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ABSTRACT

The Mat-Su Math Co-op Project was a joint effort by the mathematics department of the University of Alaska Anchorage, Matanuska-Susitna campus, and the Matanuska-Sustina Borough School District (Alaska) in the 1990-1991 and 1991-1992 school years. The project was designed to train 40 teachers from the district in improved mathematics instruction techniques, with the intent of returning those teachers to their schools to train and assist other teachers. Seminars and workshops were conducted during the fall and spring semesters, and a 4-day summer session was conducted during the summer. During the first year, K-12 teachers were targeted and, during the second year, K-8 teachers. The project's chief outcomes include providing teachers with strategies, skills, concepts, and content necessary to teach mathematics in a manner that integrates problem solving, manipulatives, computers, and classroom management. The ultimate goals of the project are to improve mathematics comprehension by students; reduce math anxiety on the part of teachers and students; and increase the number of students prepared for high school and college mathematics. Problems encountered during the project included heavy demands on teachers' time, difficulty of discussing math content with teachers from a broad spectrum of math backgrounds, and misunderstandings among some teachers about the intent of the project. Included in the paper are syllabi from courses taken by project participants, an overview of the implementation plan, and a bibliography which contains 17 references. (IAH)

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COOPERATIVE TRAINING AND RETRAINING FOR ELEMENTARY SCHOOL TEACHERS

by

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COOPERATIVE TRAINING AND RETRAINING FOR ELEMENTARY SCHOOL TEACHERS

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* How do we teach mathematics effectively to a group of students who are having difficulty in learning?

* How do we retrain our school teachers in order to meet the needs of our new generation of the 21st century?

* How do we stimulate students' interests in learning mathematics?

* How do we prepare our students meet the competitive challenge from the other countries in order to redeem ourself for past decades' failure?

* How do we use home entertainment such as video games, televisions, and other electronic devices to compete with the school for time needed to prepare the students educationally? (Chang, 1989)

These very important questions are being asked within our educational communities everywhere (Chang, 1985).

Mathematics anxiety exists among elementary school teachers who do not have extensive mathematical knowledge. Because

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This report was based on the author's Eisenhower Grant entitled "Mat-Su Math Co-op Project" from 1990-1992. This project was carried out jointly by the Mathematics Department of the University of Alaska Anchorage at Matanuska-Susitna Campus and the Academy of Instruction, Matanuska-Susitna Borough School District, Alaska U.S.A. from August 1990 to June 1992.

A portion of this report was presented to the American Mathematical Association of Two-Year Colleges, Seventeenth Annual Conference, November 7-10, 1991, in Seattle, Washington. This presentation was supported jointly by a research/travel grant from Vice-Chancellor Dr. Beverly Beeton's Office and the Matanuska-Susitna College/UAA.

A portion of this paper will be presented to the Working Groups (WG6), Pre-Service and In-Service Teacher Education, The Seventh International Congress on Mathematical Education (ICME-7), Universite' Laval, Quebec, Canada, August 17-23, 1992.

The author would like to express his gratitude for the support and encouragement from Dr. Glenn Massay, Director of the College/UAA, and the cooperation and assistance received from Dr. Eli Sorrenson, Superintendent of Mat-Su Borough School District.

of this anxiety, many teachers possess a narrow view of mathematics and believe the only main task to teach mathematics is to emphasize rapid computation and to solve problems quickly and correctly (Hyde, 1989).

As technology advances, "rapid computation" and "find the quick answer" will not be sufficient to prepare our children to maintain a functional mathematical literacy for survival in the next century (Chang, 1988). This view was supported by the National Council of Supervisors of Mathematics (NCSM). Basic skills must be broadened to include such skills as estimation, problem solving, interpreting data, measuring, predicting, and applying mathematics to everyday situations. After this proposition was announced by NCSM (1977), it was endorsed by the MAA (1979) and the NCTM (1980).

The NCSM position statement was revised again to incorporate twelve components of essential mathematics with a reaffirmation of the importance of each in the next century (NCSM, 1989). These include: Problem solving, communicating mathematical ideas, mathematical reasoning, applying mathematics to everyday situations, alertness to the reasonableness of results, estimation, appropriate computational skills, algebraic thinking, measurement, geometry, statistics, probability, and climate for learning.

How do we help teachers develop some level of confidence and competence in doing and teaching mathematics in order to meet these needs? Before exploring this timely issue, the following concerns must be addressed.

> Concern No. 1: Curricula Changes. The curricula of the school system must be revised and teachers' skills upgraded. As society becomes increasingly complex, the need for educational training also increases. The curricula of the school system will have to meet the challenge of providing adequate training for our younger generations. The retraining or re-educating of professionals in order to upgrade their skills is one of the most important tasks facing us today (Chang, 1989).
>
> Concern No. 2: Advanced Facilities vs. Poor Scores. Concerns regarding the less able students in various levels in our school system have arisen among many people across the United States and also throughout many European countries (ICIUT, 1983). Why, they ask, are the school systems experiencing such difficulties in educating students when the systems have been provided new equipment, up-to-date classrooms, advanced facilities, and more professional personnel? Parents are also wondering about the qualifications of teachers in our school systems. Poor quality teaching may be

due to low pay or because teacher training institutions have not upgraded their standards in the respective subject areas such as mathematics (Chang, 1989).

Concern No. 3: American Mathematical Competency. In 1983, a report entitled "A Nation at Risk: The Imperative for Educational Reform" was issued by the National Commission of Excellence in Education (1983). In this report, it was quoted that the international comparisons of student achievement, completed a decade ago, revealed that on 19 academic tests, American Students were never first or second, and in comparison with other industrial nations, were last seven times (The National Commission on Excellence in Education, 1983).

