

**Proposal  
for a  
Graduate Certificate in Mathematics Education  
at the  
University of Georgia**

Presented by:  
The Department of Mathematics Education  
In cooperation with:  
The Department of Mathematics

## 1. I. Basic Information

**Institution:** The University of Georgia

**Date:** 15 September, 2003

**School/College:** College of Education

**Departments/Divisions:** Mathematics Education

**Level:** Graduate

**Proposed starting date of the program:** Spring 2004

### **Abstract of the Program**

Many students graduating from the Ph.D. program in mathematics will take academic positions at small liberal-arts colleges with combined Mathematics and Mathematics Education Departments. Others will become members of larger departments where there is always a need for mathematicians who are qualified to teach content courses for pre-service teachers. While there is currently no shortage of applicants for mathematics appointments, there is a severe shortage of qualified applicants for mathematics education positions. Mathematicians who have some expertise in mathematics education will be more attractive to such departments. This expertise may take the form of assisting with courses for pre-service teachers, visiting schools and having some knowledge about mathematics education research. In response to this apparent need, we would like to develop a graduate certificate in mathematics education specifically designed for doctoral mathematics students with an interest in mathematics teacher education.

The Mathematics Department is currently attempting to forge a closer alliance with the Mathematics Education Department. This initiative, supported by the directives of the National Science Foundation's VIGRE grant (currently held by the Department of Mathematics) and CPTM (a project funded by the National Science Foundation and administered by the Department of Mathematics Education), includes a focus on mentoring and graduate student teaching.

The VIGRE grant (Vertical Integration of Research and Education in the Mathematical Sciences) strives to develop innovative research programs in which undergraduates, graduate students, postdoctoral fellows and faculty work together (<http://www.math.uga.edu/%7Eclint/vigre/vigre.htm>). The National Science Foundation mandates that all VIGRE programs broaden the educational experiences of its students and postdoctoral associates to prepare them for a wide range of career opportunities, a requirement that is complemented by the development of a certificate program in mathematics education for doctoral students in mathematics.

CPTM, (the Center for Proficiency in Teaching Mathematics, <http://www.cptm.us/>) is working to support teachers' professional learning in order to develop their students' mathematical proficiency. This is done by focusing on teachers' professional practice and by promoting positive changes in teachers' mathematical preparation. Connections to other institutions with a similar focus on teacher preparation (such as the Department of Mathematics) are integral to the growth and development of the project. The proposed graduate certificate falls in line with each of these projects and will provide a context in which interested mathematics students may interact with the mathematics education community.

This proposed certificate program is needed to improve Ph.D. instruction in mathematics classes for mathematics majors as well as mathematics education students. Moreover, with the existence of a critical shortage of mathematics education faculty and growing concern over the teaching and learning of mathematics at all levels it is necessary to facilitate cooperation between mathematicians and mathematics education faculty. Since both communities are responsible for the training of school mathematics teachers, there is a clear need to provide a connection and ongoing communication in support of the shared responsibility of effective teacher preparation.

As of spring semester 2003, there are at least 8 currently enrolled and 2 incoming graduate students interested in the graduate certificate. Given the size of the doctoral mathematics population (approximately 40) and the fact that new students have not yet been recruited for the certificate, we feel that this number is adequate and will increase over the years. Of all the respondents to a recent poll of graduate mathematics students, 10 said that they thought that a graduate certificate program in mathematics education is a good idea, but that they could not pursue a certificate at this time. No students said that they thought the proposed program was a bad idea.

The certificate requires participants to complete 15 hours of coursework and field experience. Areas of study include: a survey of mathematics education theory or research, problem solving with technology, school (K-12) observation, assistance with mathematics content and methods classes for teachers and electives. We have reviewed other UGA graduate certificate programs and feel that these requirements are consistent with the breadth and depth of study outlined by these other programs.

The proposal does not require the creation of new courses or facilities. Mathematics graduate students will choose from existing mathematics education courses, assist with existing content and methods courses for teachers and observe classes under the umbrella of existing and established relationships between area schools and the University of Georgia College of Education. Since no additional monetary resources will be necessary for this program, low initial enrollment is not a major concern. We feel that enrollment will increase steadily as the graduate mathematics student population becomes more familiar with the program, its objectives and advantages.

The graduate certificate program will be jointly administered by the chair and the graduate coordinator for the Department of Mathematics Education.

## **II. Response to the Criteria for all Programs**

### **1. The Purpose and Educational Objectives of the Program**

#### **A. Purpose and Educational Objectives:**

The purpose of the proposed certificate program will be:

- To improve instruction in mathematics classes for mathematics majors as well as mathematics education students.
- To facilitate cooperation between mathematicians and mathematics educators.

The educational objectives of the graduate certificate in mathematics education will be:

- To expose mathematics students to mathematics education theory and research.
- To bring students into the field to observe K-12 mathematics classrooms.
- To give students the opportunity to familiarize themselves with the most common technology used in schools (graphing calculators, Geometer's Sketchpad, etc.).
- To provide students with the experience of assisting with mathematics content and methods courses.

#### **B. Interdisciplinary Nature of the Program**

The Department of Mathematics and the Department of Mathematics Education share the responsibility of training school mathematics educators. Critical to this shared responsibility is the effective teaching of college mathematics to prospective school teachers. Since this is the primary responsibility of the Department of Mathematics, there is an obvious need to facilitate cooperation and communication between the mathematics and mathematics education communities and to build upon existing collaborations.

As part of the certificate program, mathematics graduate students will work alongside graduate students in mathematics education who will one day be their colleagues. The impact of such collaboration and cooperation will expand beyond the University of Georgia into other institutes of higher education. Mathematics faculty who have experience assisting with courses for pre-service teachers, visiting schools and who have some knowledge about mathematics education theory and research will be better able to assist in the training of mathematically proficient teachers.

As proposed, the graduate certificate in mathematics education requires no additional resources. Therefore, all aspects of the program will be in full effect upon the program's inception. Within five years, we expect to be able to expand the selection of elective courses and field experiences to reflect the needs and the desires of the participants and the community of mathematicians and mathematics educators.

