- 119

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PROCESS C — CURRICULUM PROPOSAL SCC #04-05- 81.1

NEW Programs - MAJOR Program Revisions - PROGRAM Name Changes

Deadlines: October 5, 2004 to be implemented Fall 2005 ~ February 11, 2005 to be implemented Spring 2006

PROPOSAL TITLE: Certificate of Graduate Study in Middle Grades Mathematics Education

Sponsor: Janet Caldwell E-Mail: caldwell@rowan.edu Ext: 4827

Jill Perry E-Mail: perry@rowan.edu Ext: 3732

DEPARTMENT: Math ~~& Science~~

COLLEGE: Liberal Arts & Sciences

If Liberal Arts & Sciences CHECK : ___ History/Humanities X Math/Sciences ___ Social/Behavioral Sciences

___ UNDERGRADUATE X GRADUATE

THE ATTACHED *NEW PROGRAM – MAJOR PROGRAM REVISION – PROGRAM NAME CHANGE* IS BEST DESCRIBED BY THE ITEM(s) CHECKED

___ *New degree program*
___ *New Major*
___ *New Minor*
___ *New concentration, specialization, or track*
X *New Certificate of Graduate Study Program (COGS & OCGA*
___ *Major changes-degree requirements/major/minor or certificate program*
___ *Changes to College name, School, Department or Degree*
___ *Cosmetic curricular change*

SEP 27 2004

THE FOLLOWING SIGNATURES REPRESENT APPROVAL

Department Chair: Donald J. Foley Date: 9/27/04

Department Curriculum Chair: Abdelkrim Hossein Date: 9/27/04

Academic Dean: Joy Wan Date: 9-27-04

COLLEGE CURRICULUM COMMITTEE

CLOSED HEARING Date: 11/19/2004 Approved ✓ Not Approved ___

COLLEGE CURRICULUM CHAIR: Stephen Hartke

UNIVERSITY CURRICULUM COMMITTEE

OPEN HEARING Date: 12/8/04 Approved 5 Not Approved ___

Senate Curriculum Chair Signature: [signature] Date Senate Announcement/Vote 12/20/04

Comments: ___

EXECUTIVE VICE PRESIDENT/PROVOST Signature: [signature] Date 1/25/05

✓ Approved ___ Not Approved

REGISTRAR

Date 1/31/05 Official Copy & Approval Sheet Filed

Date 1/31/05 Course Description Received & Approved ~ Hegis Taxonomy & Course # 1701528

Course Description Received & Approved ~ Hegis Taxonomy & Course # ___ (Mathematical Modeling & Algebraic Reasoning)

Registrar Signature: [signature]

NOTIFICATION FORWARD

✓ SCC Chair ✓ Academic Dean ✓ Department Chair ✓ Registrar ✓ IR ✓ CAP ✓ VP Student Affairs

✓ VP Student Affairs ✓ Others

TM 2/28/05

Certificate of Graduate Study (COGS)
in Middle Grades Mathematics Education

Abstract

Dr. Janet Caldwell (Professor in the Mathematics Department) and Dr. Jill Perry (Assistant Professor in the Department of Secondary Education) are sponsoring the Certificate of Graduate Study in Middle Grades Mathematics Education. This program is being developed in response to the NJ mathematics core curriculum content standards (NJCCCS), which have prompted considerable changes in mathematics curricula. Likewise, new federal legislation, No Child Left Behind (NCLB), has mandated that middle grades teachers be "highly qualified" in the subject that they teach. Thus, there is an urgent need for middle school teachers to update their content knowledge and instructional methods. Although this COGS will be housed in the CLAS Mathematics Department, it is a joint venture between CLAS and the COE, and will constitute the middle grades mathematics core for the Masters in Education in Standards-Based Practice.

