The University of Arizona

FORMAT AND GUIDELINES FOR
GRADUATE CERTIFICATE APPROVAL

Directions:
1. Provide information regarding the proposed graduate certificate in the format requested on the attached pages. Respond to each item individually. Indicate “not applicable” where appropriate.
2. Obtain signatures of the proposed unit administrator and department or committee head and college dean or Director of Graduate Interdisciplinary Programs. Signature verifies that the proposal has received faculty approval through appropriate procedures and that the unit has the resources to support the certificate. In some situations signatures of more than one dean or department head may be required. If the program changes have a commitment of resources from other than the initiating unit, the signature of the collaborating department/committee head and collaborating college dean is also required. If you have any questions, please contact Dianne Horgan, dhorgan@email.arizona.edu or Sandra Gonzales, beelers@mail.arizona.edu, 621-1847.
3. Forward the original and one copy to the college office for the dean’s signature and retain a copy for departmental files.
4. The dean should forward the original to the Curriculum Office - Academic Programs, Attn: Sandra Gonzales, CCIT 337, and retain the remaining copy for college files. An electronic version of the documents with appropriate signatures is preferred but not required.
5. Documents must be submitted in a timely manner to move through the campus approval process. UA campus protocols include review by the Graduate Council or designated representative; Provost Management Group; and Academic Council (deans) review; Instruction and Curriculum Policy Committee of the Faculty Senate; and the Faculty Senate for final formal approval.

Initiating college, department, or committee: Department of Mathematics

Title of this proposal: Certificate in Mathematics Teaching and Mentoring

Unit Administrator: (name and title) Douglas L. Ulmer, Associate Head for the Graduate Program

Unit Administrator’s Signature: _______________________________ Date: ______________

College Dean’s Signature: _______________________________ Date: ______________

Official Contact Person (name, telephone, email):

Douglas L. Ulmer, (520) 621-6861, ulmer@math.arizona.edu

8/13/2007
I. Certificate Name and Description:

- Name of the certificate – **Graduate-Certificate in Mathematics Teaching and Mentoring**
- Managing department college, department, and oversight committee membership.
  College of Science, Department of Mathematics, Graduate Committee
- Specify whether the certificate is affiliated with an existing degree program or is a stand-alone certificate.
  This is a stand alone certificate.

II. Certificate Requirements – Any changes to the originally approved certificate must be approved by the Graduate College.

- List the certificate requirements, including number of credit hours required and any special requirements for completion. **Certificate requirements should include sufficient units to provide a substantive program and an appropriate level of academic rigor and in no case be less than 9 units of credit.**

Candidates will spend one year, including summer, teaching for the Mathematics Department as an Academic Professional. They will be required to take 10 units of graduate mathematics course work. Each semester they will also have a choice of either (a) observing a course in the mathematics major, or (b) working with the Department’s Center for Recruitment and Retention of Teachers.

Under option (a), they will take the course under a house-numbered graduate practicum number (594). They will study the subject matter of the course and also function as an embedded observer of the relationship between mathematics and pedagogy in the classroom. The student will spend an extra hour a week with a program instructor, someone different from the course instructor, reporting on these observations. The session will include a discussion of strategies for critiquing teaching and how to know what is a matter of style and what is a matter of substance. This will give the student practice in being a mentor while not being a supervisor.

Under option (b), they will take an independent study course (599) focusing on teacher mentoring focusing on coaching and mentoring techniques. They will read literature on mentoring and professional learning communities, spend time analyzing professional tapes and local student work, observe professional coaches in the field, and plan and assist with four-hour Saturday workshops for new teachers in a model induction program.

Candidates will assist in professional development workshops at selected middle schools and assist in the creation of professional development communities at their assigned school. To complete the certificate, candidates will be required to present the
results of their work the Department’s Proseminar on Mathematics and Teaching each semester.

- List current and new courses needed to meet certificate requirements. *New courses should be designated as such and include a proposed catalog description. No less than 50% must be taken for a regular letter grade.*
  
  No new courses will be required beyond courses currently being developed under a National Science Foundation pilot program for a new Master’s Degree Program (EHR-0634532).