According to a recent report prepared by the Educational Testing Center, American 13-year-olds ranked dead last on a standardized test of mathematics achievement given in 12 countries and Canadian provinces. Only 9% of American students could find the radius of a circle inscribed in a square with a side of length 6, compared to 40% of the Korean students (Jackson, 1989). Besides being tested in math content, the students also answered the statement, "I am good at mathematics." Koreans came last in this category, only 23% answered yes. Americans were Number 1, with an amazing 68% in agreement (Krauthammer, 1990). In other words, the American students view themselves as competent in a field they are actually failing.

Concern No. 4: Goals for the Year 2000. In the past decade, several international comparative studies have indicated that our high school graduates' overall academic abilities rank very low among the industrialized nations (National Commission of Excellence in Education, 1983). Of course, this is one of the biggest concerns in our educational system. President Bush's "Educational Summit" did promise national standards in mathematics and science. The commitment remains vague but does recognize that the objectively measured results and not the feelings of the students, should be the focus of educational reform (Krauthammer, 1990). The National Governors' Association (NGA) drafted a statement that details the rationale for its plan for National Education Goals for the Year 2000. The NGA states, "The challenge facing us is to develop an educational system that is second to none in the world so that all Americans, at all age levels, are as well educated and as highly skilled as our competitors." Such a challenge is obviously one of the most ambitious in this century. The goals cover a life-long learning span, especially the fourth goal which states U.S. students will be first in the world

in mathematics and science achievement (Caudell, and Kneidek, 1990).

For the United States to compete in new technology on an international level will require a pool of human resources to lay a foundation in meeting the challenge. The significance of this issue is that we must examine the current activities of our classroom teachers. In order to implement these goals, the Eisenhower Foundation provides funding via competitive grants to aid teachers in improving mathematics instruction in their classrooms (Reys, Suydam and Lindquist, 1992). The Mat-Su Math Co-op Project is the result of one of these competitive grants.

The Mat-Su Math Co-op Project

The Mat-Su Math Co-op Project was carried out in a joint effort by the Mathematics Department of the University of Alaska Anchorage, Matanuska-Susitna campus and the Matanuska-Susitna Borough School District, Alaska, U.S.A., in 1990-1992. It was designed to train forty teachers from the district in improved mathematics techniques with the intent of returning those teachers to their school to train and assist other teachers.

The project consists of seminars and workshops conducted during fall and spring semesters, plus a four day summer session in early June, where each participant receives a $400 stipend [Appendix A]. The format and instruction mode used includes lecture, demonstrations, group discussions, lab activities, and group project development activities. Topics were intended to implement the twelve components of mathematics suggested by the NCSM. They include, but are not limited to:

* Cooperative Learning in the Math Classroom
* Math in the Mind's Eye
* Teaching Math in the 90's from the view of the Alaska Teacher of the Year
* Algebra Concepts and Teaching Strategies
* Computer Applications
* Curriculum Planning and Evaluations
* Problem Solving and Its Applications (Grades K-8)
* Classroom Management
* Real life concrete models for developing basic math skills
* Implementation of NCTM Standards
* "Show and Tell" sessions from past Math Co-op graduates
* Geometry and Measurement
* Probability and Statistics for grades K-8
* Logic and its Applications

* Reducing the math anxiety of teachers and their pupils.

Attending participants earned eight graduate credits toward staff development in two semesters. As a final project, each of the Co-op participants contribute to the production of the "Mat-Su Math Co-op Manual: Math Lessons/Strategies that Really Work," a streamlined product of the grant. This manual was based on the successful implementation of strategies/techniques learned during the training period. Samples of the syllabus for the graduate level courses Math 620, Ed 670 and Ed 693 are included in Appendices B through E.

Co-op graduates either present a workshop during an inservice day in their schools, or contribute to a seminar for the Co-op projects sessions. Entitled "Show and Tell," the seminar offers an opportunity to share the results from the techniques and materials devised and created during the last Co-op training year. Alternatively, the graduate may serve as a program mentor with a colleague in their school.

The first year's grant (1990-1991) targeted K-12 teachers. In the second year, the needs of elementary school teachers in grades K-8 were emphasized.

During the final phase of the Mat-Su Math Co-op, cooperation among teachers and students was initiated. To satisfy the needs of each individual, the Co-op seeks not only to improve their basic math skills, but also to offer new techniques involving teaching mathematics to youngsters and demonstrate an improved learning climate.

Participants in the project were selected by individual principals from each participating school or were nominated by peer groups or individuals.

The Co-op's project group during the first year's operation under the grant consisted of 27 teachers from grades K-12. Fifteen were men and twelve were women. Eleven each were from elementary level and middle school while five were from the secondary school level. This diversity in itself created a challenge.

With such a group, the needs varied at each level. The lower grade levels needed "tailor-made" programs to teach simple addition and multiplication, plus models for real life situations. Several kindergarten and lower grade-level teachers asked why they needed to study algebra if they already knew how to count, referring to their students' needs. Numerous participants were frustrated by simple factoring problems. They exhibited anxiety toward solving story problems, especially the lower grade-level teachers. They did not know the reasoning behind studying higher-level

mathematics. Apprehension was very apparent in all the participants.

The needs of the middle school teachers were to increase their mathematical abilities. They wanted self-contained models to aid them in teaching percentage and ratio problems.

The high school teachers presented the greatest challenge, being more advanced in their mathematical skills than the rest of the group. Their needs were to develop new skills, such as how to teach discrete mathematics, probabilities and statistics.