The COGS comprises 18 semester hours, or six courses. Four courses will be offered in the Department of Mathematics (12 sh), one in the Department of Secondary Education/Foundations of Education (3 sh), and one in the Department of Elementary Education (3 sh):

Mathematics Core - 12 sh
- Topics in Elementary Mathematics (1703.600)
- Mathematical Modeling & Algebraic Reasoning – new course proposal – 3 sh
- Selected Topics in Mathematics (1701.523) – two courses – 6 sh
  - Examples: Geometrical Reasoning, Data Analysis & Discrete Math

Mathematics Education - 6 sh
- Processes and Principles in School Mathematics (0833.502) – 3 sh
- Piaget and Elementary Mathematics Education (0802.552) – 3 sh

It is anticipated that this COGS will begin immediately after approval. It is hoped that course offerings can begin in fall 2005. Current staff and space are adequate. Moreover, current resources in the McSiip library and those acquired through 10 years of NJ SSI grants are adequate.

Certificate of Graduate Study in Middle Grades Mathematics Education

Details

a. Certificate of Graduate Study in Middle Grades Mathematics Education

b. Sponsors: Dr. Janet Caldwell, Mathematics, and Dr. Jill Perry, Secondary Education/Foundations of Education

c. Scope or size of the program: A total of eighteen (18) sh of graduate courses in mathematics and mathematics education. Twelve (12) sh will be taught in the department of mathematics,three (3) sh will be taught in the department of secondary education, and three (3) in the department of elementary education.

d. Relationship to curriculum: The program will be housed in the Department of Mathematics in the CLAS. Six courses are required. Three of the six are currently offered in the Dept. of Mathematics and the elementary and secondary education courses are currently offered. One mathematics course is new and is attached to this proposal: *Mathematical Modeling & Algebraic Reasoning*. This COGS proposal may be used as the middle grades mathematics content portion of the Masters in Education in Standards-Based Practice.

e. Prerequisites or eligibility. Students must have an elementary (K-5 or K-8) teaching certificate (but will not have mathematics certification). All policies governing admission to COGS and to non-matriculated graduate students will apply to this program.

f. Suggested time and scale of implementation. It is anticipated that this program will begin immediately after approval. It is hoped that course offerings can begin in fall 2005.

g. Resource requirements (equipment, library, staff, space, etc.) Due to the materials library developed by McSiip (Mathematics & Computer Science Instructional Improvement Program) and 10 years of NJ SSI (Statewide Systemic Initiative) grants, mathematics education materials are more than adequate to immediately support this program. Materials are currently housed in Bosshart with full-time staff. Current staff is adequate.

h. Recommended Library Resources : Library form completed by Greg Potter is attached. (pending)

Rationale

What is the appropriateness and significance of the program?

This program will address two challenges that presently exist in middle grades mathematics education. First, there is an acute shortage of middle grades teachers who are certified in mathematics, since secondary certification has required completion of a full mathematics major. The No Child Left Behind Act of 2001 (NCLB) requires that middle grades teachers demonstrate competency in the subject areas they teach. Second, many middle grades mathematics teachers in New Jersey are certified only in elementary education. These teachers generally took very few mathematics courses in their undergraduate programs. The proposed COGS recognizes the courage it takes for teachers with limited preparation in mathematics to prepare to teach mathematics. It prepares experienced teachers, who are already state-certified in an area other than mathematics, to successfully teach mathematics in the middle grades.

Research confirms that most teachers enhance their content haphazardly from occasional articles in journals or newsletters or by attending conferences. Effective teachers need mathematical knowledge that is organized for teaching and provides a deep understanding of the subject they teach. It is also important that teachers form an awareness of conceptual barriers and knowledge of the historical, cultural, and scientific roots of mathematical ideas (Ma, 1999; Shulman, 1986).

Furthermore, research on teaching and learning also suggests that carefully designed instruction, for example, active engagement of students in collaborative investigations leading to conjectures and hypotheses rather than passive lecturing, will produce deeper learning and better retention of mathematics.

Moreover, the growing role of data analysis, probability, and discrete mathematics in science, engineering, computing, and business, and new mathematics curricula have broadened the content that must be taught. Furthermore, new calculator and computer technologies with powerful computational and symbolic capabilities are transforming the mathematics classroom. The case for such a program is further strengthened by the considerable changes in school mathematics curricula, specifically NSF standards-based projects.

