the Mathematics Curriculum Improvement Project was visited by the investigator to gather student data. The student surveys were administered by the investigator for grades 1 through 4 and by the classroom teachers for grades 5 through 8. All responses were returned to the investigator on the day school was visited in May, 1987. The data from these students and the Pilot Study students were combined to form a set of comparison data.

Therefore the comparison group was composed of two sets of students who responded in the spring of the year, the Pilot Study group in 1986 and the non-MCIP group in 1987. It was thought that their responses would give a comparison over time in regard to students' perceptions of doing library work for mathematics assignments.

In Table 13 (p. 67) a mean of both sets of student responses was calculated for each of the questions by level (primary, intermediate, upper). For the first question the primary students responded "yes", that they had used an atlas or encyclopedia to do social studies assignments for a $\bar{X}$% of 47.9% while the intermediate levels $\bar{X}$% "yes" responses

were 70.4% and the upper level, 82.7%.

Question 2 on the student survey inquired about students' looking for and using books about numbers and shapes to do math assignments. The comparison group's "yes" responses to this question were: primary, 66.9%; intermediate, 32.4%; and upper 19.5%.

Question 3 (taking our library books to do book reports for English and Reading) elicited the following "yes" responses: from the primary students, 79.5%; from the intermediate students, 61.6%; and from the upper level students, 74.2%.

Question 4 sought information about students' using library books for math homework. The comparison group students "yes" responses were as follows: primary level, 5.6%; intermediate level, 1.4%; and upper level, 0%.

Question 5 was concerned with whether or not students had done book reports for math. The students in the comparison group responded "yes" 8.3% at the primary level: 1.4% at the intermediate level; and 0% at the upper level.

The second section of the student survey asked how often the students went to their school or public libraries, or if a parent took them to a library. These questions resulted in data that were not clear or precise. Therefore this section has not been included in this presentation.

RESULTS OF RESEARCH QUESTION #2

The second research question asked if the workshop participants, trained by a librarian, could transfer the training to the teachers who were their team members. As seen in Table 10 (p.60) the MCIP Phase II workshop participants trained from two to twelve teachers in their schools. Of the 154 team members, 57 or 42.9% of them chose the library component, which was one of seven options available. The data reported in the previous section show how the team members reported using the library component.

VALIDITY

Before issues of the implications of this study's research findings can be discussed, one needs to consider the process of action research. According to Isaac and Michael the purpose of action research is "to develop new skills or new approaches and to solve problems with direct application to the classroom or working world setting." The stengths of action research are 1) its practicality and direct relevancy to the actual situation; 2) its providing "an orderly framework for problem solving;" 3) its being empirical in that it relies on "actual observation and behavioral data" not subjective opinions of the subjects past experiences; and 4) its being "flexible and adaptive during the trial period."[18] The weaknesses of action

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[18]Stephen Issac and Wm. B. Michael, Handbook in Research and Evaluation (San Diego, CA: Edits Pub., 1971), p. 27.

research are 1) its "sacrificing of control in favor of responsiveness and on the spot experimentation and innovation;" and 2) its lack of scientific rigor which results in weak internal and external validity.[19]

In an explanation of internal and external validity, Campbell and Stanley deliniate the factors which can confound the results of various research designs. In terms of this study, the classes of extraneous variables which produced effects to confound the results of the treatment included the following:

(1) Maturation - the teachers became more comfortable with the MCIP and its library component over time even though this was a one-shot case study. This was seen in student survey results from Fall, 1986, to Spring, 1987.

(2) Testing - the student survey was the same in Fall, 1986, and Spring, 1987. It may have been treated with less importance in the Spring.

(3) Selection - the fact that the subjects (students and teachers) were volunteers would affect their responses.[20]

To strengthen the internal validity, qualitative measures were used: a) the self-reporting of teachers b) the student responses and c) the investigator's own

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[19]Ibid.

[20]Campbell and Stanley, p. 5.

discussions with teacher participants and team leaders.

In terms of external validity, one jeopardizing factor for this study was multiple-treatment interference. For the teachers and students involved in the MCIP this meant treatments/changes were being made in the following areas: mathematics content instruction, home learning activities, and staff development activities which included the treatment concerns of this study - the library component. However, since external validity is concerned with generalizability of a study, it would appear that this study could be replicated easily, given a library media specialist and elementary mathematics teachers. It would be possible to generalize to other populations because the mathematics content/curricula is similar across the United States as reflected in the use of both standardized textbooks and standardized testing programs.

SUMMARY

The findings presented in this chapter indicate that the teacher participants and their students become aware of, and used, to varying degrees, the math-related materials of the library component. With three exceptions (Q_3 Intermediate, Spring; Q_4 and Q_5, upper, Spring) the students of the workshop participants increased their usage of library related math materials. The students of the teacher team members also showed greater use of these materials

except for four instances (Q_4 and Q_5 Primary Spring, Q_4 Intermediate Spring, Q_2 Upper Spring)).

For the three questions (Q_2, Q_4, Q_5) the comparison group, except for the primary level Q_2, showed little use of the library to expand the mathematics curriculum.

The teacher participants showed a willingness to expose their students to math related library materials. The items they used and the questions they asked indicate that they might benefit by more information and materials.