- Describe any courses that will be offered via distance learning or other distributed methods?
  
  None at this time.

- **Student Learning Outcomes** - *Describe what students should know, understand, and/or be able to do at the conclusion of this certificate.*

  Students in this program will either be, or will expect to become, certified Highly-Qualified Mathematics teachers; this certificate will attest to the graduate’s ability to play a leadership role in education beyond their normal classroom teaching. Certificate holders will be able to assist less experienced teachers to develop their own effective teaching methods. They will be able to assist other teachers adapt to new standards, to new teaching materials, and to other classroom changes that often occur in modern classrooms. They will be able to work with more experienced and less experienced instructors jointly improving teaching strategies and classroom methods. They will be able to act as a guide for other teachers looking to solve the pedagogical problems of teaching basic mathematics.

  Graduates of the Teacher Mentor Certificate program will be qualified to conduct a Proseminar on Mathematics and Teaching in their home districts. If the Department is successful in creating a distance learning component to its Masters Degree with a Teaching option, certificate holders could assist with a locally run lab component of courses in this program.

**III. Student Admittance/Advising/Completion** – *Student must have no less than a bachelor’s degree for a post-baccalaureate, a master’s degree for a Post-Master’s certificate or be currently enrolled in a graduate level program.*

- Are there prerequisites or standardized tests required for admission?
  
  Participants will be experienced school teachers with current middle school or high-school certification. Entrants should have at least 3 years experience teaching mathematics at grade 7 or higher.

- Is concurrent enrollment in a degree program allowed, required?
  
  No.

- Is there a University credit requirement? *University credit is the term used to identify all credit offered by The University of Arizona with the exception of correspondence and Special Examination for Credit.*
  
  Yes, 10 hours.
Will transfer credit from other institutions be accepted? How many credit hours maximum? (May not exceed 6)
No.

What provisions are included for student advising?
A major part of the certificate program is working closely with Department faculty developing mentoring skills and leadership ability.

May a student change from a certificate to a degree program? What are the provisions?
No.

IV. Certificate and Student Outcomes

Provide a plan and frequency for assessing the intended certificate outcomes both for students and the certificate.
Initially the certificate program will be part of a pilot program funded by a grant from the National Science Foundation (EHR-0634532). The pilot program will bring in participants during the development stage of the program, of course without the promise of a final certificate. The NSF grant requires an extensive external evaluation. The trial certificate program will be thoroughly evaluated. A complete description of the evaluation is attached.

V. Student Demand - Is there sufficient student demand for the certificate?

What is the anticipated student enrollment for this certificate?
Current we have funding for 2 students for 5 years. This is the expected steady state for the program. After NSF funding runs out, we hope to secure continued funding from that part of the Department’s budget dedicated to lower division teaching.

Will there be any collaboration with other departments or universities to maximize resources?
Initial trials will be funded by a grant from an NSF Partnership grant with the Tucson Unified School District.

Program demand/need. Will the certificate serve a community need, preparation for professional certification exams, degree program recruitment, employability enhancement, or other. Recent initiatives in education from the State and the Federal government have had significant impact on the secondary school classroom, especially in Mathematics. Schools need to adapt to the new environment. Change, however, can be difficult. Teachers, who are already overworked, can find it difficult to find the time to make necessary changes with the care and thought essential to meet the goals that direct those changes in the first place. They expect a certain amount of assistance from school administrators, but most often they look to their colleagues for the practical help they need on a daily basis. Some schools are lucky, and experienced leaders do emerge on their faculties. Unfortunately, this is never guaranteed.
School mathematics teachers often look to their fellow math teachers for help. Sometimes that help is technical; everyone can get thrown by a surprising math problem. At other times, the problem is pedagogical. It can be difficult to introduce a technical topic thoroughly without making it seem impossibly complicated in the process. A few moments of discussion with a colleague can prove an invaluable aid. The point is that schools need mathematics teachers that can act as true mentors: mentors who are approachable, helpful, knowledgeable, and non-threatening. For the most part, schools hope that such people simply emerge out of necessity. This certificate program would provide actual training to those who will play this role.