### **2. Establishing a Need for the Program**

### **A. Explanation of the Necessity of the Program**

This program is needed to improve instruction in mathematics classes for mathematics majors as well as mathematics education students. Moreover, with the existence of a critical shortage of mathematics education faculty and growing concern over the teaching and learning of mathematics at all levels it is necessary to facilitate cooperation between mathematicians and mathematics education faculty. Since both communities are responsible for the training of school mathematics teachers, there is a clear need to provide a connection and ongoing communication in support of the shared responsibility of effective teacher preparation.

### **B. Required Information:**

1. Semester/Year of Program Initiation: Spring, 2004
2. Semester/Year Full Implementation of Program: Spring, 2004
3. Semester/Year First Certificates will be awarded (estimated): Summer, 2005
4. Annual Number of Graduates expected (once program is established): 2-3
5. Projected Future Trends for number of students enrolled in the program:

We expect that, within five years, approximately 5 to 10 mathematics graduate students per year will be working toward completion of their graduate certificates in mathematics education. This is a conservative estimate. Given an average mathematics doctoral student population of 40, this represents an expected annual program enrollment rate of 12.5% to 25%.

## **3. Substantial Demand for the Program**

### **A. Demonstration of Student Interest in the Program**

As of spring semester 2003, there are at least 8 currently enrolled graduate students interested in the graduate certificate program and 2 incoming graduate student interested in the graduate certificate program. Given the size of the doctoral mathematics population (approximately 40) and the fact that new students have not yet been recruited for the certificate, we feel that this number is adequate and will increase over the years. Of all the respondents to a recent poll of graduate mathematics students, 10 said that they thought that a graduate certificate program in mathematics education is a good idea, but that they could not pursue a certificate at this time. No students said that they thought the proposed program was a bad idea.

### **B. Minority Student Enrollment Data**

We expect that minority student enrollment in the graduate certificate program in mathematics education will be equivalent to the proportion of minority students in the total doctoral mathematics student population, with, perhaps, the exception of female participants. Judging from the response to a recent poll of mathematics graduate students concerning their interest in pursuing a certificate, we expect that female student enrollment in the program will be *greater* than the proportion of female students in the total doctoral mathematics student population. Of the 20 respondents to the recent poll, 35% were female. The general graduate mathematics student population is 20% female.

#### **4. Design and Curriculum of the Program**

##### **1. Detailed Curriculum Outline**

The minimum course requirement for the Graduate Certificate in Mathematics Education will be 15 graduate semester hours. Hours will be chosen from the following areas:

- Technology and Problem Solving (3 hours)

Choose 1 from:

EMAT 6680 **Technology and Secondary School Mathematics.**

EMAT 6600 **Problem Solving in Mathematics.**

- Field Experience/Practicum (2-6 hours)

Choose at least 1 hour from each of:

EMAT 9800 **Practicum in Mathematics Education.** (K-12 in-school experience)

EMAT 9700 **Internship in Mathematics Education.** (on-campus internship teacher education experience with undergraduate mathematics content, methods courses for teachers)

- Research (3 hours)

Choose 1 from:

EMAT 9630 **Critique of Literature in Mathematics Education.** (recommended)

EMAT 8010 **Advanced Study of Mathematics Curriculum.**

EMAT 8020 **Advanced Study of Mathematics Teaching and Teacher Education.**

EMAT 8030 **Advanced Study of Mathematics Learning.**

- Electives (3-7 hours)  
Choose at least 3 hours of elective courses in EMAT *above* the 6000 level.

**2. Identify which aspects of the proposed curriculum already exist and which constitute new courses.**

As proposed, the graduate certificate in mathematics education does not require the creation of any new courses. All courses are routinely offered by the Department of Mathematics Education. Also, required field experiences will fall within the context of existing relationships and programs currently held by the Department of Mathematics Education and area school systems. Participants will sign up for the existing EMAT 9700 (Internship in Mathematics Education) to satisfy their campus internship requirement (assisting with mathematics content and methods courses).

**3. Identify model programs, accepted disciplinary standards, and accepted curricular practices against which the proposed program could be judged. Evaluate the extent to which the proposed curriculum is consistent with these external points of reference and provide a rationale for significant inconsistencies and differences that may exist.**

Although many certification programs exist in mathematics education, most exist to train teachers to teach *in schools*. The proposed graduate certificate in mathematics education for doctoral graduate students in mathematics is unique in that it seeks to improve instruction in mathematics classes for mathematics majors as well as mathematics education students and to facilitate cooperation between mathematicians and mathematics educators. That is, the creation of this certificate will provide a context within which the Departments of Mathematics and Mathematics Education can provide training and support for those with an interest in teaching and teacher education.

We believe that the proposed program, as outlined here is not comparable to other existing programs. To the best of our knowledge, the type of foci and the implementation we propose here does not yet exist anywhere.

**4. Accreditation.**

Since no other programs of the type we have proposed here exist, there are no accreditation standards.

**5. Faculty Resources**

**A. Faculty Needs for the Program**

There are currently 13 faculty in the mathematics education and 14 mathematics faculty at UGA who will provide direct instructional support

to this program. No new faculty will be needed to fully implement the program.

## **B. Current Faculty**

### **Mathematics Education Faculty:**

**Bradford R. Findell**, Assistant Professor of Mathematics Education  
B.S.E. 1985, Princeton University, Electrical Engineering/Computer Science  
M.A. 1990, Boston University, Mathematics  
Ph.D. 2001, University of New Hampshire, Mathematics Education

Dr. Findell's research is on the teaching and learning of high school and undergraduate mathematics and the mathematical education of teachers. He has taught mathematics at the high school, undergraduate, and graduate levels, has taught mathematics education at the undergraduate and graduate levels, and has directed and co-directed workshops for in-service high school and middle school teachers.