CHAPTER V

Discussion of Results

The intent of this study was to discover ways in which the elementary teachers involved in the Mathematics Curriculum Improvement Project could be made aware of, and helped to use, math-related library materials and activities. In April, 1986, a pilot study student survey was developed and tested with the MCIP Phase I participants. The data are reported in Chapter I of this study. These surveys, returned by seventeen of the twenty-five teachers, were tallied and examined before preparing the survey used with this study's student population. From May, 1986, through July, 1986, the investigator completed the following activities: 1) the student survey (Appendix E) was finalized; 2) bibliographies, learning activities, and lesson plans/presentations for MCIP Phase II (July/August, 1986) were developed; 3) evaluation forms were written for the workshop participants and team members (Appendix F,G); and 4) packets of forms for the teachers and students were prepared for distribution in mid-September. Because of the time constraints of the grant, the implementation period was limited to the first four weeks of school or September 30,

whichever came first.

The MCIP was funded in 1987 and again in 1988. This made it easier for the investigator to conduct the follow-up student survey in the Spring of 1987. Additional teachers and schools were asked to participate in the 1987 and 1988 MCIP summer workshops. For these, the investigator revised the Library Component presentations and added information on calculators and some items on science. For the 1988 MCIP workshop the Library Component was published as "Appendix J -Mathematics and Library Assignments", a section of the MCIP Handbook.

During both the 1987 and the 1988 MCIP workshops the investigator gave a one hour presentation instead of four fifteen minute presentations. In addition, the library component materials were put on display before and after the presentations so that the participants had more time to browse. In 1988, the investigator set up the display on a Monday and gave the participants a copy of the bibliography (Appendix O) with a homework assignment. They were to visit their public library, locate two or three items from the bibliography and bring these items to the workshop sessions on Wednesday when the investigator was to give the formal Library Component presentation. This technique proved effective in two ways; the teachers became familiar with their public library's holdings and some of the librarians

asked for copies of the bibliography.

In the final report on the MCIP to cover April 1, 1986 - September 30, 1986, Drs. Schiller and Smith wrote:

> "One of the most interesting unanticipated outcomes of the project centered on a short, supplementary component called Math and the Library. Four 15 minute presentations were given on the use of the library for mathematics during the summer project. In written descriptions of the strengths of the project, participants reportedly referred to this component with enthusiasm."[21]

Their enthusiasm could be attributed to their not ever having thought of using library materials for mathematics assignments and to their discovery of how many such materials existed.

In this study the first research question wanted to determine if there were any differences between the workshop participants' use of these mathematics related library materials as compared to the team members' use of the same materials. In Tables 11 (p. 63) and 15 (p. 73) are listed the results from the seventy-five teachers who chose the Library Component. The workshop participants showed greater use of the Book Report Forms, Encyclopedias, Dial-a-Mathematician, Treasure Hunt, Almanac, and Bibliography. In terms of availability, all the teachers had copies of the Book Report forms and the Dial-a-Mathematician. The Treasure Hunt (Home Learning Activity C) was a little more

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[21]Diane Schiller and Kay Smith, "Final Report: Mathematics Curriculum Improvement Project," Loyola University, April, 1986 - September 20, 1986, p. 7-8.

difficult to do unless the students has access to an encyclopedia at school, at home, or in a library. The least used item was Maps on File since none of the schools had the item or were able to purchase it quickly. However, handouts from Maps on File were distributed to the workshop participants and could have been used for math lessons.

The Book Report forms were used by six or 33% of the workshop participants and by eleven or 19.3% of the team members. The workshop participants' students' responses show that 2.5% of the primary, 10.6% of the intermediate and 21.7% of the upper level students had been given mathematics book reports during the 4 week MCIP implementation in Sept.-Oct., 1986. By Spring, 1987, there was increased use by the primary level (up to 12%) and the intermediate level (up to 31.3%). The upper level students, however, dropped from 21.7% to 2.5%, a decrease of 19.2%. There are two possible explanations for this. First, the workshop participants were enthusiastic in the fall and were eager to try some aspect of the library component. Second, in the first weeks of school much of the math content is reviewing material but, by spring, there is pressure to cover all the materials in the math textbook. Perhaps there was not time for extras, eg. a math book report. A reverse trend occurred with the team members' students during the Fall, 1986. Use by level was: primary 6.2%, intermediate 8.3%, and upper 0%. By Spring, 1987, the intermediate level

increased to 13% while the upper level students responded "yes" 29.1%. One explanation could be that the team members hadn't had time in the fall to study all the activities in the library component. Perhaps they had not been informed about the book report. Eleven or 19.3% of these teachers reported using the forms in the fall. Another possible explanation is that the spring student surveys were received from 35 team members, all of whom were then using the library component.

In the fall of 1986 the teachers, both workshop participants and team members, had two major complaints about the library component. First was the inadequacy of their school library collections. Even though 28 of the workshop participants' schools had libraries and 20 had librarians (Table 10 p. 60), this did not mean the holdings included any or many of the items listed on the Bibliography (Appendix O). Second, they complained that there was not enough time during the workshop session in August and during September for implementing suggested activities of the Library Component. The comments below reinforce this.

