

Routing for On-Campus Approval of Degree Program Actions

Type of Action: Enter "X" for Action Type(s) and list Title and Prefix(s) as indicated

<input type="checkbox"/> New Degree Program	Proposed Program Title _____
<input checked="" type="checkbox"/> New Certificate Program	Proposed Certificate Program Title <u>Mathematics Teaching and Learning</u>
<input type="checkbox"/> New Minor Program	Proposed Minor Program Title _____
<input type="checkbox"/> Change in Degree Program Title	Current Degree Program Title _____
<input type="checkbox"/> Change in Certificate Program Title	Current Certificate Program Title _____
	Proposed Certificate Program Title _____
<input type="checkbox"/> Change in Minor Program Title	Current Minor Program Title _____
	Proposed Minor Program Title _____
<input type="checkbox"/> Change in Course Prefix	Current Course Prefix _____ Proposed Course Prefix _____
<input type="checkbox"/> Program Discontinuation	

Proposed Effective Date May 1, 2018 Program Contact: Hollylynne Lee hollylynne@ncsu.edu

Proposed CIP Code (see <https://nces.ed.gov/ipeds/cipcode/default.aspx?y=55>): 13.1311

Routing of Action: Indicate date when the following occurs

Completed Request to Plan and 1-page Concept Paper

_____ Council of Dean's- Approval to Plan

Completed Proposal

2/19/18 Department Head endorses*

2/23/18 College Curriculum Committee (undergraduate or graduate) recommends*

2/26/18 College Dean endorses*

Proposal moves to Undergraduate or Graduate office for routing

4/9/18 Recommended by Vice Provost, DELTA, if applies*

_____ Substantive Change Review Team (SCRT) informed

_____ If SACS notification is required, SCRT prepares letter for Chancellor to send to SACS

_____ University Courses & Curriculum Committee or Administrative Board of the Graduate School recommends

_____ Associate Deans Council or Graduate Operations Council informed

_____ Dean (Graduate School or DASA) approves*

Proposal move to the Executive Vice Chancellor Provost's office for routing

_____ Vice-Provosts informed

_____ Deans' Council recommends*

_____ Executive Vice Chancellor and Provost approves*

_____ Chancellor's Executive Officer's (EOM) recommend

_____ University Council informed

_____ Board of Trustees subcommittees recommend

_____ Chancellor approves*

_____ Accreditation Liaison notifies SACS, if applicable

_____ Submitted to UNC-General Administration by Provost's Office

* Signature is required on the signature page for the action

Graduate Certificate in Mathematics Teaching and Learning

North Carolina State University

This request has been reviewed and approved by the appropriate campus committees and authorities.

Endorsed By:

Kathy Trundle Kathy C. Trundle 2/20/2018
Head, Department/Director of Graduate Program (Printed Name and Signature) Date

Recommended By:

Karen Hollebrands Karen Hollebrands 2/23/18
Chair, College Graduate Studies Committee (Printed Name and Signature) Date

Endorsed By:

Lee V Stiff [Signature] Feb 26, 2018
College Dean (Printed Name and Signature) Date

Recommended By:

[Signature] Thomas K. Miller III 4/9/18
Vice Provost, DELTA (if DE degree) (Printed Name and Signature) Date

Approved By:

Dean of the Graduate School (Printed Name and Signature) Date

Recommended By:

Dean's Council (Printed Name and Signature) Date

Approved By:

Executive Vice Chancellor and Provost (Printed Name and Signature) Date

Approved By:

Chancellor (Printed Name and Signature) Date

**NC State University
Certificate Proposal Form**

Certificate Title: ___ Mathematics Teaching and Learning _____

New:

Revision:

Classification of Instructional Programs (CIP) Discipline # (**6 digits**): _13.1311_____

*Please ensure that you select the appropriate CIP code for your certificate program. Please consult this website for more information about CIP

codes: <https://nces.ed.gov/ipeds/cipcode/default.aspx?y=55>

Certificate Type:

On-Campus:

Distance:

On-Campus & Distance:

