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DOC 2004-03 Graduate Degree Program -- Professional M.S. in Mathematics Education Program Development Plan

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PROPOSAL TO THE ACADEMIC SENATE

TITLE: Graduate Degree Program – Professional M.S. in *Mathematics Education*
Program Development Plan

SUBMITTED BY: Academic Policies Committee

DATE: March 12, 2004 (approved)

ACTION: Legislative

Reference:

Designation, Rationale, Description of Purpose

The University of Dayton proposes a new professional Masters degree summer program in *Mathematics Education*. The Department of Mathematics is collaborating with the School of Education and Allied Professions to develop a program intended to prepare candidates for positions in instructional leadership in mathematics education as master teachers of mathematics in either the secondary grades or at post-secondary institutions such as community colleges. This will be accomplished by addressing three key areas: mathematics content knowledge, research in mathematics education, and development in professional education.

As a result of this three-tiered approach, the proposed MS in *Mathematics Education* has three features distinct from those features of a traditional program in pure mathematics or a traditional program in education. Traditional programs in mathematics focus primarily on depth of knowledge in the mathematical sciences and continue to prepare mathematicians for academic positions. Traditional programs in education, on the other hand, tend to focus more on pedagogy and less on specific content knowledge.

First, the MS in *Mathematics Education* will extend students' knowledge of the mathematical sciences in order to increase the breadth and depth of preparation needed to teach advanced mathematics courses in grades 9 – 12 and at post-secondary institutions, and to provide exposure to recent advances in the mathematical sciences. The curriculum is designed to increase knowledge of mathematics content while at the same time addressing the current demands placed on mathematics educators from state standards, NCTM standards, outcomes based assessment practices, and the impact of technological advances. The curriculum is also designed to help prepare the graduate to meet future demands likely to occur from new state and national standards and the continual evolution of technology applications.

Second, candidates for this degree will study methods and current research in mathematics education, and students will experience implications of this research on classroom practices in order to become better interpreters, users, and critics of research. In addition, each candidate will design and conduct an independent research study, as the capstone requirement of the proposed program, that will contribute to the research base in mathematics education.

Finally, students will continue their development as professional educators by completing coursework that increases their understanding of the historical, philosophical, psychological, and sociological foundations of mathematics education, and more broadly, education.

Description of Proposed Curriculum

The proposed program is designed primarily as a summer program, requiring attendance during at most one fall or winter semester; the program is a three summer program for fulltime students. This is not an alternative licensure program. Students who wish to pursue an initial Ohio provisional license should instead contact the School of Education and Allied Professions. The proposed MS program in mathematics education is designed for currently licensed secondary school mathematics teachers who are now required to obtain an advanced degree to secure a professional teaching license or who wish to teach at the community college level.

Admission Requirements

- 3.0 undergraduate GPA;
- baccalaureate degree in mathematics, physics, computer science, engineering, or education with a comprehensive teaching field of mathematics;
- provisional license (or higher) to teach secondary mathematics; and
- completion of necessary undergraduate coursework in mathematics to meet prerequisites for program course offerings.

Program Requirements (30 credit hours/10 courses):

- successful completion of 9 credit hours (3 courses) of graduate-level **education coursework**;
- successful completion of 15 credit hours (5 courses) of **advanced mathematics courses** for in-service teachers;
- successful completion of a 3 credit hour (1 course) required course in **research methods in mathematics education**;
- successful completion of 3 credit hours (1 course, MTH 541) devoted to a **capstone research project (mathematics clinic)** requirement in mathematics education;

Table of Courses

Education Courses (9 credit hours)	Mathematics Courses (15 credit hours)	Research in Mathematics Education (6 credit hours)
Models of Teaching, EDT500 Philosophical Studies in Education, EDT502 Professional Development of Teacher Leaders, EDT650	Geometry for Secondary Teachers, MTH543 Algebra for Secondary Teachers, MTH544 Advanced Mathematics for Secondary Teachers, MTH545 Applications of Graph Theory and Combinatorics in Modern Mathematics, MTH546 Applications of Linear and Abstract Algebra in Modern Mathematics, MTH547	Research Methods & Issues in Mathematics Education, MTH548 Mathematics Clinic, MTH541

The Mathematics Clinic Research Requirement Once students have completed MTH 548, Research Methods & Issues in Mathematics Education, students are prepared to address research questions in mathematics education. In-service teachers will be encouraged to conduct research experiments in their own classrooms to satisfy the requirements of the Mathematics Clinic, MTH541.

Administrative Arrangements

The program will be directed through the Department of Mathematics. Dr. Rebecca J. Krakowski will serve as director of the proposed program.