> "I would have liked to have had more time devoted to the library component. The person doing this aspect of the program seemed to have a wealth of information to share and always too little time for her presentation. I think this could have been the main presentation for week three or four."
> "I need the rest of the school year to try many of the library component ideas."

The teachers indicated that at the beginning of the school year it was difficult to carry out the project requirements

of teaching a new unit and one supplementary component. It took time to settle the classes down into the daily school routine and also do all the additional paperwork required upon school reopening. More than one teacher responded "use this component [library] at a different time of the year".

In looking at the student responses of the Comparison Group (Table 13), their use of library books about numbers and shapes (Q_2) compares favorably with both the workshop participants and team members groups' students - about 66%. The major differences are seen between teacher groups for questions 4 and 5.

Spring, 1987 $\bar{X}$%* of "Yes" Responses

		Workshop Participant	Team Member	Comparison
		$\bar{X}$%	$\bar{X}$%	$\bar{X}$%
Q_4	Primary	28.6	.7	5.6
	Intermediate	17.2	1.9	1.4
	Upper	3.3	14.0	0.0
Q_5	Primary	12.0	.7	8.3
	Intermediate	31.3	13.0	1.4
	Upper	2.5	28.1	0.0

* $\bar{X}$% = Mean Percentage

Q_4 Library books for math homework
Q_5 Assigned book reports for math

Question 4 (using library books for Math homework) shows that the workshop participants' primary students $\bar{X}$% was 28.6% while the Comparison groups' students $\bar{X}$% was 5.6%; at the intermediate level 17.2% to 1.4%; and the upper level 3.3% to 0.0%. At all three levels, the comparison group did not use library books for math assignments more than the other teacher groups except for the team members' primary

students $\bar{X}$% of .7% to 5.6% for the comparison group. There is nothing to indicate why this occurred. The same phenomena can be observed for question 5. At the primary level, the team members' $\bar{X}$% was .7 and comparison group's was 8.3%. In all other instances the workshop participants' students and the team members' students responded positively to having been assigned book reports for math. One cannot assume that the teachers in any of the groups were more likely to be library users themselves. This factor was an extraneous variable which could have had an effect on teacher assignments and student responses.

The person presenting the library component was a librarian or the workshop participant whose use or knowledge of the library was unknown. The second research question sought to determine how differences (in the presentation) of the library component might affect the usage of materials by the teachers themselves and by their students. The impact of the librarian, over time, seems to have been more

effective. In Table 13, the workshop participants' students, on the whole, out performed those of the team members. The one exception to this was at the upper level for Questions 4 and 5 in the Spring when the team members' students $\bar{X}$% responses were 9.7% and 25.6% more than those of the workshop participants. Therefore, it appears that the presentation by the librarian had a greater impact on teachers than the teachers' sharing the library component with their peers, the team members. Since the schools involved in MCIP were divided into teams covering geographic areas, it is suggested that the librarian could attend these team meetings to answer questions or to present new materials. This type of follow-up would cover two bases: 1) reinforce information already presented and 2) practice what research has discovered about the inadequacy of "one-shot" presentations.

Implications for the Future

The teachers who chose the library component showed their interest and enthusiasm by responding to the surveys and in making suggestions to make the component better. Since the investigator was unable to involve the librarians in this study due to their unavailability or the time constraints, it is suggested that in the future the team meetings or general meetings include the librarians. The investigator could meet with them separately and later with

the teachers and librarians together. With the cooperation of the librarian, a more vigorous research design could be prepared to include a pre/post usage of the mathematics holdings in the school libraries. In addition, the school librarian would be able to reinforce the concepts of the library component through interaction with both the teachers and the students.

Conclusions

In Blazck's study (1971), he worked with one teacher with two classes, a librarian and a third teacher for control purposes. In this study the investigator worked with over 200 teachers, and, ultimately, their thousands of students. Today, most mathematics teachers still are not aware of the library's resources nor are librarians aware of the needs of mathematics teachers. However, as a result of this study, a few more teachers have been presented with possible uses of the library and its resources for their mathematics curricula.

Blazck's study and this one have shown that:

1) teachers and librarians need to communicate about math needs and resources;

2) keeping current with professional mathematics associations and journals is a must for both teachers and librarians;

3) funding must be found by school systems and/or

principals and librarians to build library collections, especially in math and math-related resources;

4) teacher education in mathematics through undergraduate methods courses and staff development at the graduate level or on-site workshops should include a library component;

5) the bibliographies of print materials prepared for this study should be up-dated annually and expanded; and

6) bibliographies of mathematics audio-visual materials, manipulatives and computer courseware need to be developed.

Summary

Math and science are an integral part of today's information age technologies. Students must learn and apply math to everyday life. Teachers must feel confident with math content and be able to implement various teaching/ learning strategies for their students to learn math without needless anxiety. Thus, the study of math must not be limited to a textbook. Open wide the gates to resources in mathematics: books, magazines and newspapers, audio-visual materials, manipulatives, computer courseware. All are available through libraries and librarians.