Proposed Effective Date: May 1, 2018_____

Director of the Certificate Program: ___ Hollylynn Lee _____

Program Coordinator (if different from Director): _____

Graduate Services Coordinator: ___ Christy Buck _____

College: ___ Education _____

Department/Program: ___ STEM Education _____

Catalog Description:

The Graduate Certificate in Mathematics Teaching and Learning is an online program that focuses on developing knowledge and instructional approaches in teaching mathematics. The program will primarily serve practicing teachers in middle school through college settings, or those preparing for careers in such settings, who want to expand their expertise related to teaching and learning mathematics. Students will learn how to apply research-based understandings of students' thinking, pedagogical approaches, and broader educational issues (e.g., discourse and equity) to inform practices of teaching content such as geometry, algebra, and statistics.

Projected Enrollment:

On-Campus	Yr. 1-__	Yr. 2-__	Yr. 3-__	Yr. 4-__
Distance	Yr. 1-__5__	Yr. 2-__10	Yr. 3-__20	Yr. 4- 30

Attachments:

- Proposal Document
- Statement of other departments likely to be affected and summary of consultation with those departments
- Program-level assessment
- Campus Routing Form
- Signature Page

Graduate Certificate in Mathematics Teaching and Learning

Description and Rationale

The Graduate Certificate in Mathematics Teaching and Learning is an *online* program that focuses on developing knowledge and instructional approaches in teaching mathematics. The program will primarily serve practicing teachers in middle school through college settings, or those preparing for careers in such settings, who want to expand their expertise related to teaching and learning mathematics. Students will learn how to apply research-based understandings of students' thinking, pedagogical approaches, and broader educational issues (e.g., discourse and equity) to inform practices of teaching content such as geometry, algebra, and statistics. A critical focus embedded in all courses, and the specific foci of one course, is the ways that advanced technologies can be used to engage students in meaningful mathematical learning opportunities.

The Mathematics Education Masters of Education degree program in the STEM Education department has been a long-standing degree option, and has produced many master teachers in NC that become department heads, district mathematics specialists, and even have worked for DPI as mathematics specialists or professional development providers. When NC revoked additional pay for a masters degree in 2013, the enrollment in our program drastically declined (e.g., current enrollment is 13). In 2015, a funded project that paid tuition for 18 practicing teachers to take 5 masters level courses, led to 10 of them enrolling in our masters program. Six of the eight teachers who did not enroll indicated that while they enjoyed the Mathematics Education masters courses, they did not want to take the masters level Mathematics courses that they perceived to be less relevant to their work as a classroom teacher. Even with lack of extra pay, many teachers (both middle, secondary, and community college) are still interested in continuing their education and see NC State as a desirable place to advance their learning.

We receive many inquiries into our graduate masters program (e.g., 30 inquiries since August 16th), with two dominant questions:

Can I take classes online?

What funding is available for masters students?

Most practicing teachers enroll part-time and take 1-2 classes per semester. A barrier in allowing us to serve teachers through a masters program has been a lack of courses offered online, and the cost of tuition.

Teachers can currently earn a graduate certificate (12 hrs) in related areas such as: a) teacher training and educational technology (community college teaching specialization), b) mathematics, c) statistics, or d) statistics education. We would like to propose an online Graduate Certificate in Mathematics Teaching and Learning that could serve teachers not wanting a full masters degree (but could count towards a masters degree), current graduate students in mathematics, or community college instructors who would like to develop expertise in teaching mathematics. Specifically, our graduate certificate in Mathematics Teaching and Learning differs from the graduate certificate in Mathematics offered by the mathematics

department. While these certificate programs may serve the same audiences (grades 6-12 and community college teachers), they have different purposes. Ours is meant to increase teachers' understanding of issues of pedagogy and to further develop their repertoire of successful research-based teaching techniques. The certificate in Mathematics is meant to deepen and/or broaden teachers' understanding of advanced mathematical content.

In the past 2 years, four courses in mathematics education have been transitioned to DE courses, EMS 519, EMS 514, EMS 513, and EMS 580. These courses have action research projects embedded in them that can support teachers in pursuing National Board Certification (for which they do still earn a salary stipend), as well as state requirements for those earning initial licensure through an M.A.T. program or an M license through a masters program.