The advantages offered by the Mat-Su Math Co-Op Project included:

* Improving skills in mathematics
* Learning new ideas in mathematics instruction
* Increasing teachers' understanding of application of mathematics in "real" life
* Reaching different teachers in one cooperative effort. The participants benefit from interaction with a variety of viewpoints. Linking school districts and the university and individual schools proved to be a beneficial experience for all.
* Alleviating math anxiety and improving math awareness
* Learning how to participate in cooperative teaching activities
* Initiating continued math leadership.

The biggest advantage of this project was increasing teachers abilities to teach math in their grade level and eliminating math anxiety. The same kindergarten teachers that exhibited math anxiety at the onset of the project are now able to answer math problems with confidence and display an aggressive attitude toward problem solving.

Another unexpected advantage for the teachers involved with this project was the fact that for many, this was the first time that elementary and secondary teachers communicated regarding mathematics. High school teachers found out how the elementary teachers were giving instruction regarding fundamental ideas. The high school teachers thereby benefit from the different viewpoints of the elementary teachers, while the elementary teachers were able to find out the areas of weakness that were showing up in the secondary level. The teachers helped each other to the mutual benefit of each level.

The disadvantages observed during the Mat-Su Math Co-op project included:

* Complaints concerning the schedule combined with the fact all of our participants were working teachers. As a result, some of the teachers were physically too tired to attend class in the evening.

* Coordination between the school district and university also presented a few limitations with the obvious bureaucracy involved in such an undertaking.

* Due to the variety of backgrounds of the teachers, it was very difficult to discuss math content with such a broad spectrum of math backgrounds.

* The misunderstanding by some teachers that the Co-op Project was an instrument to disperse classroom materials rather than a program to upgrade mathematical skills and competence.

* During the spring semester of 1991, it was decided to split the class sessions according to grade levels K-2, 3-5, 6-8, and 9-12. In hindsight, this was a poor decision, creating less instruction time for the various groups, even though it turned out to be a popular decision. The summer session was one of the best and involved the whole group in four days of activities.

The principle outcome of this project will provide teacher participants with teaching strategies, skills, concepts and content necessary to teach mathematics in a manner that integrates problem solving, manipulatives, computers, and classroom management in grades K through 8. Those participating in this project will gain a greater understanding and application of principles and teaching strategies that utilize the results of research on learning and effective teaching.

The ultimate outcome of this project will be improved mathematics comprehension by students, a reduced anxiety toward math, and an increase in the number of students prepared for high school and college mathematics.

Recommendations and Conclusions

As our program is approaching the midpoint of the second and final year of the funding period, we feel the focus of enhancing teacher mathematical skills should encompass five particular areas. These include math content, instructional methods, relieving math anxiety, real world application of

mathematics, and remediation of teacher math skills (MAA, 1983 and NCTM, 1991).

Math Content. Math content should encompass four areas:

* Algebra Concepts and Applications.
  a. Elementary algebra involving applications such as word problems, proportional and distance problems, and introduction to real life applications of algebra.
  b. Intermediate algebra involving polynomials, products, factoring, introduction of functions, graphing, and introduction to real life applications of these skills.

* Geometry and Measurement. Teachers should be able to recognize shapes and compute area, perimeter and volume. They should utilize concrete classroom applications and manipulative materials to convey real life applications of concepts.

* Probabilities and Statistics. Teachers should be well versed in predicting, collecting data, analyzing data and interpreting results.

* Number Theory and Application. Teachers should be able to recognize number patterns, the amazing patterns of addition, subtraction, multiplication and division. They should be well versed in algorithms and how to manipulate numbers.

Instructional Methods. Instructional methodology should address the following:

* Small Group Cooperative Learning. Teachers should emphasize the team approach to problem solving and how to work together as members of society.

* Problem Solving and Applications. Teachers should be able to use various techniques to help students understand a problem and formulate procedures to solve problems. Teachers should emphasize finding the correct answer is not paramount in solving a problem. Rather, teachers must emphasize the importance of teamwork necessary to devise a plan of how to solve a problem.

* Show and Tell Sessions. From teacher training sessions, teachers should be versed in how to present concepts to all grade levels.

* Individualized and Self-paced Instruction. Teachers should be aware of individualized instructional techniques, drawbacks and benefits.

* Computer Assisted Instruction. Teachers must be knowledgeable in how to utilize computers within the classroom for the benefit of their students.

* Demonstration Methods. Teachers must be knowledgeable about demonstration methods, such as in a laboratory setting.

Relieving Math Anxiety. Math anxiety must be addressed on two levels: the anxiety expressed by the teacher and the anxiety expressed by their students.

* Overcoming math anxiety expressed by teachers:
  a. Teachers must broaden their own math background, acquiring more math skills.
  b. Teachers should contact their local college math education department faculty to enhance their skills via college courses.
  c. Teachers should take "How to Overcome Math Anxiety" courses whenever available.

* Overcoming math anxiety expressed by their students:

  a. Teachers should understand testing and retesting. They should refocus the emphasis on the test grade from a punitive measure of points deducted to an indicator of the student's weakness and strengths in certain areas (Chang, 1985).
  b. Teachers should be able to recognize students' study habits, and also should be able to understand students and give them individualized attention. Additionally, they should give students an unlimited amount of time to correct their mistakes (Hulbert, 1992).
  c. Teachers should recognize errors committed by their students in a positive manner. For example, when Johnny makes an error the teacher might say, "Hi, Johnny! You made a little mistake here. See if you can find it. I'm sure you'll get it!"
  d. Teachers must display their own delight in math, adjusting their attitude to reflect a positive approach to mathematics.