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APPENDIX A

APPENDIX A

STUDENT QUESTIONNAIRE

PHASE I MCIP

May, 1986

GRADE_____ Circle One BOY GIRL CIRCLE YOUR ANSWER

WHEN MY TEACHER SENDS ME TO THE LIBRARY,

I use atlases and encyclopedias to do my Social Studies assignments.	YES	NO	SOMETIMES
I look for books about numbers and shapes to do my Math assignments.	YES	NO	SOMETIMES
I take out fiction books to do book reports for English and Reading.	YES	NO	SOMETIMES
I do my homework by using textbooks.	YES	NO	SOMETIMES
I read books about sports.	YES	NO	SOMETIMES
I look up statistics on countries of the world.	YES	NO	SOMETIMES

I USE THE SCHOOL LIBRARY.	ONCE A WEEK	ONCE A MONTH	NEVER
I USE THE PUBLIC LIBRARY.	ONCE A WEEK	ONCE A MONTH	NEVER
MY PARENTS TAKE ME TO A LIBRARY.	ONCE A WEEK	ONCE A MONTH	NEVER

APPENDIX B

APPENDIX B

MATHEMATICS CURRICULUM PROJECT

58 Northgate Road
Riverside, IL 60546

May 14, 1986

Dear Teacher-Volunteer,

The questionnaires in this packet are to be used to gather base-line data about your students' library usage. There are seventy copies, enough for two of your mathematics classes. For the lower grades, you may need to substitute the words "story books" for "fiction" in the question on book reports. Also, if their responses to the last three questions are more than "once a week" or "once a month", they could indicate that number of times by "2X, 3X, etc.".

Any information gathered from this questionnaire will be treated confidentially. Any codings for statistical purposes will guarantee anonymity.

Please complete the following:

Your Name:
Your School:
Grade level of _____Class 1 _____Class 2
Number of students _____Class I _____Class 2

By May 30, 1986, please return the following items int he enclosed, stamped envelope: 1) this sheet, 2) completed questionnaires, and 3) any blank copies of questionnaires.

Thank you for your cooperation. I look forward to working with you.

Sincerely,

Denise G. Dwyer
Graduate Student,
Loyola University

APPENDIX C

APPENDIX C

58 Northgate Road
Riverside, Illinois 60546

September 2, 1986

Dear

A group of students from _____ School are involved in a Mathematics Curriculum Improvement Project co-sponsored by Loyola University and the Office of Catholic Education, Archdiocese of Chicago.

The teacher involved has received a library component containing a bibliography of math-related items, sample worksheets and book report forms as well as form letter to let you and the school librarian know what the assignments are. Enclosed you will find 1) a sample of the teacher assignment sheet which the teachers have been encouraged to send you, and 2) book report forms for the primary and intermediate/upper levels.

Hopefully, you will see an increase in the use of the items in your mathematics collection. I told them that not all libraries would have all the items listed on the bibliography but that they would be able to find similar items.

I hope you find the above information helpful. If you have any questions, I can be reached at Kenwood Academy Library Media Center from 7:30 a.m. - 2:00p.m. (536-8877) or at home (447-7105).

Sincerely,

Denise G. Dwyer
Graduate Student
Loyola University

Enclosures (3)

APPENDIX D

APPENDIX D

MATHEMATICS CURRICULUM IMPROVEMENT PROJECT

September 2, 1986

Dear Eileeen,

Thank you so much for your interest in this project. Enclosed you will find the evaluation forms as listed in number 6 of the Staff Development Feedback Material.

1) Student responses for your class (choose only one of your classes involved in the project.) Have the students give on answer for each of the items. For the younger students you may have to read each item aloud.

2) Your response--Please answer this as succinctly as possible. We have tried to keep it short and to the point.

3) Packet for team member--Included are a set of student responses for one class and one copy of the team member response. This packet is to be completed and returned to you and then you will issue the remuneration.

4) Added to the above, you will need to include your responses to items 1, 2, 3, & 4 as listed on the Staff Development Feedback Material.

All forms and responses should be completed between September 22 and September 30, 1986. Mail them in the stamped, addressed envelope. Your remuneration will be mailed upon receipt of all the data requested.

We look forward to your continuing interest. We are writing a proposal for Phase III of the project. We will inform you of our

progress in this regard as soon as possible. Thank you again for your enthusiasm and cooperation.

Sincerely,

Denise G. Dwyer

Diane Schiller, Ph.D.

Enclosures(4)

APPENDIX E

APPENDIX E

STUDENT QUESTIONNAIRE PHASE II MCIP

SCHOOL _____GRADE _____ CIRCLE ONE BOY GIRL

Circle your Answer

SINCE SCHOOL HAS STARTED,

Our class has used an atlas and/or an encyclopedia to do Social Studies assignments. YES NO

Our class has looked for or used books about numbers and shapes to do Math assignments. YES NO

Our class has taken out library books to do book reports for English and Reading. YES NO

Our class has used library books to do Math homework. YES NO

Our class has been assigned a book report for Math. YES NO

SINCE SCHOOL STARTED,

Our class has used the School Library. 1 time 2 times 3,4,.. times

Our class has been sent to the Public Library. 1 time 2 times 3,4,.. times

I have gone to the library with my Mom or Dad. 1 time 2 times 3,4,.. times

---

What did you like most about the unit we just studied in Math?