This certificate program would improve the State’s efforts in mathematics education by seeding the schools with mathematics teachers with the skills necessary to be active mentors. Educational reform, state initiatives, new local policies all require an educational infrastructure that can adjust comfortably. School and district administrations can help develop this infrastructure, but in the end, a few well placed teacher-leaders will always be the essential ingredient. We hope that this certificate program will in time place trained mentors in schools throughout the state.

VI. **Expected Faculty and Resource Requirements**

- List the name, rank, highest degree and estimate of level of involvement of all current faculty who will participate in the program.
  - Daniel J. Madden Ph.D., Associate Professor, Mathematics: Director of the NSF funded Arizona Teacher Initiative will be involved in teaching and mentoring in the Certificate Program.
  - William G. McCallum Ph.D. University Distinguished Professor, Mathematics: Co-PI on NSF Grant will be involved in teaching and mentoring in the Certificate Program.
  - Rebecca H. McGraw Ph.D. Assistant Professor, Mathematics: Co-PI on NSF Grant will be involved in teaching and mentoring in the Certificate Program.
  - Erin Turner Ph.D. Assistant Professor, Teaching and Teacher Education, will be involved in teaching and mentoring in the Certificate Program.
  - Approximately 5 other Mathematics faculty members have agreed to help mentor and advise Certificate candidates.

- Describe additional faculty needed for the first three years of the certificate.
  None.

- Give the present numbers of FTE students and FTE faculty in the department or unit in which the certificate is offered.
  - Mathematics
    - FTE Students (Undergraduate): Attached
    - FTE Students (Graduate): Attached
    - FTE Faculty: Regular Faculty 60.28 FTE; Visitors and Lecturers 17.00 FTE; Adjunct Instructors 20.00 FTE
• Give the proposed numbers of FTE students and FTE faculty for the next three years in the department or unit in which the certificate is offered. Indications are that Mathematics Faculty size is stable. Mathematics Graduate Program should also remain the same size. However, Mathematics plays a major role in the Applied Mathematics IDP graduate program, and is expected to be an equally important part of the new Statistics IDP. Undergraduate enrollment projections for Mathematics are inexorably tied to University undergraduate enrollment projections.

• Provide a copy of the current department budget and note any impact the approval of the certificate could have on department resources. Attached.

VII. Additional Clarification

• This certificate program will be quite small, between 2 and 4 people per year. They will be registered under house numbered graduate courses set for independent studies. They will work with a faculty member on the pedagogy and mathematical content of one of our undergraduate courses. The course will be chosen to mesh with their interest and previous mathematical training. They will attend a section of the undergraduate course acting as a student learning or reviewing the material and an observer of the teaching method. They will work with the faculty member directing their independent study course on improving their understanding of the course material and on developing effective methods for teaching that material based on their observations. Therefore seat availability is not an issue.

• The certificate has been designed so that it requires no new courses. All courses in the program will be independent study based on the content and teaching of existing courses.

• Certificate candidates would be hired by the math department as full time academic professionals. This certificate program would be a natural extension of our Co-op program from a few years back. (Local HS school teachers would come to the UofA on loan from their districts and the University would supply a replacement.) That program was lost to previous cut backs, but we are trying to revise it. We hope that a new co-op program could include a graduate certificate. For University funded positions, these teachers would be assigned 6 to 8 credit hours of teaching each semester, almost always lower level and entry courses (or possibly our course for elementary education majors.) They would also be assigned as GTA supervisors. This would allow them to gain mentoring experience as part of their certificate program. (GTA supervisors are themselves supervised by department members experienced in helping new and inexperienced teachers.)

• We have 5 years of NSF funding for two people. The Department hopes to get permission to use it's undergraduate teaching budget to fund additional HS teachers on top of this. (There is a certain loss of efficiency in hiring "co-op's" to teach our courses instead of temporary hires. However, there is a definite increase in quality, and the department is finding it increasingly difficult to hire acceptable instructors into one year positions.)

8/13/2007
As long as the department is allowed to hire Co-op type HS school teachers to teach entry level courses, the cost of the certificate program is covered.

NOTE: Implementation of any graduate certificate requires approval by the appropriate university committees prior to announcement and implementation.