Real World Application of Mathematics. Teachers must strive to produce real-life application of mathematics so that students are able to relate to the usefulness of skills being taught. For instance, on the elementary level children always relate well to

problems involving money. As children approach the upper grades, however, it may be necessary to shift emphasis to acquiring mathematical skills that are useful in particular occupations.

Remediation of Teacher Math Skills. In order to provide remediation of teacher math skills, teachers should:

* Seek courses at college.
* Visit the math education faculty at local universities.
* Participate in in-service training offered by school districts or teacher development programs.
* Utilize the expertise of colleagues in enhancing skills.

In addition to enhancing teacher skills through these five areas, the following issue needs to be addressed. Since the beginning of the twentieth century, the public has questioned why high school graduates are unable to apply basic mathematical skills despite teachers implementing the latest educational theories regarding teaching these skills. Has this been caused by:

* Lack of teacher preparation.
* Overemphasizing manipulative materials to entertain children without making real connections in utilizing basic skills.
* Competition with advanced technological gimmicks of video games, television and other electronic entertainment devices (Chang, 1989).
* Expending tremendous amounts of time to remedy the majority of ill-prepared students.
* Neglect of the horizontal expansion of the curriculum for the gifted student.
* Heavy dependency on modern tools such as calculators and computers, on answer sheets and solution books (Hulbert, 1992).
* Inability to direct classroom students to an enjoyable mathematic learning experience (Hulbert, 1992).

The cooperation between the university and the local school district is one of the positive ways to improve and upgrade the mathematics skills of the school teachers. Without the massive and intensive in-service and re-education of today's teachers, the goal for the year 2000 will fail.

In conclusion, we would like to contribute the following recommendations regarding the inservice and re-education of today's school teachers.

1) This project should be expanded to meet the needs of the teachers of rural areas.

2) This project should be expanded in involve local students, such as organizing a "Math Camp" for elementary school students [Appendix F].

3) Evaluation and dissemination of information via a Math Resource Center newsletter, and seeking non-N.S.F. Funding.

4) In order to upgrade the standards and math ability of elementary school teachers, we need to emphasize more mathematics than the current methodology.

5) Future teachers should be aware that the focus of a Math Co-op Project is to upgrade skills, not to supplement materials or methodology in teaching mathematics.

6) This project should be incorporated with the local university's School of Education and State Department of Education to offer a special type of endorsement in mathematics such as Mathematics Specialist for Middle School.

7) Funding for this type of project should be allotted in at least five-year intervals in order to evaluate the successful impact on the various communities affected [Appendix G].

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Content of Appendices

Appendix A. Announcement regarding Math/Science project.

Appendix B. Math 620, Fall 1990 Syllabus for all instructors and Math Co-op participants. "Topics in Mathematics for Teachers -- K-12, Four Semester Hours."

Appendix C. Math 620, Fall 1990 Syllabus for Co-op participants. "Topics in Mathematics for Teachers K-12: Algebra Concepts and Teaching Strategies."

Appendix D. Math 670, Fall 1991 Syllabus for all instructors and Math Co-op participants. "Enhancement of Math Teaching Techniques K-8 (I), Three Semester Hours Plus Two Lab Hours."

Appendix E. Math 693, Fall 1991 Syllabus for all instructors and Math Co-op participants. "Enhancement of Math Teaching Techniques K-8 (I): Practicums and Cooperative Education, One Semester Hour."

Appendix F. Overview of Implementation Plan, Matanuska-Susitna Mathematics Co-op Project.

Appendix G. Matanuska-Susitna Mathematics Co-op Project 5 Years and Beyond Plan.

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Linda Suriano, Director of Instruction, Mat-Su Borough School Dist., 746.9510

* only for Mat-Su borough school district teachers

Appendix B

Mat-Su College / Univ. of Alaska Fall, 1990

S Y L L A B U S

I. Administrative Details
   1. Name of the subject : MATH 620
      Topics in Mathematics for Teachers -- K-12, Four Semester Hours
   2. Course description:
      Problem solving and logic are emphasized. Topics are chosen from Euclidean and Non-Euclidean Geometry, Probability and Statistics, Algebra, Number Theory, Topology and others. This course may not be used to satisfy UAA degree requirements in Mathematics.
      Prerequisite: Certified teachers in the state of Alaska.
   3. Behavioral objectives of this course:
      After completion of this program, the participant will be able to :
      (a) understand the history and development of mathematics.
      (b) place the learning activities in classroom.
      (c) describe current trends in school mathematics.
      (d) know "how to" perform the mathematical operations that are required, also " why to " perform the operations based on an understanding of the mathematics concepts.
      (e) use problem-solving strategies for various grade levels and its applications.
      (f) identify calculator/computer activities appropriate for the grade level students.
      (g) know the extended basic skills for the 21st century mathematics.
      (h) create activities designed to help student to learn algebra, geometry, measurement and others.
      (i) create problems and new ideas for teaching mathematics.
      (j) use real-life concrete models for developing basic math skills.
   4. Instructors : Dr. Arthur Bukowski
      Dr. Ping-Tung Chang
   5. Times : Fall Semester, 1990
   6. Textbooks: Instructors' notes and handout.