Many teachers of middle grades mathematics presently have little formal training in mathematics, having taken only two or perhaps three mathematics and/or mathematics education courses as undergraduates. Federal and state regulations (NCLB) now require that such teachers in grades 6-8 have a minimum of 15 semester hours of mathematics or mathematics education courses. Thus, middle grades mathematics teachers need to know more mathematics than traditionally has been taught in teacher education programs. Likewise, since they are being asked (urged) to teach in different ways, teachers also need to experience learning mathematics in those ways themselves.

Similar graduate level programs exist at other institutions around the country (e.g., Salisbury State University in Maryland). Montclair State University has been offering a similar certificate program at the graduate level for the past few years and has recently established a Master of Arts in Teaching Middle Grades Mathematics.

Essence of the Specialization /Concentration/ Minor/Achievement Certificate

a. Major goals of the program:

- To increase teachers' mathematics content knowledge in order to address the considerable changes in mathematics curricula.
- To increase teachers' pedagogical content knowledge in order to address the considerable changes in mathematics curricula.
- To create a community of learners to facilitate teachers' engagement in reflective practice

b. Specific objectives of the program.

The primary objective of this program is to increase the mathematical knowledge and related pedagogical skills of New Jersey middle grades mathematics teachers. The program is designed for teachers, with NJ teaching certificates in disciplines other than mathematics and closely-related fields, who are teaching mathematics in the middle grades or preparing for such an assignment. The program provides teachers with a broad understanding of the conceptual foundation of school mathematics while making connections to the mathematics that they teach.

More specifically, students will:

1. demonstrate a deep conceptual understanding of school mathematics
2. model and implement multiple teaching methodologies (e.g., collaborative and cooperative grouping, inquiry learning, discovery learning, direct instruction, . . .)
3. create and implement standards-based unit plans
4. integrate into their teaching awareness of conceptual barriers students face in the learning of mathematics
5. integrate into their teaching knowledge of the historical, cultural, and scientific roots of mathematical ideas
6. engage in reflective practice as members of a community of learners

c. Structure of Organization:

I. Mathematics core - 12 sh

Required:

Topics in Elementary Mathematics (1703.600)
This course is designed to improve the understanding and attitudes of practicing elementary teachers (K-8). Specific topics to be addressed include quantitative reasoning, spatial reasoning, inductive and deductive reasoning, mathematical

systems, and communication in mathematics. Students are expected to engage in some independent work.

Mathematical Modeling & Algebraic Reasoning – new course proposal – 3 sh (1703.xxx)
Students in this course will learn about polynomial, rational, and exponential functions by building and analyzing mathematical models for a variety of situations. Using algebraic representations, problem solving, using technology, connecting abstract algebra with middle grades mathematics, and fluency with algebraic procedures will be stressed.

Selected Topics in Mathematics (1701.523) – Students will be expected to select two course offerings from different areas of mathematics (e.g., Geometry; Data Analysis & Discrete Math)– 6 sh
This course provides students with the opportunity to explore current issues in mathematics. The course will have a changing focus that will permit faculty to offer specialized seminars focused on new developments in the field, issues of significance, areas of faculty research, or in response to students' requests. Students may take this course for credit more than once (limit: 9 sh), as long as the focus of the course is different each time the student enrolls.

II. Mathematics Education - 6 sh

Processes and Principles in School Mathematics –0833.502 – 3 shIn this course students will expand their pedagogical repertoires to include the mathematical processes of communicating, representing, making connections, problem solving, and reasoning and proving. The principles of curriculum, teaching, technology, equity, learning, and assessment will provide a framework for the study of the processes and students' current practice. These processes and principles will be studied entirely within the context of school mathematics content.

Piaget and Elementary Mathematics Education – 0802.552 – 3 sh
This course provides an opportunity for students to examine how students learn mathematics throughout the elementary and middle grades, including concepts of time, fractions, and proportions.

Sequence of courses: We expect to offer the courses as follows, but there is no required sequence. Thus teachers may start the COGS at anytime and finish in one year. Mathematic core choices will be offered in every semester (fall, spring, and summer sessions). Since teachers are not likely to take two classes per semester during the school year, we expect most teachers to progress through the program as shown in the table below.