Effective: 4/2006
Appendix I: Evaluation Plan

Research shows that in addition to improvement in teacher practice and student learning, the evaluation of professional development should be based on “the degree to which the professional development is characterized by … a focus on content, active learning, and coherence delivered with sufficient duration and collective participation” (Desimone, Garet, Birman, Porter, & Yoon, 2003, p. 642). These principles will guide the assessment plan.

The overall outcome will be improved student achievement in mathematics in the schools participating in the grant, as a result of increased teacher knowledge of mathematics. The other outcomes include an increase in the number of highly qualified teachers, increased capacity to produce teacher mentors and postdoctoral fellows each year, increased skills to run a Master’s level program in Middle School Mathematics Leadership, an increase in the number of Middle School Mathematics Leaders as the result of increased distance learning capacity and an increase in the number of Middle School Mathematics Leaders regionally and nationally during the term of the grant.

An external evaluator hired by the project will work with the TUSD internal evaluator through the Accountability and Research department to obtain student achievement data, student course failure in mathematics at participant schools, attendance and other relevant data. The evaluator will also develop project instruments, a documentation log to determine if project objectives and activities are being accomplished within timelines.

Formative evaluation will determine the strengths and weaknesses of the program through survey instruments developed by the evaluator. A process evaluation will be conducted within 6 months of the start of the project. Process evaluation will utilize a model that provides continuous information about the program in progress and calls for continuous improvement through design, management, assessment and communication. It will be carried out during the program in the spring and fall through student surveys, parent surveys, staff surveys, staff logs and student records. The evaluator will survey partners to determine what is going well, what barriers have been encountered, and what could be done to improve the project’s implementation. Results will be discussed with the principal investigators and used to guide the program development.

The outcome evaluation will use quantitative and qualitative measures, including standardized norm-referenced test results on the TerraNova mathematics subtest, and results on the mathematics portion of the Arizona Instrument to Measure Standards, both given in 8th grade on a yearly basis. This data is all available in TUSD on the district’s website: http://tusdstats.tusd.k12.az.us/planning/assessment_main.asp. For the AIMS test, results are available on a school and teacher level. The evaluator will establish a baseline before the project starts, and compare yearly results to results in the previous year, both in schools and classrooms impacted by the grant and in schools and classrooms with similar demographics.

Other quantitative data will include the number of course failures, attendance rates, number of faculty at the University of Arizona with a knowledge and understanding of how to support effective teacher preparation and in-service professional development, number of certified teacher leaders and Ph.D. mathematicians who have the knowledge and understanding to implement the program in their local areas, number of Middle School Mathematics Leaders produced nationally each year, and the number of Teacher Mentors and Postdoctoral Fellows produced each year. Ratings and self-report instruments, student enrollment data and student records participation, and discipline will also be of a quantitative nature.

Qualitative methods will include surveys and self-report instruments, including some open-ended. Classroom observations and interviews are other methods that may be utilized to obtain qualitative information. One such instrument will be a survey developed by the evaluator to determine the satisfaction of the school district and site principal on the quality of services provided by the grant.

Complete results on mathematics assessments will be made available and disaggregated by grade level, ethnicity, socioeconomic status, gender, and disability. This information will be used to determine if there are achievement gaps that should be addressed in future years, and will be useful to others interested in replicating the project.

Participants on the program will be given pre- and post-tests on their knowledge of mathematics and teaching. For the participants in the Master’s program, permission has been obtained to use tests of teacher knowledge for middle school teachers developed at the University of Michigan. Feedback via a survey of site principals, university professors, and TUSD middle school mathematics teachers will be obtained and analyzed. Classroom observations will be conducted to determine if the project participants are meeting the Arizona Professional Teacher Standards.

For the Teacher Institute, participants will be asked to complete a survey at the end of the Institute to determine if they have benefited from attendance and plan to utilize the skills they have gained. A follow-up survey will be sent after 6 months to determine if they have implemented any of the strategies learned in the Institute.

Throughout the project period, the evaluator will meet at least monthly with the principal investigator to share assessment results and to see if there should be any additions to the evaluation design.