II. Schedules of Seminars/Activities:
   A) Day Seminars : 8:30 a.m.- 4:30 p.m. (Academy -- Colony High School)
      a) October 24, 1990 -- Co-operative Learning in The Mathematics Classroom Teachers of K-5 Only .*
      b) November 1, 1990 -- Co-operative Learning in The Mathematics Classroom Teachers of grades 6 - 8 and 9 - 12 ONLY *
      c) November 14, 1990 -- Math in The Mind's Eye -- Part I *
      d) December 5, 1990 -- Math in The Mind's Eye -- Part II *

B) Evening Seminars : 5:00 p.m. - 8:00 p.m.(Academy -- Colony High School)
   a) Oct. 16, 23, 30 and Nov. 6, 1990 - Algebra Concepts and Teaching Strategies (Instructor: Dr. Ping-Tung Chang)*
   b) Nov. 13, 23, & 27, 1990 - Mathematical Foundations for the year 2001 (Instructor: Dr. Arthur Bukowski)*
   c) December 4, 1990 - Problem Solving and its Applications (Instructor: Dr.Ping-Tung Chang)*
   d) December 11, 1990 - Computer Applications. *
   e) January, 1991 - Geometry and Its Applications (Instructor : Dr. Ping - Tung Chang) -- (at least 15 contact hours) *

C) Special Seminar: District-Wide Inservice
   a) Oct. 12, 1990 - Equity in Mathematics *

* To all Instructors : Please submit your syllabus to Linda Suriano before your class starts.

III. Evaluation of this Seminars.
   1) 60%.....Mathematics Content : (Algebra, Geometry, Foundation, Computers)
   2) 40%.....Math Teaching Methods : (Problem-Solving, Co-operative Learning, Math in Mind's Eye, Equity in Mathematics)
   3) Criteria of The grade distributions :
      a) Each Topic : Grade x (hours in this topic/Total hours) x either 40 % or 60 %
      b) Final Grade : Topic A + Topic B +....= Total points
      c) A : 90 points or above
         B : 80 points or above
         C : Below 79 points
      d) Please send your grade after your final session to Linda Suriano, indicate your numerical grade as well as your letter grade, for example :
         A (98 points), A (90 points), B (83 points), or B (80 points).
      e) Dr. Chang will assign the final grade.

IV. Attendance Policy.
   According to the policy of Mat-Su Math Co-op Program, Academy of Instruction, Mat-Su Borough School District, and MSC/UAA.

V. Appendices: Topic Syllabus

Appendix C

Mat-Su College / Univ. of Alaska Fall, 1990

S Y L L A B U S

I. Administrative Details
   1. Name of the subject: MATH 620
      Topics in Mathematics for Teachers K-12 -- Algebra Concepts and Teaching Strategies.
   2. Course description
      An intensive course designed to introduce classroom teachers to the latest information in Algebra and its application in everyday situations. This course will upgrade teachers' skills to meet the challenge of providing adequate training for our future generations.
      Prerequisite: Must be Certified teachers in Alaska from Mat-Su Borough School District, or Members of Mat-Su Math Co-op Program.
   3. Behavioral objectives of this course:
      After completion of this program, the participant will be able to :
      (a) describe current trends in school mathematics.
      (b) know "how to" perform the mathematical operations that are required, also " why to " perform the operations based on an understanding of the mathematics concepts.
      (c) use problem-solving strategies for various grade levels.
      (d) identify calculator/computer activities appropriate for the grade level students.
      (e) know the extended basic skills for the 21st century mathematics.
      (f) create activities designed to help participant to integrate Algebra into other subjects.
      (g) create problems and new ideas for teaching Algebra.
      (h) use real-life concrete models for developing basic math skills in Algebra.
   4. Instructor : Dr. Ping-Tung Chang
   5. Times : See Schedule
   6. Textbooks: Instructor's notes and handouts.

II. Schedules of Seminars/Activities:
   Evening Seminars : 5:00 p.m. - 8:00 p.m.(Academy -- Colony High School), Oct. 16, 23, 30 and Nov. 6, 1990

III. Content of this topic :
   a) October 16, 1990
      0. Fun and Games in Mathematics
      1. Real Numbers & Set Theory
      2. First-degree equations and inequalities
      3. Polynomials and Factoring
      4. Rational Expressions
      5. Binomial expansion: $(x + y)^4$, $(a+b)^{20}$
      6. Some games in Algebra.

b) October 23, 1990
   0. Equations & Functions
   1. Introduction to Functions.
   2. Linear Function
   3. Quadratic Functions.
   4. Composition and Inverses.
   5. Graphs of functions.

c) October 30, 1990 **
   0. Applications -- Word problems.
   1. Jobs, Distance-Rate-Time.
   2. Applications in Business and Economics.
   3. Radicals, Rational Exponents.
   4. Other interesting topics.

d) November 6, 1990 **
   0. Systems of equations and inequalities
   1. Determinants
   2. Cramer's Rule.
   3. Gauss-Jordan Method
   4. Matrix Operations
   5. Linear Programming

** If time permits during this semester. The Algebra Seminar will continue during Spring Semester.

IV. Evaluation of this Seminars.
   1. Assignments ..... 40 %
   2. Examinations..... 30 %
   3. Final ..... 30 %

V. Attendance Policy.
   According to the policy of Mat-Su Math Co-op Program, Academy of Instruction, Mat-Su Borough School District, and MSC/UAA.