Dr. Findell serves as director of UGA's PRIME (Partnerships in Reform in Mathematics Education) program, which forms the core of the senior year of the undergraduate program in secondary mathematics education. As part of the program, he teaches the secondary mathematics methods course and coordinates activities among the partners: 34 pre-service teachers, more than 40 teachers at 12 local high schools, and 13 graduate students and faculty serving as field supervisors and conduct research on the program. The program rests on two fundamental premises: First, all partners are working together to learn about the teaching and learning of high school mathematics. Second, the partnership is promoted as three or more student teachers, three or more mentors, and a supervisor work together in school "clusters." This project has been supported by funds from Georgia's Eisenhower Higher Education Program, The Improving Teacher Quality Program, and the Georgia Systemic Teacher Education Project.

Dr. Findell also serves as Co-Principal Investigator in the three-year project CoSTAR (Coordinating Students' and Teachers' Algebraic Reasoning), supported by the National Science Foundation. In the context of a middle school implementing new reform-oriented mathematics curricula, the project aims to contribute methods and theories for describing the ways that students and teachers understand shared classroom interactions.

**Larry L. Hatfield**, Professor of Mathematics Education  
B.S.Ed. 1962, University of Minnesota, Mathematics  
M.A. 1966, Western Michigan University, Mathematics  
Ph.D. 1969, University of Minnesota, Mathematics Education



Dr. Larry Hatfield is a professor of mathematics at the University of Georgia. He is the recipient of many awards for distinction in teaching, including the Josiah T. Meigs Award for Excellence in Teaching Award in 1991. He is also the Author or co-author for 18 articles, 15 books, 11 chapters, and 14 monographs, including, most recently, “Up the back holler, down the dusty road, cross the windy prairie”: Issues, perspectives and strategies for research in the crisis of improving mathematical education of rural youth. [Invited paper, Research Symposium, NSF-supported ACCLAIM Center, November 2002, <http://kant.citl.ohiou.edu/ACCLAIM/> [Also presented at Research Pre-session of the National Council of Teachers of Mathematics, April 2003.]

Dr. Hatfield's has had 22 grants or contracts awarded, totaling over \$4.5M. Included are: the NSF-funded Project LITMUS was a comprehensive teacher enhancement project that involved rural Georgia educators in a long-term collaboration to improve the teaching of mathematics in two rural Georgia school systems and the Eisenhower-supported Project Keystone (*Planning Innovative Graduate Programs for Early Childhood and Middle Grades Mathematics Teaching Specialists*) and Project Keystone-in-Rockdale (*Developing and Pilot-implementing Keystone Graduate Programs*).

Dr. Hatfield's work is in mathematics teacher education at all levels (Early Childhood, Middle, and Secondary) and at all stages of professional development (undergraduate and graduate, pre- and in-service). He teaches a wide variety of courses, including those for middle grades (EMAT 5/7280, 5/7290, 5/7320, MATH 5/7020, 5/7030, 5/7035), early childhood (EMAT 6310, 6320; MATH 7003) and secondary (EMAT 2000, 4/6950, 7050, 6600, 6990, 9630, 8990).

**Andrew Gyula Izsák**, Assistant Professor, Mathematics Education  
B.A. 1987, U.C. Berkeley, Mathematics  
S.M. 1992, Massachusetts Institute of Technology, Mathematics  
M.Ed. 1993, Harvard, General Education  
Ph.D. 1999, U.C. Berkeley, Science and Mathematics Education

Dr. Izsák teaches many courses for the Department of Mathematics Education, including EMAT 3450, 4550 (mathematics content courses for pre-service high school teachers)

His research areas include the psychology of mathematical thinking, students' understanding and use of representations, the development of mathematical knowledge in and out of classrooms.

Dr. Izsák is Director of Coordinating Teachers' and Students' Algebraic Reasoning (CoSTAR), a 3-year NSF funded project that examines teaching and learning algebra at the middle school.

**Jeremy Kilpatrick**, Regents Professor of Mathematics Education

B.A., 1956, University of California, Berkeley

M.A., 1960, University of California, Berkeley

M.S., 1962, Stanford University

Ph.D., 1967, Stanford University

Dr. Kilpatrick teaches courses in mathematics and mathematics education for students preparing to teach in middle or high school. He also teaches courses on the mathematics curriculum (EMAT 7080 and 8010) and on research in mathematics education (EMAT 6990 and 9630) at both the master's and the doctoral levels.

He has taught courses in mathematics education at several European and Latin American universities and has received Fulbright awards for work in New Zealand, Spain, Colombia, and Sweden. He holds an honorary doctorate from the University of Gothenburg, is a National Associate of the National Academy of Sciences, and received a 2003 Lifetime Achievement Award from the National Council of Teachers of Mathematics (NCTM). He is a co-principal investigator in the Center for Proficiency in Teaching Mathematics.

Dr. Kilpatrick's edited publications include *A Research Companion to Principles and Standards for School Mathematics* (with W. G. Martin & D. Schifter) and *A History of School Mathematics* (with George Stanic), both published by NCTM in 2003. He chaired the Committee on Mathematics Learning of the National Research Council whose report *Adding It Up* was published by the National Academy Press in 2001. He also served on the RAND Mathematics Study Panel, whose report *Mathematical Proficiency for All Students: Toward a Strategic Research and Development Program in Mathematics Education* appeared in 2002. His research interests include teachers' proficiency in teaching mathematics, curriculum change and its history, assessment, and the history of research in mathematics education.

**Denise Spangler Mewborn**, Associate Professor of Mathematics Education

B. S. Ed. 1987, Illinois State University, Elementary Education

M. S. 1989, Illinois State University, Mathematics

Ph. D. 1995, University of Georgia, Mathematics Education

Dr. Mewborn is the author or co-author of numerous scholarly publications, including, recently, *Assessment standards for school mathematics* (1995), a publication of the National Council of Teachers of Mathematics, "Teaching, teachers' knowledge, and their professional development." In J. Kilpatrick, W. G. Martin, & D. Schifter (Eds.), *A research base for the NCTM Principles and Standards for School Mathematics* and "The role of mathematics content knowledge in the preparation of elementary teachers in the United States" in *Journal of Mathematical Teacher Development*.