Offering these classes online will broaden our ability to market these courses to teachers, both local and non-local, that may be interested in obtaining a certificate, using a course or two as part of another degree program (e.g., M.Ed. in Mathematics Education, M.A.T. in 9-12 mathematics) or as a non-degree student, perhaps using the course as professional development or to transfer to another institution.

To help kick off the first cohort of students to be enrolled in the certificate program, funds from the STEM Initiative have been awarded, to be spent by June 2018. Three students accepted into the certificate program for Fall 2018 will each be awarded a \$2500 scholarship.

Program Requirements

Students take graduate-level mathematics education courses that are offered online. The certificate requires 12 hours of mathematics education courses, taken for a grade, at NC State. No courses can be transferred into the graduate certificate program.

Students can **choose four out of the five** courses (12 hrs):

EMS 510: Interactions in the Mathematics Classroom (to be transitioned to an online course in 2018-19)

EMS 580: Teaching Mathematics with Technology

EMS 513: Teaching and Learning of Algebraic Thinking

EMS 514: Teaching and Learning of Geometric Thinking

EMS 519: Teaching and Learning of Statistical Thinking

EMS 580 is offered every year in the Fall. EMS 519 is offered every year in Spring. EMS 514 and 513 are offered in alternate Fall semesters, and EMS 510 is offered in Odd year Spring semesters. If enrollment in the rotating courses increases, they could be offered more frequently. As the program grows, additional courses may be developed and offered online (e.g., Teaching and Learning Calculus, Learning School Mathematics from an Advanced Perspective). With current course offerings, students could complete the Graduate Certificate in three or four semesters.

To summarize: Courses available each semester are shown in the following table:

Fall odd year	Spring even year	Fall even year	Spring odd year
EMS 514 EMS 580	EMS 519	EMS 513 EMS 580	EMS 510 EMS 519

Students could finish the certificate in three semesters if they begin in an odd Fall semester or in two semesters if they begin in an even Fall semester. The longest period of time to complete the certificate would be four semesters.

A grade of C- or better is required for a course to count toward the certificate. A 3.00 GPA is required to earn the certificate.

Academic success in the Graduate Certificate in Mathematics Teaching and Learning might have a strong bearing on admission to a Masters or PhD program. However, completion of a graduate certificate program in no way guarantees entry into a graduate degree program, which must be completed through a separate application process.

Enrollment Projections:

To provide more detail to the enrollment projections stated on the cover page, enrollment projections for new and continuing students are as follows, assuming the longest possible time (2 years) to complete 4 courses:

	YR1	YR2	YR3	YR4
New	5	5	15	15
Continuing		5	5	15
TOTAL	5	10	20	30

Admissions Procedures:

An application for acceptance into the Graduate Certificate in Mathematics Teaching and Learning is required for all new students. Students must complete the Graduate School application, found at <http://www.ncsu.edu/grad/applygrad.htm>. Requirements for admission to the certificate program include:

1. completion of a bachelor's degree in mathematics education, mathematics, or statistics or a related field with a GPA of 3.0 or greater on a 4.0 scale.
2. transcripts of all undergraduate and graduate course work (unofficial copies accepted)
3. a written statement of goals related to enrolling in the Graduate Certificate in Mathematics Teaching and Learning.

International applicants who are not degree-seeking students in an NC State University graduate program can complete the program online. International students will not be able to receive a visa to complete this graduate certificate program in the US.

Those applicants who are currently enrolled in an NC State graduate degree program and in good standing need only submit the graduate student Certificate Plan Data Entry form to the program coordinator.

<https://grad.ncsu.edu/wp-content/uploads/2015/12/grad-cert-plan-data-entry.pdf>

Deadlines:

Applications will be considered on a rolling basis with the following deadlines:

Fall: April 1

Spring: October 15

Tuition:

Tuition rates will be the regular graduate tuition rates for distance education.

4 Distance Education courses at approximately \$1300/3-credit course for instate students, and \$3444/3-credit course for out-of-state students. Total tuition for certificate is \$5200 instate, \$13776 out-of-state (rates based on current tuition and fees for 2017-2018).