Appendix D

Mat-Su College / Univ. of Alaska Fall, 1991

S Y L L A B U S

I. Administrative Details

1. Name of the subject : ED 670 *
   Enhancement of Math Teaching Techniques K-8 (I)
   Three Semester Hours Plus two lab hours.
   *This course may be used toward Master Degree Credit Hours with the approval of your individual committees.
2. Course description
   This course identifies math methodology and techniques which will enhance and expand math programs currently offered in K-8 curriculum. Course content emphasizes problem-solving, data analysis, probability, measurement, mathematics for everyday life, and other critical areas in making the elementary school mathematics more interesting and relevant to students in the rapid changes of technological society. **
   Prerequisite: Certified teachers in the state of Alaska.
3. Behavioral objectives of this course:
   A) After completion of this program, the participant will be able to :
      (a) understand the history and development of mathematics;
      (b) place the learning activities in classroom;
      (c) describe current trends in school mathematics;
      (d) know "how to" perform the mathematical operations that are required, also " why to " perform the operations based on an understanding of the mathematics concepts;
      (e) use problem-solving strategies for various grade levels and its applications;
      (f) identify calculator/computer activities appropriate for the grade level students;
      (g) know the extended basic skills for the 21st century mathematics;
      (h) create activities designed to help student to learn algebra, geometry, measurement and others;
      (i) create problems and new ideas for teaching mathematics;
      (j) use real-life concrete models for developing basic math skills.
   B) After completion of this program, the participant will be able to shift: **
      (a) toward classrooms as mathematical communities--away from classrooms as simply a collection of individuals;
      (b) toward logic and mathematical evidence as verification--away from the teacher as the sole authority for right answers;
      (c) toward mathematical reasoning--away from merely memorizing procedures;

(d) toward conjecturing, inventing, and problem-solving--away from an emphasis on mechanistic answer-finding;
(e) toward connecting mathematics, its ideas, and its applications--away from treating mathematics as a body of isolated concepts and procedures.

** National Council of Teachers of Mathematics. PROFESSIONAL STANDARDS FOR TEACHING MATHEMATICS---Prepared by the Working Groups of the Commission on Teaching Standards for School Mathematics of the NCTM. Reston, VA.: NCTM, March, 1991.

4. Instructor : Dr. Ping-Tung Chang , Office: Mat-Su College/UAA, Tel: 745-9727
5. Times : Fall Semester, 1991
6. Textbooks: Instructor's notes and handout.

II. Schedules of Seminars/Activities:
A) Day Seminars : 8:30 a.m.- 4:30 p.m. (Academy -- Colony High School)
a) October 30, 1991, (Wednesday)
Cooperative Learning in the Math Classroom
Instructor : Ms. Carol Goetz, Anchorage School
b) November 6, 1991 (Wednesday)
Math in the Mind's Eye (Part 1)
Instructors :Mike Curran, Math Consortium Fellow & Math Curriculum Committee, MSBSD
c) November 14, 1991 (Thursday)
"Math Authentic Assessment"
Instructor: Mardene Collins, Math Consortium Fellow, Colony Middle School, MSBSD
d) November 22, 1991 (Friday)
" Teaching Math in the 90's " from the view of Alaska Teacher of the Year
Instructor :Nancy Norman, Finger Lake, MSBSD
e) December 4, 1991 (Wednesday)
"Math in the Mind's Eye" (Part 11)
Instructor: Mike Curran, Math Consortium Fellow & Math Curriculum Committee, MSBSD
f) December 11, 1991 (Wednesday)
Teaching Math in the 90's from the View of Alaska Teacher of the Year
Instructor: TBA
B) Evening Seminars : 5:30 p.m. - 8:30 p.m.(Academy -- Colony High School)
a) October 15, 22, 29, November 5, 1991, (Tues)
Algebra Concepts and Teaching Strategies
Instructor : Dr. Ping-Tung Chang
b) November 12, 1991, (Tuesday)
Computer Applications
Instructor : Gary Gustafson
c) November 19, 1991, (Tuesday)
Curriculum Planning & Evaluations

Instructor: Linda Suriano

d) November 26, 1991
Show and Tell Sessions; speakers; 1990 Mat-Su Math Co-op Graduates
Instructor: Janis Bishop, Finger Lake Elementary Teacher
Mathematics Through Measurement (Intro. to NDN Program)
Instructor: Allison Holsten
Presider and Moderator: Dr. Ping-Tung Chang

e) December 3, 10, 1991, (Tuesday)
Problem Solving and Its Applications (K-8)
Instructor: Dr. Ping-Tung Chang

C) Special Seminars ;
District-Wide In Service, October, 14, 1991
From 8:30 AM to 4:30 PM
Equity in Mathematics.
Instructors : TBA.

III. Evaluation of this Seminars.

1) 40%.....Mathematics Content : (Algebra, Geometry, Computers)
2) 60%.....Math Teaching Methods : (Implementation of Standards, Cooperative Learning, Methodology)
3) Criteria of grade distributions :
   a) Each Topic : Grade x (hours in this topic/Total hours) x either 40 % or 60 %
   b) Final Grade : Topic A + Topic B +....= Total points
   c) A : 90 points or above
      B : 80 points or above
      C : Below 79 points
   d) Please send your grade after your final session to Linda Suriano, indicate your numerical grade as well as your letter grade, for example : A (98 points), A (90 points), B (88 points), or B (80 points).
   e) Dr. Chang will assign the final grade.

IV. Attendance Policy.
According to the policy of Mat-Su Math Co-op Program, Academy of Instruction, Mat-Su Borough School District, and MSC/UAA.

Appendix E

Mat-Su College / Univ. of Alaska Fall, 1991

S Y L L A B U S

I. Administrative Details

1. Name of the subject : ED 693 *
   Enhancement of Math Teaching Techniques K-8 (I)---Practicums and Cooperative Education. One Semester Hour
   *This course may be used toward Master Degree Credit Hours with the approval of your individual committees.
2. Course description
   This is a practicum course to be used in conjunction with ED 670 A. Prerequisite: Certified teachers in the state of Alaska.
3. Behavioral objectives of this course:
   A) After completion of this program, the participant will be able to :
      (a) understand the history and development of mathematics;
      (b) place the learning activities in classroom;
      (c) describe current trends in school mathematics;
      (d) know "how to" perform the mathematical operations that are required, also " why to " perform the operations based on an understanding of the mathematics concepts;
      (e) use problem-solving strategies for various grade levels and its applications;
      (f) identify calculator/computer activities appropriate for the grade level students;
      (g) know the extended basic skills for the 21st century mathematics;
      (h) create activities designed to help student to learn algebra, geometry, measurement and others;
      (i) create problems and new ideas for teaching mathematics;
      (j) use real-life concrete models for developing basic math skills.