Summer	Fall	Spring	Summer
Year n	Year n	Year (n+1)	Year (n+1)
Topics in Elementary Math Mathematical Modeling & Algebraic Reasoning	Selected Topics	Selected Topics	Processes and Principles in School Mathematics Selected Topics Piaget and Elementary Mathematics Education

Administration
The COGS will be housed in the mathematics department and advising will be conducted by the graduate advisor of the mathematics department, who currently advises students in the M.A. in mathematics program and students in the Subject Matter Teaching – Mathematics M.A. program.

Results of Consultation
a. Letters of consultations are attached from: (pending)

Dr. Carol Sharp, Dean of College of Education
Dr. Jay Kuder, Dean of Graduate School
Dr. Holly Willett, Department of Secondary Education
Dr. Robin McBee, Department of Elementary Education

New Courses

a. Mathematical Modeling & Algebraic Reasoning

See attached proposal.

1701528

New Course Proposal

1. Details
   - A. Title: Mathematical Modeling and Algebraic Reasoning
   - B. Sponsor: Dr. Janet Caldwell, Department of Mathematics
   - C. Credit Hours: 3
   - D. Course Level: Graduate
   - E. Prerequisites: Undergraduate degree in elementary education or elementary teaching certificate
   - F. Suggested Time, Implementation: One section of the course to be offered once every summer
   - G. Curricular Effect: Required in the COGS in middle grades mathematics education
   - H. Adequacy: Present staff is adequate. Cost incurred would be limited to faculty summer pay for 3 sh
   - I. Resources: Faculty, computer equipment, and mathematics department resources are adequate. Ten years of NJ SSI and the current MSP grant have collected a more than adequate library of materials.

2. Rationale:

a) With the completion and implementation of the NJ Mathematics Curriculum Frameworks (1996) across the state, the mathematical content knowledge of in-service teachers needs to be upgraded. There is content in the Standards (e.g: mathematical modeling) that many teachers did not learn as undergraduates, especially if they took only the minimum number of mathematics courses required for elementary certification. This course will provide the opportunity for teachers to update their mathematical content knowledge, preparing their students to pass the mathematics sections of the new state tests.

b) There is no current similar mathematics course at Rowan University that addresses the critical need that middle grades mathematics teachers have with respect to updating their content knowledge and the relationship between school mathematics and higher mathematics. Since algebra serves as the gatekeeper for higher-level mathematics and is more often being taught in the middle grades, it is important for middle grades mathematics teachers to have a particularly strong background in this area.

c) Similar courses exist at Salisbury State University, Wright State University, William Paterson University, and Western Michigan University. There is no similar course offered elsewhere in southern New Jersey.

3. Essence of the Course and Outline:

The objective of this course is to develop a deeper understanding of mathematical modeling and a new appreciation of the beauty, logical structure, and applicability of

algebra. The course will take into account not only the many interconnections among school mathematics topics but also their relationship to higher mathematics.

The content for this course is an area of mathematics that is of great benefit to middle grades mathematics teachers but is rarely seen by them. Specifically, content includes:

I. Mathematical Modeling
   a. The modeling process
   b. Linear models
   c. Quadratic models
   d. Exponential and logarithmic models
   e. Trigonometric models
   f. Polynomial models
   g. Logistic models

II. Algebraic reasoning
   a. Variables and patterns
   b. Functions - historical evolution, problem analysis, properties, limiting behavior, fitting data
   c. Matrix modeling
   d. Equations – isomorphism, algebraic structure
   e. Number system structures - modular arithmetic, integer congruence, number fields

The above content will be examined with the following in mind:

- analyses of alternative definition, language, and algorithms for mathematical ideas and concepts
- why concepts arose and how they change over time
- a wide range of applications
- calculator and computer technology approaches to problems
- analyses of common middle grades math problems from a deeper mathematical level
- how problems and proofs can be extended and generalized
- how ideas studied in school mathematics relate to ideas studied later in mathematics

Resources:

Beaumont & Pierce (1963). The Algebraic Foundations of Mathematics. Addison-Wesley.

House & Coxford (eds). (1995). Connecting Mathematics across the Curriculum, 1995 Yearbook of the NCTM. NCTM.