She is a Principal Investigator for the Spencer Foundation-funded project “Learning to Teach Elementary Mathematics,” a four-year study of a cohort of novice teachers. Her research interests are in pre-service elementary teachers’ sense-making processes in classroom situations and elementary teachers’ content knowledge and its impact on instruction

Dr. Mewborn teaches extensively in the Department of Mathematics Education. Her teaching credits include EMAT 8020, EMAT 7050, EMAT 6420, EMAT 3400, EMAT 3410, and MATH 1700. She is a member of the UGA Teaching Academy and has received several awards from the university and student groups for excellence in teaching.

**John Olive**, Professor of Mathematics Education  
B.Sc. 1967, Manchester University (England), Mathematics  
P.G.C.E. 1968, Leicester (England), Elementary Education  
Ph.D. 1985, Emory University, Mathematics Education

Dr. Olive came to UGA as an assistant professor in 1986. He has been working with students and teachers from kindergarten through college for more than 35 years. His professional work over the past 20 years has focused on three major themes: children’s mathematical learning, the use of technology as a tool to enhance mathematical learning, and helping practicing and prospective educators to base their teaching and scholarship on what we are learning from the first two themes. He is currently co-PI (with Dr. Andrew Izsák, Dr. Bradford Findell and Dr. Chandra Orrill) of an NSF research project to coordinate students’ and teachers’ algebraic knowledge (CoSTAR). Dr. Olive coordinated the Beta testing of the dynamic geometry software, *Geometer’s Sketchpad* at the University of Georgia and has published several chapters and articles on teaching and learning with the *Sketchpad*. He is currently writing a *Geometer’s Sketchpad* companion for pre-service mathematics teacher education with Dr. Oppong to be published by Key College Publishing. Dr. Olive has also published many research articles on children’s fractional knowledge and on technology and school mathematics in national and international journals. He has presented papers at numerous national and international conferences, including an invited plenary paper for the Portuguese conference on Research in the Teaching and Learning of Geometry. He recently coordinated the Working Sessions on Early Algebra at the International Conference on Psychology of Mathematics Education (PME 27) in Hawaii.

Dr. Olive has held Georgia teaching certificates at every level of pre-college education (K-4, 5-8, 7-12 Mathematics). He has taught courses in all of the different programs in the department of Mathematics Education (elementary, middle and secondary; undergraduate and graduate). During the past two years he has taken responsibility for developing and teaching the capstone course for doctoral students in mathematics education (EMAT 9640).

**Nicholas Kumih Oppong**, Associate Professor of Mathematics Education  
B.S.Ed. 1975, University of Cape Coast (Ghana), Mathematics Education  
M.Ed. 1988, University of Georgia, Mathematics Education  
Ed.D. 1992, University of Georgia, Mathematics Education

Dr. Oppong is an award-winning teacher whose research interests include the role of electronic communication technology in teacher education and teachers' thinking processes. He is the author of several related publications, including "Promoting Critical Thinking In Pre-service Teachers By Using Combinations Of Software" (1998) in *Mathematics and Computer Education* with A. Russel and "A Technology-Based Exploratory Course in Geometry for Middle School Teachers" (Fall, 1997) in *Journal of Computing in Teacher Education* with S. Beckmann and E. Gootman.

Dr. Oppong is currently co-PI (with Dr. Peg Graham and Dr. Steve Oliver) of a National Board research project titled *An Interdisciplinary Study of Teacher Change and Its Impact on Students' Learning*. He teaches many courses for the Middle and Secondary program as well as graduate courses in Mathematics Education. The list of courses he has taught or will teach includes EMAT 5290, EMAT 5310, EMAT 3500, EMAT 4500, EMAT 4680, EMAT 6500, EMAT 6690, EMAT 7050, EMAT 7290, EMAT 7310, EMAT 8900, and EMAT 9630.

**Leslie P. Steffe**, Distinguished Research Professor of Mathematics Education.  
B.S., Morningside College, Mathematics  
M.S., Kansas State Teachers College, Mathematics  
Ph.D., University of Wisconsin, Mathematics Education

Dr. Steffe offers undergraduate courses in the teaching of algebra in the middle school, mathematical learning in the elementary school, and graduate courses in the secondary school mathematics curriculum and theories of mathematics learning. His research interests are in constructing models of students' mathematical thinking and learning.

Dr. Steffe is the author or co-author of numerous scholarly publications, including, recently, *Learning as Accommodation in the Context of Interaction* (2003) in A. Saenz-Ludlow, M. Anderson, S. Zellweger, & V. Cifarelli, (Eds.) *Educational perspectives on mathematics as semiosis: From thinking to interpreting to knowing, PSSM From a constructivist perspective* (2003) in D. H. Clements, J. Sarama & A.-M. DiBiase (Eds.), *Engaging young children in mathematics: Standards for early childhood mathematics education*, and *The fractional composition, commensurate fractional, and the common partitioning schemes: Jason and Laura* (2003), in the *Journal of Mathematical Behavior, Special Issue*.

**Paola Sztajn**, Assistant Professor of Mathematics Education.  
B.S. 1985, Universidade Federal Fluminense (Brazil), Physics  
M.S. 1989, Universidade Estadual de Campinas (Brazil), Solid State Physics  
Ph.D. 1995, Indiana University, Mathematics Education.

Dr. Sztajn teaches graduate and undergraduate courses in K-12 mathematics education. Her undergraduate instructional assignments are primarily situated within the early childhood teacher education program. Dr. Sztajn also supervises field experiences for undergraduate elementary education majors and advises undergraduate and graduate students in mathematics education. Since 2001, Dr. Sztajn has been the head of the Elementary Mathematics Education Program within the Department of Mathematics Education. She also serves on the Early Childhood Advisory Board of the Department of Elementary Education.

Dr. Sztajn's research program in mathematics education focuses on in-service elementary teachers. She has organized her work into two main areas of inquiry. The first is related to teachers' knowledge construction. Dr. Sztajn investigates experienced teachers' lifelong professional knowledge growth. She is interested in factors in teachers' careers that influence their knowledge for teaching mathematics. The second component of Dr. Sztajn's research program is teachers' professional development opportunities. She is working to develop a deeper understanding of the professional experiences that lead to teachers' growth and professional change. Dr. Sztajn is investigating teachers' professional communities and the importance of these communities for promoting change in mathematics teachers' participation and practices.