Advisory Board The program has an Advisory Board of 9 members representing a variety of disciplines in education and mathematics education. In order that the program maintain close alliance with the School of Education and Allied Professions, Dr. Kathryn Kinnucan-Welsch, Chairperson of the Department of Teacher Education, serves on the Advisory Board, as well as Dr. Thomas Lasley, the Dean of the School of Education and Allied Professions.

Need for Professional MS Program in *Mathematics Education*

To assess the demand for the proposed program, we have conducted a survey of in-service high school mathematics teachers during the Fall of 2002, we have sought information through informal conversations with community school leaders in the city of Dayton, local public school districts, and the Archdiocese of Cincinnati, and we have performed a second survey with in-service teachers participating in a mathematics professional development program in July, 2003. We have obtained enthusiastic positive feedback regarding the proposed degree program. High school mathematics teachers have expressed their deep concern for their continued growth as both mathematicians and educators. The opportunity to gain experience with quantitative research methods is appealing as well. (See Appendix A for summaries of results from 2002 and 2003 surveys.)

The Conference Board of the Mathematical Sciences (CBMS), in cooperation with both the Mathematical Association of America (MAA) and the American Mathematical Society (AMS), has included several recommendations that can be addressed by such a degree program in the recent publication, *"The Mathematical Education of Teachers"* (CBMS, 2001). Not only is reform called for in the preparation of new teachers, but in the continued professional development of experienced educators. In particular, it is recommended that, "Teachers need the opportunity to develop their understanding of mathematics and its teaching throughout their careers, through both self-directed and collegial study, and through formal coursework" (CBMS, 2001). The CBMS report is totally aligned with the National Council of Teachers of Mathematics' Principles and Standards for School Mathematics, perhaps the single most driving force in the reform of mathematics education to date.

The Ohio Department of Education has taken the recommendations from the MAA and NCTM one step further by implementing a requirement that teachers will need to complete a masters degree program in either their field or general education before licensure renewal after 8 years on the job.

A further indication for need of such a program is given by the ongoing activities related to mathematics education. The University of Dayton is actively involved in Project 30, SUSTAIN, the Regents Scholars Program, and the federally funded Improving Teacher Quality (ITQ) grant through the Ohio Board of Regents. Many of these activities include collaboration among local universities, colleges, community colleges, and school systems.

Research has already been conducted, via the world wide web, to explore programs in mathematics education at other universities during the initial development of the new MS program. One such exemplary program was found in the Department of Mathematics, Science, and Technology Education at North Carolina State University, and a campus visit to further discuss the philosophy and success of their program was made during the summer of 2002. Other programs that have been helpful in the development of the proposed program include Illinois State University, Ohio State University, University of Maryland, and Penn State University. Related programs we have found regionally include those at University of Cincinnati, Miami University, Kent State University, Wright State University, Xavier University, and Wittenberg University. The three-tiered approach to blend mathematics content, mathematics education research and professional educational development, and the extensive collaboration that will occur between the Department of Mathematics and the School of Education and Allied Professions are, however, fairly unique to this program.

Student Placement

The majority of students enrolled in this program will be in-service secondary mathematics teachers who will continue their employment with their school districts, making the placement of our graduates from this program a non-issue.

Projected Enrollment

Based upon the surveys, the target enrollment in the program each year is approximately four full-time students and one to two part-time students. In the context of a three-summer completion time frame, we project twelve full-time students and six part-time students at the end of five years.

Recruiting Minority Students

We will develop an aggressive recruiting strategy for minority students. The University of Dayton will make every effort to recruit, enroll, retain, and graduate minority students in the program. The Graduate School has consistently supported minority students in graduate programs with stipends and tuition remission. It will actively support minority students in this proposed program. We will work closely with Central State University and Wilberforce University, two HBCU's in this region. We will also work closely with local public school districts and the Archdiocese of Cincinnati.

Evaluation

Outcomes assessment practices currently used for our other mathematics programs will also be used in this program to ensure continuous improvement and achievement of student learning. The proposed program will be evaluated by the Department of Mathematics after four years.

Program Faculty

The program faculty is from the Departments of Mathematics (MTH) and the School of Education and Allied Professions (SOEAP).

Dr. Atif Abueida (MTH)
Dr. Wiebke Diestelkamp (MTH)
Dr. Paul Eloë (MTH)
Dr. Janet Herrelko (SOEAP)
Dr. Kathryn Kinnucan-Welsch (SOEAP)

Dr. Jayne Brahler (SOEAP)
Dr. Shannon Driskell (MTH)
Dr. Robert Gorton (MTH)
Dr. Aparna Higgins (MTH)
Dr. Rebecca Krakowski (MTH)

Need for Additional Staff

Neither the Department of Mathematics nor the School of Education and Allied Professions has need for additional staff to administer the program as it is designed primarily as a summer program. Recent strategies to recruit faculty by both the Department of Mathematics and the School of Education and Allied Professions make the development of the proposed program feasible. Dr. Krakowski has a Ph.D. in mathematics education; she came to the University of Dayton in 2000. Dr. Driskell has a Ph.D. in mathematics education; she came to the University of Dayton in 2003. Dr. Herrelko has an Ed.D. in mathematics education; she came to the University of Dayton in 1999.