What did you like least about the unit we just studied in Math?

Was this different from other Math lessons?

Would you like to do another Math unit like this?

APPENDIX F

APPENDIX F

WORKSHOP PARTICIPANT

MATHEMATICS CURRICULUM IMPROVEMENT PROJECT LIBRARY COMPOENENT

UNIT CHOSEN: Check one (or more, if you had time to teach more. Then check the library-related materials used to teach the unit(s).

___DATA COLLECTION	___ALGEBRA	___PROBABILITY
__Atlas	__Treasure Hunt	__Almanac
__Encyclopedia	__Dial-a-Mathematician	__Encyclopedia
__Almanac	__Maps on File	__Statistical Abstract of the U.S.
Statistical Abstract of the U.S.	___Book Report	Maps on File exercises/or adaptation of these
___Book Report	___Bibliography	___Book Report
___Bibliography	___Other	___Bibliography
___Other	_____	___Other
_____		_____

OTHER SUBJECT AREA: (Fill in) _____Check following:
Sources used ___Dictionary ___Almanac ___ Atlas ____Encyclopedia
___Book Report ___Bibliography ___Maps on File

___ Other _____

ASSIGNMENT SHEETS:
Did you give/use assignment form to inform school librarian of class assignment? _____ YES _____NO

Did you give/send/use assignment sheet to infomr public librarian of class assignment? _____YES _____NO

TEAM PROGRAM:
Did you use videotapes of workshop sessions to inform your team members about
___the Math component ___the Methods component ___the Library component

What was the most useful aspect of the Library component? _____

_____

the least useful? _____

_____

What would you change in the library component? What would you need that we didn't do?_____

_____

APPENDIX G

APPENDIX G

TEAM MEMBER

MATHEMATICS CURRICULUM IMPROVEMENT PROJECT LIBRARY COMPOENENT

UNIT CHOSEN: Check one (or more, if you had time to teach more. Then check the library-related materials used to teach the unit(s).

___DATA COLLECTION	___ALGEBRA	___PROBABILITY
___Atlas	___Treasure Hunt	___Almanac
___Encyclopedia	___Dial-a-Mathematician	___Encyclopedia
___Almanac	____ Maps on File	___Statistical Abstract of the U.S.
Statistical Abstract exercises/or these)	___Book Report	___Maps on File (or adaptation of
___Book Report	___Bibliography	___Book Report
___Bibliography	___Other	___Bibliography
___Other	_____	___Other

OTHER SUBJECT AREA: (Fill in) _____Check following:
Sources used ___Dictionary ___Almanac ___ Atlas ____Encyclopedia
___Book Report ___Bibliography ____Maps on File
___ Other _____

ASSIGNMENT SHEETS:
Did you give/use assignment form to inform school librarian of class assignment? _____ YES _____NO

Did you give/send/use assignment sheet to infomr public librarian of class assignment? _____YES _____NO

TEAM PLANNING SESSIONS:
Did the leader of your session use the videotapes of summer workshops to inform you and other team members about _____the Math Component _____the Methods component _____the Library component?
Did you team leader bring library resources to your sessions?_____
How were you informed about the library component? _____
_____
What was the most useful aspect of the Library component? _____
_____
the least useful? _____
What would you change in the library component? What would you need that we didn't do? _____
_____

APPENDIX H

APPENDIX H

WORKSHOP PRESENTATION I

MATHEMATICS CURRICULUM PROJECTS --- LIBRARY COMPONENT

SESSION I

I Introduction

Library can do much to extend mathematics instruction.
Resources are available in library.

II General Reference Sources

A. Encyclopedias — Use opaque and overhead projectors

World Book — Treasure Hunt type activity

B. Dictionaries

Beginning, intermediate, high school level dictionaries
Graphing/data collection

Mathematics dictionaries

C. Almanacs

III Special Reference Sources

A. Statistical Abstract of the United States

B. Dictionary of Sports

C. McGraw-Hill Encyclopedia of World Biography

Dial-a-Mathematician sheet

D. The Baseball Encyclopedia — Graphing/statistics

APPENDIX H

WORKSHOP PRESENTATION II

MATHEMATICS CURRICULUM PROJECT --- LIBRARY COMPONENT

SESSION II

I Introduction

Continue with special resources

II Muir, Sharon Pray and Helen Neely Cheek. "Mathematics and the Map Skill Curriculum," School Science and Mathematics 86 (4) (April 1986): 284-291.

III Atlases

IV Maps on File from Facts on File

Use transparencies of maps for a) latitude/longitude
b) data collection

V Webster's Geographical Dictionary

Worldmark Encyclopedia of Nations, Worldmark Encyclopedia of the United States

Lands and Peoples

VI Chicago Public Library

Homework Centers

Branches use transparency of map of branches

Assignment sheet

APPENDIX H

WORKSHOP PRESENTATIONS III AND IV
MATHEMATICS CURRICULUM PROJECT --- LIBRARY COMPONENT

SESSION III

I Introduction

Recreatinoal reading in mathematics

Matthias, Margaret and Diane Thiessen. Children's Mathematics Books A Critical Bibliography

II Use opaque projector/overhead projector to show examples of Books on primary, intermediate and upper levels for:

A. Counting

B. Geometry

C. Measurement

D. Number Concepts

E. Probability/Statistics

F. Codes and math puzzles

III How to do a book report -- distribute form

SESSION IV

I Introduction

Professional reading

II Bibliographies

A. Professional books

B. Professional journals

Handouts of title pages or sample articles

The Arithmetic Teacher

The Mathematics Teacher

The Illinois Mathematics Teacher

School Science and Mathematics

III Conclusion/Question and answers about these four sessions

APPENDIX I

APPENDIX I

MATHEMATICS CURRICULUM PROJECT —— LIBRARY COMPONENT

It is important to teach subjects and skills in tandem. The library media specialist and the classroom teacher need to plan together.