**Dorothy Yazidah Walker White**, Associate Professor of Mathematics Education  
B.S. 1985, Morgan State University, Mathematics  
M.A. 1989, Teachers College - Columbia University, Mathematics Education  
Ph. D. 1997, University of Maryland at College Park, Curriculum and Instruction

Dr. White's instructional assignments are primarily situated within undergraduate and graduate teacher education programs in early childhood education and middle school mathematics education. She also supervises field experiences for undergraduate early childhood education majors and advises undergraduate and masters students in mathematics education. Dr. White developed and refined the two required mathematics methods courses for the Georgia Pre-kindergarten-Grade 2 Emphasis teacher certification program. In recognition of her outstanding teaching, Dr. White has been honored by both faculty and students in the College of Education with several notable teaching awards.

Dr. White's research investigates the ways in which the mathematical performance of K-8 students is affected when their teachers participate in professional development projects. She is particularly interested in examining ways to support mathematics teachers of culturally diverse student populations. Her work centers on the development of school-based mathematics communities in urban settings. She is currently examining how to develop and support teacher leaders within these mathematics communities. Her other research interests include the preparation of teachers of color to work in culturally diverse mathematics classrooms. Dr. White has published and presented her work in several venues in mathematics education and teacher education in order to reach a variety of audiences including researchers, teacher educators, teachers, and policymakers.

Dr. White's professional service includes work on various committees at the departmental, college and university level, reviewing for peer-reviewed journals, reviewing of grant proposals submitted to the National Science Foundation, and reviewing proposals submitted to AERA. She also provides professional development to Elementary and Middle school teachers across the county. She is currently chair of the Editorial Panel for the journal Teaching Children Mathematics (TCM) and editor of the 2004 Focus Issue of TCM entitled, "Teaching Mathematics to Special Needs Students".

**Heide G. Wiegel**, Academic Professional (Undergraduate Coordinator;  
Project Manager, Center for Proficiency in Teaching Mathematics [CPTM])  
B. S. Ed. 1963, Teachers' College, Osnabrück (Germany), Mathematics  
Education  
M. Ed. 1986, The University of Georgia, Mathematics Education  
Ph. D. 1993, The University of Georgia, Mathematics Education

Dr. Wiegel has taught content and methods courses for pre-service and in-service elementary, middle school, and secondary teachers. As member of the Secondary Program Team, She developed an initial syllabus for the new course EMAT 4500/6500, "Connections in Secondary School Mathematics," and has taught the course in Fall 1998, Spring 2000, and Spring 2001. She served as Managing Editor for the Journal of Mathematics Teacher Education, 1996 - 2001.

Starting in August 2001, she has coordinated the Business-to-Teaching program for Mathematics Education. She adapted EMAT 4500/6500, "Connections in Secondary School Mathematics," for WebCT and taught the course with a large web-based component in Fall 2001.

Dr. Wiegel served as Research Associate in the Fractions Project. Her primary interest within the project was the interaction of individual and social factors in the construction of fractional knowledge. She also adapted the activities

initially designed for elementary students to be used with middle school students.

As project director of the Eisenhower grant "Ordinal Number and Linear Models in Primary Mathematics Instruction," she conducted three summer workshops for primary teachers in Jackson Primary School (Butts County). During the school years 1995-1998, she taught numerous lessons in order to model the use of manipulatives and technology in primary mathematics classrooms. With Dr. Norman Thomson (Science Education) she has co-directed a 2-year Eisenhower Project, "Integrating Mathematics, Science, and Language Arts: Hands-On/Minds-On Workshop for Middle School Mathematics and Science Teachers." Since Summer 2001, she is part of the project visiting team for Eisenhower (now Improving Teacher Quality Grants Program) projects in Georgia.

Since January 2003, Dr. Wiegel serves as project manager for the NSF-funded grant "Center for Proficiency in Teaching Mathematics." She collects and manages data for internal as well as external evaluation.

**James W. Wilson**, Professor of Mathematics Education and Graduate Coordinator

B.S. 1958, Kansas State Teachers College, Mathematics  
M.A. 1960, Kansas State Teachers College, Mathematics  
M.S. 1964, Stanford University, Mathematics  
M.S. 1965, University of Notre Dame, Mathematics  
Ph.D. 1967, Stanford University, Mathematics Education

Jim Wilson became a faculty member in the Department of Mathematics Education in 1968 and gained tenure in 1971. His research interests include mathematics visualization, visual reasoning in mathematics, and development of understanding in mathematics. In particular, he continues to explore the role and impact of technology tools in mathematics for creating and manipulating external representations that lead students to refining and using visual images and visual reasoning. He was recognized with the NCTM (National Council of Teachers of Mathematics) Lifetime Achievement Award in 2001.

In recent years the courses he has shaped and taught include EMAT 4680/6680 Technology in Secondary School Mathematics, EMAT 4690/6690 Technology Enhanced Instruction in Secondary School Mathematics, EMAT 4700/6700 Advanced Explorations with Technology in Mathematics Instruction, and EMT 4600/6600 Mathematics Problem Solving. His experimentation with the many uses of technology is on-going. The Internet Web Page at [Http://jwilson.coe.uga.edu](http://jwilson.coe.uga.edu) contains many examples of these innovations. The Web Site has extended his impact to mathematics education beyond these classes. The site receives extensive contact from throughout the

world, in the range of 30,000 "hits" per week and it is linked by over 300 sites around the world.

Jim Wilson is involved in funded projects and the search for outside funding. He is a PI for Project Intermath -- a 5-year NSF funded effort for improving mathematics background and of middle school mathematics teachers. He was a PI for the NSF Geometry and Measurement Project, is involved in the Contextual Teaching and Learning (CTL) project, PI of the Interactive Dictionary Project, and is Co-P.I. of the NSF-funded Center for Proficiency in Teaching Mathematics. He had a leadership role in the development of the Learning and Performance Support Laboratory (LPSL) and continues as an affiliated faculty member.

Dr. James Wilson will serve as co-director of the certificate program with Dr. Patricia Wilson.