   B) After completion of this program, the participant will be able to shift: **
      (a) toward classrooms as mathematical communities away from classrooms as simply a collection of individuals;
      (b) toward logic and mathematical evidence as verification--away from the teacher as the sole authority for right answers;
      (c) toward mathematical reasoning--away from merely memorizing procedures;
      (d) toward conjecturing, inventing, and problem-solving--away from an emphasis on mechanistic answer-finding;
      (e) toward connecting mathematics, its ideas, and its applications--away from treating mathematics as a body of isolated concepts and procedures.

      ** National Council of Teachers of Mathematics. PROFESSIONAL STANDARDS FOR TEACHING MATHEMATICS---Prepared by the Working Groups of the Commission on Teaching Standards for

School Mathematics of the NCTM. Reston, VA.: NCTM, March, 1991.

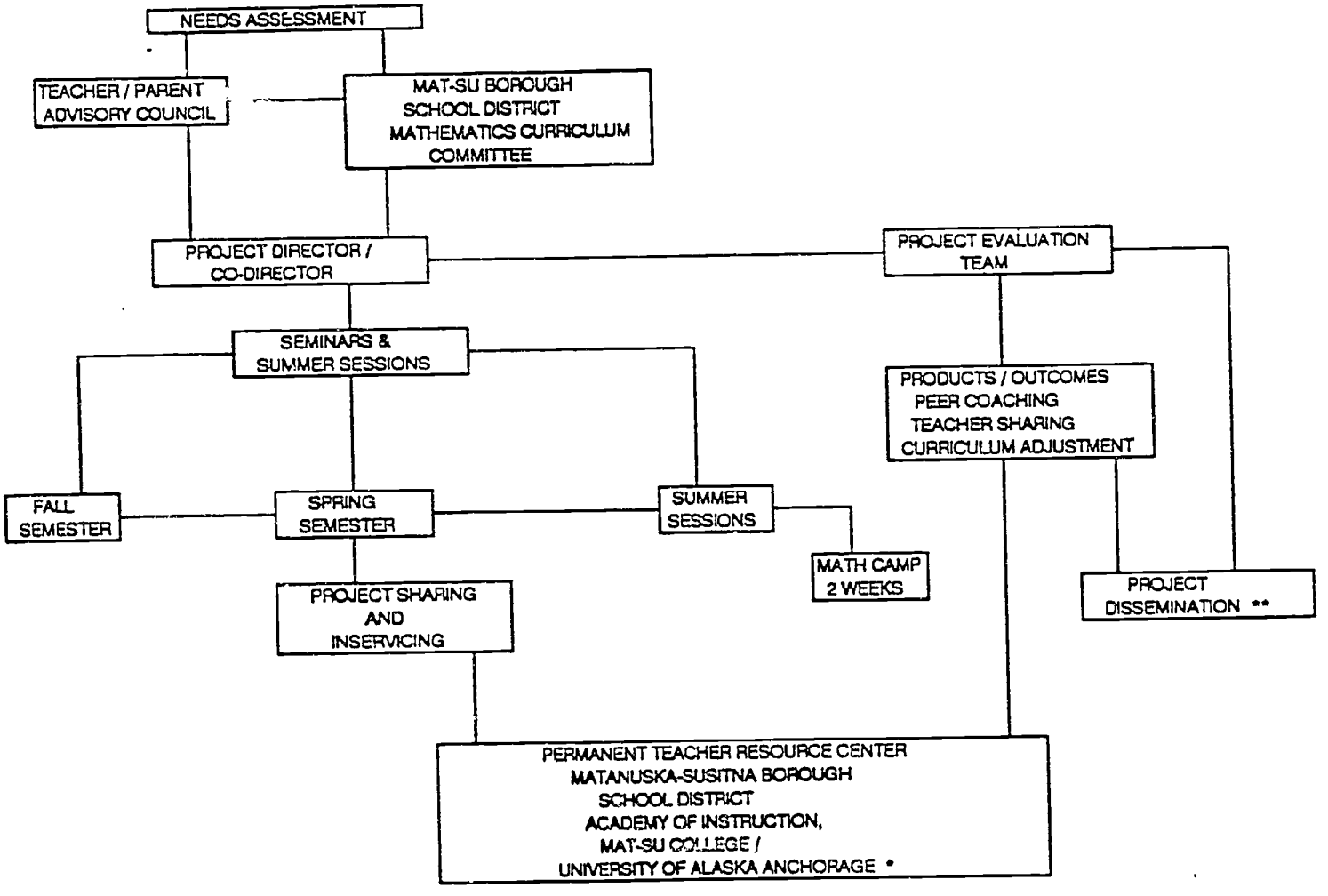
4. Instructor : Dr. Ping-Tung Chang , Office: Mat-Su College/UAA, Tel: 745-9727
5. Times : Fall Semester, 1991
6. Textbooks: Instructor's notes and handout.

II. Schedules of Seminars/Activities:
   A) Day Seminars : 8:30 a.m.- 4:30 p.m. (Academy -- Colony High School)
      See Schedule of ED 670.
   B) Evening Seminars : 5:30 p.m. - 8:30 p.m.(Academy -- Colony High School)
      See Schedule of ED 670.
   C) Special Seminars ;
      See Schedule of ED 670.