Program-level Assessment

Learning Outcomes:

1. Graduate certificate students will demonstrate their ability to apply their knowledge of teaching and learning mathematics/statistics content (algebra, geometry, statistics) to support students' mathematics learning.
2. Graduate certificate students will demonstrate their ability to design lessons that use mathematically-rich tasks to promote students' conceptual understanding.
3. Graduate certificate students will demonstrate their ability to use different instructional strategies (e.g., discourse, technology) to support students' mathematics learning.
4. Graduate certificate students will demonstrate their ability to analyze students' mathematical/statistical thinking.
5. Graduate certificate students will be satisfied with their learning experience in the certificate program.

Data for Assessing Learning Outcomes

Outcome	Data	Data Source	Collection Date
Graduate certificate students will demonstrate their ability to apply their knowledge of teaching and learning mathematics/statistics content (algebra, geometry, statistics) to support students' mathematics learning.	Task design rubric scores	The task design assignment requires students to apply their knowledge of a particular mathematics or statistics topic	A similar task design assignment is offered in EMS 513, EMS 514, and EMS 519
Graduate certificate students will demonstrate their ability to design lessons that use mathematically-rich tasks to promote students' conceptual understanding.	Task design rubric scores	The task design assignment requires students to select, modify, or create a mathematically-rich task that can be used to promote students' conceptual understanding	A similar task design assignment is offered in EMS 513, EMS 514, and EMS 519
Graduate certificate students will demonstrate their ability to use different instructional strategies (e.g., discourse, technology) to support students' mathematics learning.	Inquiry project rubric scores	The inquiry project requires students to design an intervention that uses a particular instructional strategy and assess its effectiveness with students	The inquiry project is one course project option that can be completed in any of the EMS courses.
Graduate certificate students will demonstrate their ability to analyze students' mathematical/statistical thinking.	Inquiry project rubric scores	The inquiry project requires students to analyze students work that results from a particular instructional intervention to determine its effectiveness	The inquiry project is one course project option that can be completed in any of the EMS courses.

Graduate certificate students will be satisfied with their learning experience in the certificate program.	Survey responses	The Graduate Certificate in Mathematics Teaching and Learning Satisfaction Survey	The Graduate Certificate in Mathematics Teaching and Learning Satisfaction Survey will be completed by students at the end of the certificate program
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The task design assignment and inquiry projects will be embedded in the courses students are taking. Rubrics used by the instructor of these courses to rate students' work on these projects will be submitted to the Coordinator of the Certificate program to use for program evaluation purposes. A Three-point Rubric will allow for rating students as developing, on target or exemplary.

- Developing indicates a student's knowledge related to teaching and learning mathematics are not well developed and applied, and/or not well communicated.
- On Target indicates a student's knowledge related to teaching and learning mathematics are satisfactorily developed and applied, and is well communicated.
- Exemplary indicates a student shows evidence of a deep understanding of issues related to teaching and learning mathematics and creatively applies this an assignment and communicates these ideas in an exceptional way.

Task Design Assignment: Guidelines and Scoring Rubric

Section	Rated on 3 Point Scale Developing (1), On Target (2), Exemplary (3)
<p>I. Introduction Choose a topic that may be difficult for students to learn. Describe the topic that you are planning to teach and the grade level/course where your task could be taught. Identify the prerequisite skills and concepts that are essential for students to be successful in your investigation. Use references and quotes from sources to help provide a clear justification for why this topic is important for students to understand.</p>	