**Patricia S. Wilson**, Professor and Head of Mathematics Education  
B.S. 1967, Ohio University, Mathematics  
M.A. 1970, Ohio State University, Mathematics Education  
Ph.D. 1982, Ohio State University, Mathematics Education

Dr. Wilson currently serves as Department Head of the Department of Mathematics Education. She teaches courses in the graduate and undergraduate programs. She prepares students to teach mathematics in high school. At the graduate level, she has recently taught the Advanced Study of Mathematics Teaching and Teacher Education, Historical and Cultural Foundations of Mathematics, and Analysis and Critique of Research in Mathematics Education.

Dr. Wilson's research interests are centered on mathematics teacher development. She is currently the director the NSF funded Center for Proficiency in Teaching Mathematics in collaboration with the University of Michigan.

Dr. Patricia Wilson will serve as co-director of the certificate program with Dr. James Wilson.

### **Mathematics Faculty:**

**Malcolm R. Adams**, Professor of Mathematics  
B.A. 1978, University of Oregon, Mathematics  
Ph.D. 1982, Massachusetts Institute of Technology, Mathematics

Dr. Adams is a professor and researcher in mathematics. He is the recipient of the Sandy Beaver Teaching Award in 2001 and occasionally teaches mathematics content courses for teachers.



**Edward A. Azoff**, Professor of Mathematics  
B.S. 1967, University of Chicago, Mathematics  
M.S. 1969, University of Michigan, Mathematics  
Ph.D. 1972, University of Michigan, Mathematics

Dr. Azoff is the recipient of the Sandy Beaver Teaching Award in 1993 and the Josiah B. Meigs Teaching Award in 2001. He teaches many mathematics courses for teachers, including MATH 1700 (now 5001, MAT 205-6 under quarters) - Spring 1999, MATH 3200 - Fall 2001, Fall 1998, MATH 4000 - Fall 2002, MATH 5020 - Fall 2002, MATH 5200 - Spring 2003, MAT 556 (Probability for Teachers - only taught under quarters) - Spring 1988, MATH 1060 - Spring 2000, MATH 3000 - Fall 2000, MATH 3100 - Spring 2000, MATH 4600 - Spring 2002 and MATH 4900 (Game Theory) - Spring 2003.

Dr. Azoff has served on the Doctoral Committees for five Mathematics Education students and has been involved in designing Preliminary Examinations in Mathematics for students in that program in 1998, 1999, and 2000.

**Sybilla Beckmann-Kazez**, Professor of Mathematics and General Sandy Beaver Teaching Associate  
B.S. 1980, Brown University, Mathematics  
Ph.D. 1986, University of Pennsylvania, Mathematics

Dr. Beckmann-Kazez has developed and taught 3 mathematics content courses for prospective elementary teachers, MATH 5001, 5002, and 5003, and is writing a textbook for such courses. The preliminary edition, Mathematics for Elementary Teachers by Sybilla Beckmann, volumes 1 and 2 with activity manuals, is published by Addison-Wesley, 2003.

She has presented a number of papers on teacher education at national and international meetings. She has also led and helped to lead workshops for college faculty on the teaching of mathematics content courses for prospective elementary teachers.

Dr. Beckmann-Kazez is an executive member of a project directed by Jim Milgram of Stanford University to recommend and describe mathematics content courses for prospective elementary and middle grades teachers. The work is building upon and extending the recommendations in the Mathematical Education of Teachers published by the MAA and CBMS. The project reports directly to the U.S. Department of Education.

She has directed and helped with professional development projects for teachers at several local schools. She has also taught occasional mathematics lessons to various groups of elementary school children.

Dr. Beckmann-Kazez is a member of the Georgia Mathematics Consortium, which has been for prospective elementary and middle grades teachers. The work is building upon and extending the recommendations in the Mathematical Education of Teachers published by the MAA and CBMS. The project reports directly to the U.S. Department of Education.

**David J. Benson**, Distinguished Research Professor of Mathematics.  
Ph.D., Trinity College, 1981

Dr. Benson is a professor and researcher in mathematics. He occasionally teaches mathematics content courses for teachers.

**Brian D. Boe**, Professor of Mathematics  
B.S. 1978, Queens University, Mathematics  
Ph.D. 1982, Yale University, Mathematics

Dr. Boe has taught numerous mathematics courses for teachers, including MAT 437-8-9 (637-8-9): 1993-94, 1997-1998, MATH 4000 (6000): Spring 1999, MATH 4000-4010 (6000-6010): 2001-02, MAT 520 (720): Winter 1997, MATH 3200: Fall 2000. He has also served as a committee member for five graduate students in the Mathematics Education program.

**David E. Galewski**, Associate Professor of Mathematics  
B.S. 1963, Michigan State University, Mathematics  
M.S. 1964, Michigan State University, Mathematics  
Ph.D. 1969, Michigan State University, Mathematics

Dr. Galewski is a professor and researcher in mathematics. He occasionally teaches mathematics content courses for teachers.

**Elliot C. Gootman**, Professor of Mathematics  
A.B. 1965, Harvard University, Mathematics  
Ph.D. 1970, Massachusetts Institute of Technology, Mathematics

Dr. Gootman has taught MATH 5020/7020 and MATH 5030/7030 5 times each. He has also written the course notes for, and taught, MATH 5035/7035. Dr. Gootman has served on the advisory and examination committees for graduate students in the Mathematics Education program.

**William H. Kazez**, Professor of Mathematics  
B.S. 1975, Penn State University, Mathematics  
M.S. 1978, Cornell University, Mathematics

Ph.D. 1982, Cornell University, Mathematics

Dr. Kazez is a professor and researcher in mathematics. He occasionally teaches mathematics content courses for teachers.

**Clinton G. McCrory**, Professor of Mathematics

B.S. 1962, Massachusetts Institute of Technology, Mathematics

M.A. 1970, Brandeis University, Mathematics

Ph.D. 1972, Brandeis University, Mathematics

Dr. McCrory has taught many courses with significant Mathematics Education enrollment, including MAT 390 - F95, W97, W98, MATH 5200 - F98, F99, F00, F01, F02 and MATH 5210 - Sp99, Sp00, Sp01, Sp02, Sp03. He has also served on seven advisory committees for students in that program.