What skills are to be taught? Teacher and librarian shall decide who is to introduce, develop and reinforce skill/subject or topic.

Research tells us that mathematics teachers rarely utilize resources of the library to extend their instruction. How can we change this?

In the Guidelines for the Preparation of Teachers of Mathematics, the section on Library Materials and Instructional Media Center states that appropriate print and non-print resources should be provided for both students and teacher and that they be encouraged to use the variety of materials available.

During the four sessions set aside for the library component you will become familiar with a variety of library resources and how you can use them to extend your mathematics instruction.

APPENDIX J

APPENDIX J

HOME LEARNING ACTIVITY C

Questions about Numbers Outside of the Math Class

Many times we assume that mathematics and numbers are only found in the mathematics class, but actually numbers are used in everyday situations. The following questions will check your knowledge of some uses of numbers in the real world. To help you locate the answers or information needed to determine the answer, the subject headings for each question are given from the World Book Encyclopedia. Other encyclopedias could be used but the subject headings could vary.

1. Bicycle sizes are given in inches. What does it mean to say a bicycle is a 26-inch bicycle?
   Subject: BICYCLE Source: World Book Vol. 2

2. A number of 2 1/2 pencil contains more of what common substance mixed with the graphite in the lead than does a number 2 pencil?
   Subject: PENCIL Source: World Book vol. 8

3. Gold clubs are named by using numbers and material, such as number 2 wood and number 5 iron. As the number increases, does the loft increase or decrease?
   Subject: GOLF Source World Book vol. 8

4. In the manufacture of whiskey, numbers are used to indicate the proof. Specifically, what does 80 proof mean?
   Subject: WHISKEY Source: World Book vol. 21

5. Geologists break the earth's history into eras, periods, and epochs, not of uniform length. Which of the three divisions of time is about 50 million years?
   Subject: EARTH Source: World Book vol. 6

6. Lawn fertilizer is often described by using three numbers, such as 25-10-5. What does the first number ordinarily indicate?
   Subject: FERTILIZER Source: World Book vol. 7

7. The size of a juice or vegetable can is given by numbers usch as 1,2, or 3. A number-2 can contains how many cups?
   Subject: CANNING Source: World Book vol. 3

8. Automobile tire sizes often given by a letter and a set of numbers, such as H 70-15. The 15 means the tire fits a wheel of 15 inches in diameter. What does the 70 indicate?
Subject: TIRE Source: World Book vol. 19

9. One of the numbers used in a weather report gives the dew point. What does it mean to say the dew point is 36 degrees?
Subject: DEW POINT Source: World Book vol. 5

10. What does a gasoline octane rating of 93 mean?
Subject: OCTANE NUMBER Source: World Book vol. 14

11. The location for receiving a particular station on a radio dial is indicated by a number, such as 1140 on the dial. What does the number represent?
Subject: RADIO/Tuner Source: World Book vol. 16

12. One of the numerals found on a package of light bulbs indicates lumens. How many watts (40, 60, 75, 100, or 150) are needed to yield an output of 860 lumens?
Subject: ELECTRIC LIGHT Source: World Book vol. 6

13. Several numerals appear on the face of paper money, such as the serial number and the denomination. In addition, a numeral, such as 2, 7, or 12, appears four times, once in each quadrant of the face. What does this number indicate?
Subject: MONEY Source: World Book vol. 13

14. How long is an eight-penny nail in inches?
Subject: NAIL Source: World Book vol. 14

APPENDIX K

APPENDIX K

BOOK REPORT: PRIMARY - INTERMEDIATE LEVELS

NAME: DATE:

AUTHOR OF BOOK: _____

TITLE OF BOOK: _____

How does this book help you know more about numbers? Write two or three sentences about the book?

_____

_____

_____

Can you draw a picture to show what the book told you about numbers or shapes?

Circle one answer: I found this book at my school library.

I found this book at my public library.

BOOK REPORT: INTERMEDIATE - UPPER LEVELS

NAME: DATE:

AUTHOR OF BOOK: _____

TITLE OF BOOK: _____

How does this book help you know more about mathematics?

Write a short summary of what you learned about mathematics.

_____

_____

_____

_____

_____

_____

Can you do a problem or draw something from the book which will show what you have discovered about math?

Circle one answer: I found this book at my library.

I found this book at my public library.