<p>II. Rationale/Justification</p> <p>You will read 6-8 articles related to the topic you wish to teach. These articles will be used to inform your task design. Develop a rationale to support the methods/activities you will be using in your task. The rationale should contain evidence of a synthesis of the information you learned from reading and justify why different aspects of the task are appropriate and help meet your goals. Describe how parts of the task build upon each other to facilitate students' learning of the topic.</p>	
<p>III. Task and Guide for Teachers</p> <p>Include the task as you would give it to students (handouts, slides, etc). If students are using any data or technology files these should be included. If you have adapted this task from another source (or sources), the citation for that source should be made clear (you can put in a footer or at end of task). The task should be easy to read for the intended audience and should have the qualities of a worthwhile mathematical/statistical task. The intended length of students' engagement in the task could be as minimal as 20 minutes, or it could span several class periods.</p> <p>The guide for teachers should have enough detail about classroom procedures, guiding questions for students, and an outline of what you and the students will be doing throughout the task. Throughout the task, students should be actively engaged in appropriate activities to facilitate their development of the ideas you are teaching.</p> <p>The format of the teacher guide is flexible but should at the least include a statement of your mathematical/statistical goals and/or objectives, a list of materials needed, approximate times allocated for each activity, guiding questions the teacher will ask, how you will conclude students' work on the task, etc.</p> <p>Cite any sources if materials are adapted from existing materials.</p>	
<p>IV. References, Writing, Style, and Grammar</p> <p>Cite all references in proper <i>APA format</i>. Points in this section will also apply to the use of proper citations within the body of the paper. Your report should be organized, and of high quality. Please include a table of contents and proper headings. Points in this section will also apply to the use of proper grammar and spelling within the body of the paper.</p>	

Mathematics Education Inquiry Project: Guidelines & Rubric

During their certificate program, each student who would like to be recommended for the Graduate Certificate in Mathematics Teaching and Learning will need to complete this project, which builds from assignments completed during coursework.

Section of Paper	Rated on 3 Point Scale Developing (1), On Target (2), Exemplary (3)
<p>Introduction</p> <p>Describe the topic(s) or issue(s) which are the focus of your analysis. Describe why you are interested in the topic/issue and use references from literature to describe the topic or issue and its importance, (e.g., include references to NCTM, GAISE, and Common Core). State the focus research question(s) that you are exploring.</p> <p>(2-3 pages)</p>	
<p>Methods</p> <p>Describe the context in which data was collected, participants, and tasks or instruments used. Describe a way of framing your analysis that may help you in characterizing students' understanding of the topic or the issue you are investigating. For example, if the focus topic is on students' understanding of proof, there may exist literature that describes "levels of understanding proof" that could be used to characterize students' work on a task on constructing a proof. You may need to develop your own framework based on the focus of your work and what you know from literature. Describe the analysis procedures used with references to appropriate citations to support techniques used. Techniques should be appropriate for the type of data collected and may combine quantitative and qualitative techniques.</p> <p>(3-4 pages)</p>	
<p>Analysis and Results</p> <p>Describe your analysis of data and important findings. When appropriate, use tables and graphs to illustrate your points and organize your work. This section should be organized around central themes or findings and not just a running record of what you did. In what ways can/did the results from your project have positive impacts on student learning or teaching? Support your findings/results with data to back your claims. Insert samples of work or quotes to support claims or illustrate your points.</p> <p>(6-7 pages)</p>	

Discussion

Answer your focus question(s) and discuss what you learned about the teaching or learning of the topic(s) or issue(s) of interest.

Connect your findings with findings from other research about the focus topic(s) or issue(s) of interest.

What new questions about the topic(s) or issue(s) have you formulated that you would like to explore?

(2-3 pages)

References and Grammar

Provide a reference list of literature used in proper APA format. Minimum of 6 *research* references should be used. Points in this section will also apply to the use of proper citations in APA format within the body of the paper. Your report should be organized, and of high quality. Please include a table of contents and proper headings. Points in this section will also apply to the use of proper grammar and spelling within the body of the paper.

Annually, the program faculty will review the data from these sources as part of a program review to determine if the courses and assignments are meeting the needs of our students and allowing students to meet the learning outcomes. Changes may be made accordingly if the learning outcomes are consistently not being met (overall majority at the On Target level or above).

Satisfaction Survey

The following survey will be administered to students upon completion of the last class and awarding of the graduate certificate. The results will also be reviewed annually to determine if the program is meeting the needs of our students.

1. Based on your experiences in the online certificate program, what do you perceive to be the strengths and weaknesses of the online mathematics teacher education courses (EMS 510, EMS 513, EMS 514, EMS 519, EMS 580)?