Dr. McCrory has been involved in the 2000 Learning Technologies Grant, UGA Office of Instructional Support and Development, "Geometry for Secondary School Teachers". He has been part of the GSTEP (Georgia Systemic Education Program) Mathematics Curriculum Team 2000-01, 2001-02, 2002-03, and he serves on the CPTM (Center for Proficiency in Teaching Mathematics) Advisory Committee 2002-03. During the CPTM Summer Institute for Middle School Teachers (June 2003), he led the daily seminar for college mathematics teachers.

**Mitchell Rothstein**, Associate Professor of Mathematics

Ph.D. 1984, University of California at Los Angeles, Mathematics

Dr. Rothstein is currently working with Dr. Nicholas Oppong (Mathematics Education) and Dr. Clint McCrory (Mathematics), with support from GSTEP (Georgia Systemic Education Program), to improve the preparation of high school mathematics teachers. He will be teaching MATH 5200 in fall, 2003. As part of the GSTEP project, he will be working closely with Nicholas Oppong to coordinate this course with EMAT 4680. The two professors will also be meeting and coordinating with selected high school mathematics teachers throughout the semester.

Dr. Rothstein has taught a variety of teacher preparation courses, including MATH 5020/7020, Arithmetic for Middle School Teachers (using the book by Dr. Sybilla Beckmann-Kazez) and MAT 520, Foundations of Geometry.

**Robert S. Rumely**, Professor of Mathematics

B.A. 1974, Grinnell College, Mathematics

Ph.D. 1978, Princeton University, Mathematics

Dr. Rumely is a professor and researcher in mathematics. He occasionally teaches mathematics content courses for teachers. Dr. Rumely attended the

CPTM (Center for Proficiency in Teaching Mathematics) Institute on Geometry for Middle School Teachers, June 2-6, 2003.

**Theodore Shifrin**, Professor of Mathematics

B.S. 1974, Massachusetts Institute of Technology, Mathematics

M.A. 1975, University of California at Berkeley, Mathematics

Ph.D. 1979, University of California at Berkeley, Mathematics

Dr. Shifrin was the recipient of a Lothar Tresp Outstanding Honors Professor Award in 2002 and one of five recipients of the 1997 Josiah Meigs Award for Excellence in Teaching at The University of Georgia. He was also the 2000 winner of the Award for Distinguished College or University Teaching of Mathematics, Southeast section, presented by the Mathematical Association of America

Dr. Shifrin is the author or co-author of several mathematics textbooks. He wrote his textbook *Abstract Algebra: A Geometric Approach* as a text for future secondary teachers, adopting an atypical approach that he believes is pedagogically preferable. He will continue to teach future teachers (primary and secondary) throughout his career at the University of Georgia.

**Robert Varley**, Professor of Mathematics

B.S. 1972, University of North Carolina, Mathematics

Ph.D. 1977, University of North Carolina, Mathematics

Dr. Varley is a professor and researcher in mathematics. He occasionally teaches mathematics content courses for teachers.

**Paul Wenston**, Associate Professor of Mathematics

B.S. 1969, University of Pittsburgh, Mathematics

Ph.D. 1974, Carnegie-Mellon University, Mathematics

Dr. Wenston has taught many mathematics content courses for teachers, including MATH 5001/7001, MATH 5002/7002, MATH 5003/7003, MATH 7020 and MATH 7035, and has served as a Ph.D. committee member for several Mathematics Education graduate students. Also, Dr. Wenston attended the CPTM (Center for Proficiency in Teaching Mathematics) Institute on Geometry for Middle School Teachers, June 2-6, 2003.

Recently, Dr. Winston taught several new courses aimed at in-service Elementary and Middle School teachers. These courses have been aimed at teachers in a single county and have been taught off campus in classrooms in one of the local schools. This effort has been part of a project to increase the mathematical and mathematical teaching skills of in-service teachers in Georgia.

**C. Future Faculty Needs**

No new faculty will be needed for the full implementation of this program.

**6. Library, Computer and Other Resources**

**A. Library Resources**

No additional library resources are needed for the full implementation of the proposed graduate certificate program. Academic journals and periodicals not currently received by UGA or the Department of Mathematics Education's own independent library may be supplemented by internet resources and inter-library loan.

**B. Computer Resources**

Both the Department of Mathematics Education and the Department of Mathematics currently have adequate computer resources to support the proposed graduate certificate program. No new computer resources are needed for the full implementation of the program.

**C. Other Resources**

Other resources include Learning and Performance Support Laboratory (LPSL). More information about LPSL can be obtained at <http://lpsl.coe.uga.edu/>. Both the Mathematics Education and Mathematics Departments maintain consistent external funding. Such funding provides a context for working with area schools. Examples of current funding include the Center for Proficiency in Teaching Mathematics (CPTM) and the Vertical Integration of Research and Education in the Mathematical Sciences grant (VIGRE). More information on CPTM can be obtained at <http://www.cptm.us/>. More information on the University of Georgia VIGRE program can be obtained at <http://www.math.uga.edu/~clint/vigre/vigre.htm>.

**7. Physical Facilities**

The proposed program will use existing classroom space and other facilities. No additional teaching space will be required for the full implementation of the program.

**8. Expenses to the Institution for the Full Implementation of the Program**

**A. Funding to Initiate and Subsequent Annual Additions**

No additional funding is necessary for the full implementation of the proposed program.

**B. Student Support (fellowships, assistantships, scholarships)**

Participating mathematics doctoral students will be eligible for fellowships, assistantships and scholarships awarded by the Department of Mathematics .

**9. Financial Support Commitments Needed for Initiation and Full Development**

**A. Identify Sources of Additional Funding**

No additional funding is needed for the full implementation of the proposed program.

**B. Long-Range Plans for Additional or Expanded Facilities**

No additional facilities will be needed for the full implementation of the proposed program.

**10. Administration of the Program/ Admission and Retention of Participants**

**A. Administration of the Program**

The Graduate Certificate in Mathematics Education will be jointly administered by the department chair and the graduate coordinator for the Department of Mathematics Education.