Ifah, Georges (2000). The Universal History of Numbers. Wiley.

Nelson, Roger (2000). Proofs Without Words II: More Exercises in Visual Thinking. MAA.

Peressini, A. & Sherbert D. (1971). Topics in Modern Mathematics for Teachers. Holt, Rinehart & Winston.

Polya, George (1954). Induction and Analogy in Mathematics. Volume I and II. Wiley.

Ribenboim, Paulo (2000). My Numbers, My Friends. Springer-Verlag.

Silvester, J. (2001). Geometry: Ancient and Modern. Oxford University Press.

Usiskin, Peressini, Marchisotto, & Stanley (2003). Mathematics for High School Teachers. Pearson Education.

Evaluation & Grading:

Students will be evaluated through written homework and exams, including open-ended questions. Moreover, students will have written projects involving hands-on activities and requiring the development and testing of mathematical models.

Course evaluation:

This course will be evaluated through the customary student evaluations as well as a regular departmental review.

4. Consultations: (pending)

Dr. Carol Sharp, Dean of College of Education
Dr. Jay Kuder, Dean of Graduate School
Dr. Holly Willett, Department of Secondary Education
Dr. Robin McBee, Department of Elementary Education

Catalog Description: Mathematical Modeling & Algebraic Reasoning

1703.XXX - ??? - 3 sh

Students in this course will learn about polynomial, rational, and exponential functions by building and analyzing mathematical models for a variety of situations. The course stresses using algebraic representations and technology, problem solving, connecting abstract algebra with middle grades mathematics, and fluency with algebraic procedures.

ROWAN UNIVERSITY

Dean of The Graduate School

September 10, 2004

Janet Caldwell, Ph.D.
Department of Mathematics
Rowan University

Dear Dr. Caldwell:

Thank you for the opportunity to review the proposal.for the Certificate of Graduate Study in Middle Grades Mathematics Education.

I believe that this program would be an excellent addition to the graduate-level program offerings of Rowan University. As you note in your proposal, many middle school math teachers do not have full certification in mathematics. Under the "NO Child Left Behind" act, they will need to demonstrate that they are fully qualified to teach mathematics. The proposed program will provide them with a course of study that is specifically tailored to the needs of teachers of middle grade mathematics and, therefore, enable those teachers to demonstrate their competence.

You are to be commended for developing a collaborative program with the College of Education. Such programs more fully utilize the resources of the university and recognize the special expertise that faculty from both colleges can contribute to the program. As proposed, the program fits the guidelines for certificate programs. It appears to be well designed to accomplish the goals you have set for the program.

I look forward to working with you to implement all of the elements of this program and to inform potential students of this new and exciting opportunity.

Sincerely,

S. Jay Kuder, Ed.D.
Associate Provost for Research and
Dean of The Graduate School

201 Mullica Hill Road • Glassboro, New Jersey • 08028-1701 • Phone (856) 256-4050 • Fax (856) 256-4436

Office of the Dean, College of Education

August 23, 2004

Dr. Janet H. Caldwell
Rowan University
Mathematics Department

Dear Dr. Caldwell:

Your proposal to implement a Certificate of Graduate Study (COGS) in Middle Grades Mathematics Education has my complete support. This COGS addresses several key issues facing middle grades mathematical education: the severe shortage of middle grades teachers who are certified in mathematics; the federal legislation – No Child Left Behind Act – which requires that middle grades teachers demonstrate competency in the subjects they teach; and recent changes in curriculum and pedagogical approaches to mathematics instruction. This program will also provide teachers who are certified in other subject areas to attain certification in middle grades mathematics education.

I commend your efforts in developing this proposal.

Sincerely,

Carol A. Sharp

Carol A. Sharp, Ph.D.
Dean

201 Mullica Hill Road • Glassboro, New Jersey • 08028-1701 • Phone (856) 256-4750 • Fax (856) 256-4918

Department of Secondary Education/Foundations of Education
September 16, 2004

Dr. Janet Caldwell
Department of Mathematics
Rowan University

Dear Janet;

Thank you for attending the SE/FE Curriculum Committee meeting yesterday. Your participation was very helpful in our deliberations.