Strengths:

Weaknesses:

2. To what extent did the certificate program prepare you to be competent in the following: (scale 1-5: 1 not prepared, 2 somewhat unprepared, 3 neutral, 4 well prepared, 5 exemplary preparation)
 - a. Knowing mathematics/statistics content
 - b. Planning for instruction around mathematically rich tasks

- c. Implementing mathematics instruction centered around students' mathematical/statistical thinking
 - d. Using a variety of instructional strategies (technology, discourse) to promote students' mathematical/statistical thinking
 - e. Analyze students' mathematical/statistical thinking
3. While you were enrolled in the graduate certificate program were you a part-time or full-time mathematics/statistics instructor? a)Yes b) No

If yes, what specific knowledge or experiences from the graduate certificate program did you draw upon in your own teaching practice? (open ended response)

4. Would you recommend this graduate certificate program to others interested in improving their mathematics teaching practice? a) Yes b) No

Statement of Consultations with Other Departments

On February 12, 2018, emails were sent to graduate coordinators in three different programs for consultation requesting they review our proposed program and let us know of any conflicts or concerns.

1. Community College Teaching--Duane Akroyd
2. Mathematics--Pierre Gremaud
3. Statistics--Wenbin Li

Consultation with Community College Teaching graduate program

Re: Consultation on Grad Certificate in Mathematics Teaching and Learning



Inbox x



Duane Akroyd

8:37 AM (2 hours ago) ☆



to me, Tuere, Michelle ▾

Hollylynn



In consultation with the AWCPE faculty who work with our certificate and our community college students and we have no objections to the certificate.

Duane

Consultation with Mathematics graduate programs.

In addition to the email sent on 2/12/18, a meeting was held between graduate coordinators and also included several faculty in mathematics on 2/19/18. They gave feedback that was incorporated into the proposal (e.g., making the distinction between

graduate certificates in Mathematics and the proposed one in Mathematics Teaching and Learning), and are in support of the program. Coordinator Pierre Gremaud is consulted further with a department-level graduate committee of faculty to ensure uniform support and write the following email on 2/19/18.

Re: Consultation for Grad Certific proposed in Mathematics Teaching and Learning  

 Inbox x



Pierre A Gremaud

12:17 PM (24 minutes ago) ☆



to me, Ernest, Jo-Ann ▾

Dear Hollylynne,

Thank you for sharing with us your proposal for an online graduate certificate in Mathematics Teaching and Learning.

We have no objection to the development of the proposed activities. In fact, as your proposed certificate aims at providing its graduates with an improved understanding of pedagogical issues pertaining to the teaching of mathematics whereas ours concentrated on mathematical content, we see here several areas of potential synergy.

We are looking forward to extending our discussions and collaboration regarding graduate programs and hope for a prompt approval of your current proposal.

Best regards,

Pierre

Consultation with Statistics graduate programs

Re: COnsultation for Grad Certif in Mathematics Teaching and Learning  Inbox x



Wenbin Lu

1:36 PM (28 minutes ago) ☆



to me ▾

Hi Hollylynne,

I read the proposal. It looks good to me. I have no comments or concerns. I think it may be attractive to some of our master students who have background in mathematics/statistics Education in high school or college.

Best,

Wenbin

Proposed Online Graduate Certificate in Mathematics Teaching and Learning

Graduate certificate targeting practicing math teachers in middle school through college. Expected steady-state enrollment up to 30 students.

This program is differentiated from others in Departments of Mathematics and Statistics by its focus on the pedagogy and learning of math, rather than its practice. Consultations with those departments, and also with the Community College Teaching program, were supportive of the proposed Certificate in Mathematics Teaching and Learning.

The proposed program will be fully online. No new resources are requested, but implementation of the program will require conversion of two site-based DE courses (EMS 510 and EMS 514) to an online format. Other courses in the certificate (EMS 513, EMS 519, and EMS 580) are, or have been, taught online already. Currently all these courses are offered as Flexible Access.

Overall, there seem to be no significant issues with the proposed new online certificate and I believe that it should be recommended by the Vice Provost, DELTA.