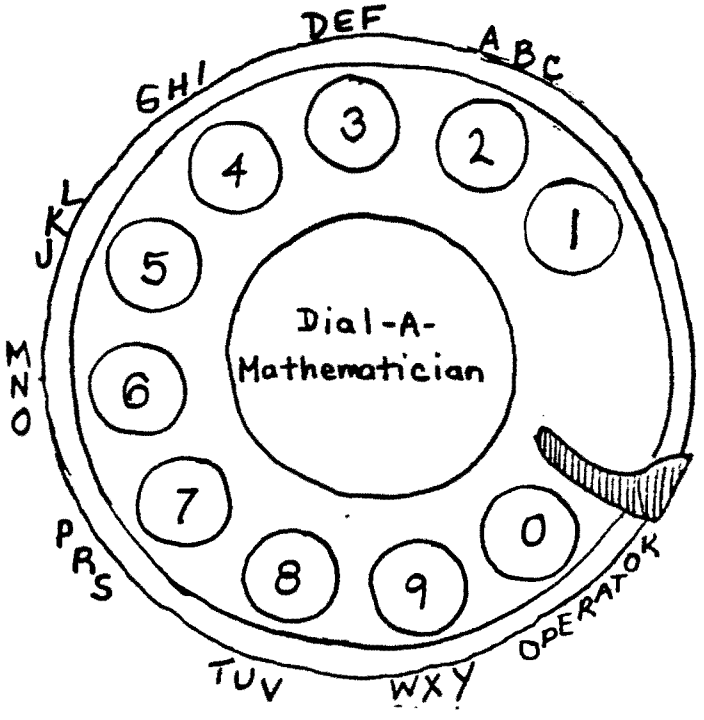
APPENDIX L

APPENDIX L

DIAL-A-MATHEMATICIAN

This game allows students to become acquanited with the names of a few famous mathematicians. By dialing the number which follow, the student will discover who will answer the phone. Students receive points for number of correct answers.

1. 382543
2. 7984246727
3. 22663537
4. 727225
5. 7436266
6. 26934824
7. 337227837
8. 34678346
9. 229539
10. 337628



In addition, students might like to find out more about these famous people by reading the World Book Encyclopedia article "Mathematics". Some might like to read Jean Lee Latham's Carry on, Mr. Bowditch (Houghton-Mifflin, 1955). Other Sources to use would be 1) Clark, Margaret G. Benjamin Banneker: Astronomer and Scientist (Garrard, 1971); 2) Bell, E.T. Men of Mathematics (Simon and Schuster, 1937); 3) McGraw-Hill Encyclopedia of World Biography (McGraw-Hill, 1973).

The answers for the game are 1. Euclid 2. Pythagoras 3. Banneker 4. Pascal 5. Riemann 6. Bowditch 7. Descartes 8. Einstein 9. Cayley 10. Fermat.

APPENDIX M

APPENDIX M

MAPS ON FILE or other maps with statistical information can be used to generate questions and problems similar to those which follow.

1. POPULATION GROWTH -- look up the population for countries (on map) in an almanac. Find the number of new people in country (% growth rate X population).

2. ELECTRIC BILLS -- Find the average bill for the North Central State (IN, MI, IL, OH, WI, MN, ND, SD, NEB, MO, IO). Find the range; use the states as sets and subsets.

3. DEATH RATES/BIRTH RATES -- What is the total death rate for fourteen states and Washington, D.C. whose rates were below 9,999? Are these same states the ones with the lowest increase in births (under 19,999)? Look up the population of one state (in an almanac or encyclopedia) and compute the rations of births and deaths from total population to show change.

4. SCHOOL ENROLLMENT -- How many more students are enrolled in Illinois than in Indiana? To make a bar graph -- take any ten states' school enrollments and compare with each states' total population.

5. TRAFFIC DEATHS -- What does "per million traffic miles" mean? Is it safer to drive in New york or in Illinois? Look in an almanac or The Statistical Abstract of the United States to discover how many traffic deaths are the result of drunken drivers. Will these statistics affect students personnally in terms of the age at which they can obtain a driver's license,

the cost of auto insurance for young people under 25, and the age at which they can purchase liquor?

6. TEMPERATURE -- Use a map and charts from an encyclopedia along with an almanac (eg. New Mexico) to compare the differences in temperatures within the state or a country. Which city, Albuquerque or Roswell, is warmer? What is the range of temperatures for the two cities (highs, lows)? What is the highest Celsius temperature for both cities? What is the average temperature for each city during the months of June, July, and August? After looking at a shaded map, can you estimate the proportion of the state of New Mexico having temperatures of 88 or more during July?

-- Using an atlas, locate city (cities) to pinpoint location (grid codes). Is city north or south of the equator? How close to the equator is it? Does this affect the temperature?

- Using an almanac, find a list which will give the ten hottest cities or ten coldest cities in the world. Go to the atlas and locate them. Make a bar graph to show locations close to, and far from, the equator.

-- Using an encyclopedia, find climate and temperature information on the a) a number of hottest or coldest cities in the world b) capital cities of countries and/or c) capital cities of the United States.

7. TREES -- From this list about trees, taken from the Statistical Abstract of the United States, ask the following questions: Is there a tree taller than the Sequioa? If yes, what tree is it?