Cost

Teaching Stipends Tuition revenue will be targeted to cover summer teaching stipends.

Marketing Costs Initially, funds from Continuing Education will be used to cover marketing costs. Word of mouth will be very effective as a marketing tool as we continue activities such as Project SUSTAIN, Regents Scholars Program, ITQ, and Project 30. Through tuition revenue and opportunities for external support, the Department of Mathematics will share the cost.

Curriculum Development Costs Costs related to curriculum development will be absorbed by the Department of Mathematics.

Director for the Proposed Program Dr. Rebecca Krakowski of the Department of Mathematics will serve as Program Director. The program director will receive release time equivalent to one 3-credit hour course during the summer school term.

External Support With guidance from the Directors, the Board of Advisors, and the Graduate School, we will continually seek outside support. Opportunities include state, federal and private initiatives. Financial aid through federal resources such as the Stafford Student Loan Program will be available for degree candidates.

Tuition Revenue Students enrolled in the proposed program will be awarded a tuition scholarship so that tuition in the MTH designated courses will match tuition in the EDT courses. The College of Arts and Sciences will financially support the tuition scholarship program.

A realistic projection is that tuition revenue alone will offset the cost of the program by the fourth year.

Advisory Board

The Advisory Board of the professional Master of Science program in *Mathematics Education* serves multiple purposes in the development and maintenance of the new degree program at the University of Dayton. The Board members serve as advisors for the proposed curriculum, and provide advice for the proposed program related to the academic credibility, current pertinence to mathematics education, pertinence to local needs in mathematics education, and the mission and vision of the University of Dayton. The Advisory Board members are:

Ms. Shirley Cooper, Curriculum Supervisor in Mathematics, Dayton Public Schools

Dr. Frank Demana, The Ohio State University, retired.

Dr. Paul Eloe, Chair, Department of Mathematics, University of Dayton, ex officio

Dr. Ann Farrell, Department of Mathematics, Wright State University

Dr. Kathryn Kinnucan-Welsch, Department of Teacher Education, University of Dayton

Dr. Rebecca Krakowski, Program Director, Department of Mathematics, University of Dayton

Dr. Thomas Lasley, Dean, School of Education and Allied Professions
Dr. Katy E. Marre, Associate Vice President for Graduate Studies and Research,
Graduate School, University of Dayton
Dr. Lee V. Stiff, National Council of Teachers of Mathematics (former president), Department of
Mathematics, Science and Technology Education, North Carolina State University

Appendix A: Needs Assessment Survey Results

Fall 2002: The entire mathematics departments at several area high schools – Carroll High, Chaminade Julianne, Franklin-Monroe, and Belmont – were asked to complete a survey gauging their reactions to the proposed MS program and their thoughts about the coursework they would value in such a program. Faculty who held permanent certificates or licenses were not excluded from participation in the survey, as several of them provided valuable feedback regarding their own Masters Degree programs. A total of 27 teachers responded to this survey, 20 of whom did not have permanent licenses and would require additional coursework in the near future. Of these 20 teachers, 75% of them expressed interest in a Masters degree program that would focus on professional education, educational research, and mathematics content knowledge.

Summer 2003: During the summer of 2003, as the result of an Improving Teacher Quality Grant from the Ohio Board of Regents, 23 mathematics teachers attended a three week summer institute to improve their skills integrating physical science topics with technology in their mathematics classrooms. These teachers were asked to complete the same survey at the conclusion of the institute. The majority of these teachers were from Dayton Public Schools and Huber Heights Schools, with single faculty representatives from at least 8 other districts. Again, there was overwhelming support from these teachers regarding the proposed MS program, especially in its design to offer coursework that could easily be seen to connect to their own classroom practices. Seven of the teachers who completed the survey were either enrolled in a Masters program at Wright State University, or had received permanent licensure in Ohio. Among the 16 remaining teachers – all of whom would require a Masters degree in order to maintain their licensure under the new Ohio guidelines – 15 of them indicated that they would be interested in the three-tiered program currently being considered in this proposal.

The feedback gained from both surveys, in addition to informal conversations with other mathematics teachers in the Dayton area, indicate a tremendous need for this new program, as well as early support and interest in its delivery.