Directorship duties shall include:

- Coordinating course offerings and maintaining student records
- Making final decisions concerning program curriculum matters
- Coordinating and promoting program activities, including speakers and seminars.
- Consulting with mathematics education faculty on matters including policy, planning, resources and admissions.

**B. Admission and Retention of Participants**

To be eligible to apply to the Graduate Certificate in Mathematics Education program, a student must be either (1) enrolled in the mathematics Ph.D. program or (2) enrolled in one of the Master's programs with the intention of going on to obtain a Ph.D. in mathematics at the University of Georgia. All students must seek approval of their major professor. Interested participants will submit a formal application to the program (see Appendix A). The faculty of the Department of Mathematics Education will vote to accept or reject the student's application. Rejected students may reapply the following semester and/or appeal to the mathematics education faculty.

A proposed program of study should be submitted to the graduate coordinator for the Department of Mathematics Education during the student's first semester in the program (see Appendix B). The faculty of the Department of Mathematics Education will vote to accept, accept with modifications, or reject the student's proposed program of study. Required changes to a student's program of study may be appealed to the faculty of the Department of Mathematics Education.

The academic standards are the same as the UGA Graduate School standards. Students must maintain a 3.00 grade point average in all certificate courses. The graduate certificate will be awarded to students meeting the certificate requirements upon completion of their Ph.D. degree.

# **APPENDIX A**

**Application for Admission to the  
University of Georgia's Graduate  
Certificate in Mathematics Education**

**Application for Admission to the University of Georgia's Graduate Certificate in  
Mathematics Education**

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All applicants must be either (1) enrolled in the mathematics Ph.D. program or (2) enrolled in one of the Master's programs with the intention of going on to obtain a Ph.D. in mathematics at the University of Georgia.

Name:

UGA ID Number:

UGA Address:

UGA Telephone Number:

E-mail address:

Major:

Major Professor:

Highest Degree Obtained:

(Degree/Institution/Major/Date)

Briefly state your reasons for applying to this program:

**Required Signatures**

Student's Approval

Date

Major Professor's Approval

Date

Certificate Director's Approval

Date



# **APPENDIX B**

**The University of Georgia's Graduate  
Certificate in Mathematics Education  
Proposed Program of Study**

## Graduate Certificate in Mathematics Education Proposed Program of Study

Courses selected from the approved list (minimum 15 semester hours). You must choose at least 3 hours from the Technology and Problem Solving cluster, 2 to 6 hours from the Field Experience/Practicum cluster, at least 3 hours from the Research cluster and at least 3 hours of approved electives.

**Course Prefix and Number**

**Course Title**

Additional information/coursework (optional):

Required Signatures

Student's Approval

Date

Certificate Advisor's Approval

Date





# The University of Georgia

College of Education  
*Mathematics Education Department*

August 18, 2003

To Whom It May Concern:

I would like to express the support of the Department of Mathematics Education at the University of Georgia for the proposal of a new graduate certificate program in mathematics education. The certificate is designed to help doctoral students in mathematics understand the nature of the *mathematics that teachers need to be effective teachers of mathematics*. We also want program participants to learn about the field of mathematics education and related research.

Mathematicians working and teaching in academic environments are responsible for a substantial portion of the mathematical content preparation of pre-service schoolteachers. While this is obvious in the teaching of the specialized content courses for teachers, mathematicians are also responsible for pre-service teachers' mathematical experiences in courses ranging from calculus to more advanced topics including abstract algebra and analysis. The proposed certificate is designed to expose future teacher educators to the reality of school mathematics teaching. The program places an emphasis on mathematics content, teaching and learning for teacher education as well as building connections both in content and across the communities of mathematics and mathematics education.

It is our belief that the proposal, as outlined, will serve to better acquaint the participants with all aspects of the scholarship of mathematics education, from teacher preparation to research. It is our hope that such exposure will facilitate communication and cooperation not only here at the University of Georgia, but at the future academic homes of those who successfully complete the program.

Participants in the proposed certificate program will benefit from the Department of Mathematics Education's Center for Proficiency in Teaching Mathematics (CPTM), a program funded by the National Science Foundation for the purposes of improving teacher preparation by focusing on the practice of teaching. The Center is partnered with the University of Michigan as well as area school systems and the Board of Regents. These partnerships will provide a broad range of opportunities for interested mathematics graduate students to explore as part of their certificate program.

The Department of Mathematics Education believes that a graduate certificate program represents an opportunity, not only for the participating students, but also for the communities of mathematics education and mathematics here at UGA and elsewhere. It is our belief that this opportunity will lead to the improvement of the teaching of mathematics at all levels.

Sincerely,

Patricia S. Wilson  
Professor, Department Head



# The University of Georgia

Department of Mathematics

September 15, 2003

To Whom It May Concern:

This letter is to express the support of the mathematics department at the University of Georgia for the proposal of a new graduate certificate program in Mathematics Education. The certificate addresses a need to foster a closer connection between the two related but disparate fields of mathematics and mathematics education. Both communities share an interest in improving mathematics teaching and a concern over the quality of mathematics education at all levels.

We recognize that many students graduating with graduate degrees in mathematics will enter academic environments where they will be working closely with mathematics faculty and their students, and where there is always a need for mathematics faculty willing and able to teach mathematics content courses for teachers. Moreover, a growing number of mathematics departments are employing faculty who specialize in undergraduate mathematics education.

The proposed certificate incorporates a broad set of goals that will expose participating graduate students to the community of mathematics educators and their academic interests, the practice of teacher education at the university level, the practice of school mathematics education at the elementary, middle and high school levels, and the teaching of mathematics at all levels based upon mathematics education theory and research. Further, the program will allow students enough flexibility to focus on their personal interests in the subject, such as teacher education, mathematics education research and the like.

The Department of Mathematics believes that a graduate certificate program is a welcome opportunity for students pursuing their doctorates in mathematics to experience the field of education for the purposes of improved communication between the two fields, the improvement of the teaching of mathematics at all levels and the enhancement of job prospects for graduating students in mathematics in an environment of increased concern over the effective teaching and learning of mathematics.

Sincerely,

Dhandapani Kannan, Head  
Department of Mathematics

Joseph H. G. Fu, Graduate Coordinator  
Department of Mathematics