R -S = ___. How many trees are found in Oregon ___, California ____, and Florida ____ on this list? How many states are mentioned on this list? Make a bar graph a) for the ten smallest trees, and b) the ten tallest trees. What is the average height of the trees on the list? the range?

8. MAPS -- Find a map of your neighborhood or draw one. Put a symbol (eg. a small triangle) at your home address, at your school address, and at the address of your public library. How far is it from your house to school? from your school to the public library? Draw the route you would take to go to school, from school to the public library, from home to the public library? Draw the route you would take to go to school, from school to the public library, from home to the public library. Be able to describe how many blocks you would walk (or ride your bike) to reach each place. What different directions would you have to take? Plot these routes out on your map.

APPENDIX N

APPENDIX N

TEACHER ASSIGNMENT SHEET

TO: _____ School Library

FROM:

Grade Level _____ Number of Students _____

The assignment will be given _____ and is due _____.

TOPIC:

ASSIGNMENT:

The students will probably need to use the following materials:

The students will need to come into the library as a group or in small groups of 5 or 6. Would the following date (s) _____ be available at _____ period?

Do you have any other suggestions? Are there any items which could be placed on researve for this assignment? The assignment sheet is attached (if one was given out).

TEACHER ASSIGNMENT SHEET

TO: _____ Public Library

FROM: _____School

Number of students _____ Grade level _____

The assignment will be given _____ and is due _____.
TOPIC:

ASSIGNMENT:

The students will probably need to use the following materials:

Do you have any other suggestions? If so, the school phone number is _____. The assignment sheet given to the students is enclosed (If one was given out).

APPENDIX O

APPENDIX O

MATHEMATICS CURRICULUM PROJECT LIBRARY COMPONENT

SELECTED BIBLIOGRAPHY OF MATHEMATICS MATERIALS

The materials listed in Part One may be used to give mathematics related assignments. The starred items can be found in the Chicago Public Library's Homework Centers which are located near the Children's Section. In most public libraries in the area you will be able to find the items listed in the Reference Section. The holdings of the school and public libraries will vary as far as the other items are concerned. General encyclopedias were not listed in the bibliography but will be available in all libraries, Part Two lists items for you and your librarian.

The following information concerns some professional journals and journal articles which you may find useful.

The Arithmetic Teacher and/or The Mathematics Teacher

Individual membership in the National Council of Teachers of Mathematics entitles you to one of the journals listed above. The second journal would cost an additional $13. Membership dues are $35, but institutional membership is $40: 1906 Association Dr., Reston, Va., 22091

Exceptional Children Council for Exceptional Children
1920 Marine St., Farmingdale, NY 11735

Journal of Recreational Mathematics Baywood Publishing Company
120 Marine St.,
Farmingdale, NY 11735

The Illinois Mathematics Teacher Membership in the Illinois Council of Teachers of Mathematics: dues $10/regular member;

$5 for Senior Citizens or Student members; $15 for institutional membership. Address: Hal Anderson, Mathematics Department, Eastern Illinois University, Charleston, Il., 61920.

Mathematics Student Geared for grades 7 through 12; subscriptions are by group rate only. Address: Donald H. Firl, NCTM, 1906 Association Drive, Reston, Va., 22091.

School Science and Mathematics School Science & Mathematics Association, 126 Life Science Bldg., Bowling Green State University, Bowling Green, Ohio 43403. Individual membership is $19/institutional is $22.

If you have any questions regarding the Library Component, you are welcome to contact me, Denise Dwyer, at my home number 447-7105, or at my school number (Kenwood Academy Library Media Center 536-8877).

MATHEMATICS CURRICULUM PROJECT LIBRARY COMPONENT

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The CODING information is as follows:

A	Pre-school through grade 3
B	Grades 4 through 6
C	Grades 7 and 8
D	All grade levels. Some of the items with this coding can be used by the teacher to present concepts or by older children to younger children.

Please note that the coding information is a guideline for you to suse. Some of the items may be used with older children if you are just introducing a topic.

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JOURNALS

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APPENDIX P

APPENDIX P

Loyola University
School of Education
MCIP
820 North Michigan Ave.
Chicago, IL 60611

April 15, 1987

Dear MCIP Participant,

Thanks for your help in the past. Since many of you indicated that the rush at the beginning of the school year made it difficult to cover all bases (including the library component), we are not sure if our data is meaningful. Therefore, we are asking you again to have your students complete the enclosed questionnaires. Please return them in the stamped envelope by May 8, 1987.

There will be a library component in the summer program. If you have any suggestions for it, please let me know by including a note when returning your students' questionnaires.

Thanks again for your cooperation. We are looking forward to working with you once more.

Sincerely,

Denise G. Dwyer

Diane Schiller, Ph.D.

APPROVAL SHEET

The dissertation submitted by Denise G. Dwyer has been read and approved by the following committee:

Dr. Diane Schiller, Director
Associate Professor, Curriculum, Loyola

Dr. Todd Hoover
Associate Professor, Curriculum, Loyola

Dr. Kay Monroe Smith
Associate Professor, Curriculum, Loyola

Dr. William Brace
Professor, School of Library Science, Rosary College

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 Philosophy.

Nov. 29, 1989
Date

Diane Schiller
Director's Signature