III. Evaluation of this Seminars.
   1) 40%.....Mathematics Content : (Algebra, Geometry, Computers)
   2) 60%.....Math Teaching Methods : (Implementation of Standards, Cooperative Learning, Methodology)
   3) Criteria of The grade distributions :
      a) Each Topic : Grade x (hours in this topic/Total hours) x either 40 % or 60 %
      b) Final Grade : Topic A + Topic B +....= Total points
      c) A : 90 points or above
         B : 80 points or above
         C : Below 79 points
      d) Please send your grade after your final session to Linda Suriano, indicate your numerical grade as well as your letter grade, for example : A (98 points), A (90 points), B (88 points), or B (80 points).
      e) Dr. Chang will assign the final grade.

IV. Attendance Policy.
   According to the policy of Mat-Su Math Co-op Program, Academy of Instruction, Mat-Su Borough School District, and MSC/UAA.

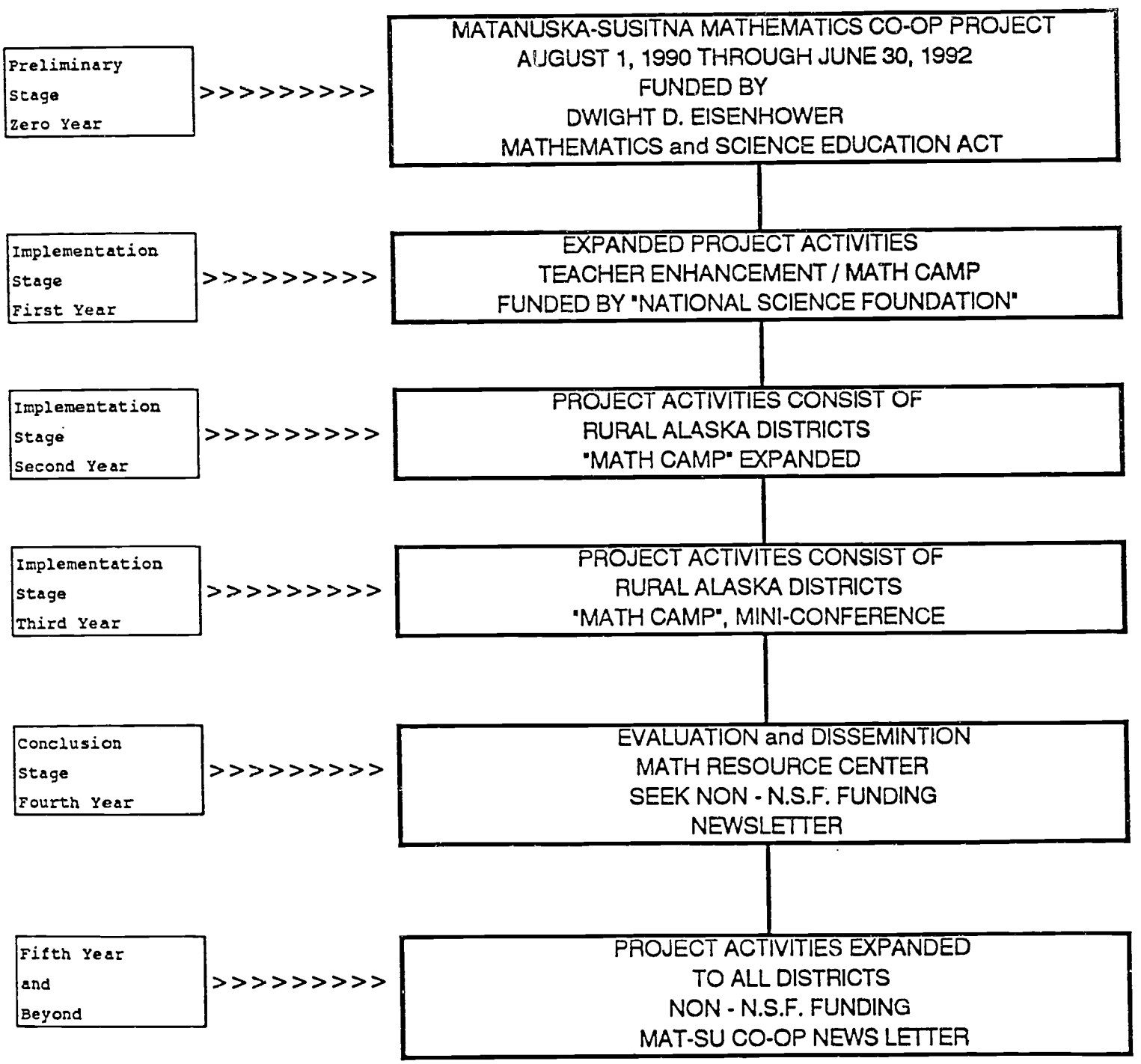
OVERVIEW of IMPLEMENTATION PLAN
MATANUSKA-SUSITNA MATHEMATICS CO-OP PROJECT



* TEACHER RESOURCE CENTER WILL BE A COORDINATING AND GATHERING CENTER FOR ALL INFORMATION CREATED DURING AND AFTER THE GRANT. ALL TEACHERS WILL HAVE ACCESS TO THESE CLASSROOM MATH RESOURCES AND INFORMATION.

** FINDINGS WILL BE REPORTED TO RESPECTIVE AGENCIES.

MATANUSKA-SUSITNA MATHEMATICS CO-OP PROJECT 5 YEARS and BEYOND PLAN



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