I am pleased to report that at our department meeting today we voted to support strongly the Middle School Mathematics Certificate of Graduate Study. The proposal addresses the need for highly qualified math teachers in middle schools. It provides an important professional development opportunity for teachers who haven't majored in math to focus attention within their grade level, which can only strengthen middle school math instruction. We note with pleasure that the proposal also addresses the recent changes in school mathematics. In addition, we welcome the additional COGS option for the new master's degree within the College of Education.

While this COGS presents instructional and scholarly opportunities for our departments, the ultimate beneficiaries will be New Jersey middle school students. Not only will their teachers be able to better communicate the excitement of mathematics to their students, these teachers will also see that collaboration strengthens all levels of instruction.

We appreciate the Math Department's initiative in creating this joint venture, and we look forward to working with the graduate students that our two departments will share.

Yours,

Holly G. Willett, Ph.D.
Associate Professor
Department Chair

cc: Dr. Eric Milou
Dr. Jill Perry
Dr. Ron Czochor
Dr. Carol Sharp

201 Mullica Hill Road, Glassboro, New Jersey 08028-1701•856-256-4755•Fax: 856-256-4918

Department of Elementary/Early Childhood Education

September 14, 2004

Dr. Janet Caldwell, Professor
Mathematics Department
Dr. Jill Perry, Assistant Professor
Secondary Education/Foundations of
Education Department
Rowan University
Glassboro, NJ 08028-1701

Dear Drs. Caldwell and Perry:

On behalf of the Department of Elementary/Early Childhood Education, I am writing to express the Department's support of your proposed Certificate of Graduate Study in Middle Grades Mathematics Education. The Department has reviewed in depth both the proposal and the new course proposal, and we have consulted with you in depth about the content of the COGS. We are pleased to include our department's course, *Piaget and Elementary Mathematics Education (0802.552)*, in the COGS, and we believe that the program represents a sound approach to further preparing experienced teachers to teach mathematics at the middle school level. Further, the Department did meet and vote to support the proposal on September 8, 2004.

We wish you luck with the approval process and look forward to working further with you on the COGS.

Sincerely,

Robin Haskell McBee, Ph.D.
Associate Professor and Chair
Elementary/Early Childhood
Education Department

201 Mullica Hill Road • Glassboro, New Jersey • 08028-1701 • Phone (856) 256-4735 • Fax (856) 256-4918

Rowan University

Campbell Library

Library Resources Form

Department/School: College of Education/ Mathematics & Secondary Education

Proposed by: Drs. Caldwell and Perry

Program Title: Certificate of Graduate Study in Middle Grades Mathematics Education

Anticipated Date for Course/Program Offering: Fall 2005

Part B: Resources that should be acquired

No additional resources are needed at this time.

Part C: Resources available in Campbell Library

The library has 7,279 book and multimedia resources on mathematics (Books: 7,123; Reference Materials: 112; Videos: 44). Within these holdings are included works about mathematics education and the teaching of mathematics. With vendor approval plans in place for both education and university presses, the library captures new imprints across all areas of mathematics.

Part D: List key periodical resources

Campbell Library is fortunate to have access to online journal databases in a large number of academic subjects, including the arts, humanities, literature, education, mathematics, philosophy, psychology, the physical and natural sciences, and the social sciences. Access to worldwide, regional, and local newspapers is also provided, including alternative press publications.

Of particular significance is the Math-Science database (MathSci +), produced by the American Mathematical Association. This online database contains information from the printed publications of Mathematical Reviews and Current Mathematical Publications. MathSci + provides comprehensive coverage of international research in mathematics and mathematically related research in statistics, computer science, physics, operations research, engineering, biology, and related disciplines. Almost 2,000 journals are represented.

In addition, the library subscribes to the Elsevier Science Direct database. Included in this comprehensive online journal database are 128 titles in mathematics, computer science, logic, operations research, computer-aided design, and statistics.

Certificate of Graduate Study in Middle Grades Mathematics Education, continued…

Part E: Librarian remarks

Given the library's current book holdings and online journal access, this program can be supported.

GCP 8/30/04

Form B

Rowan University
Board of Trustees
Academic Affairs Subcommittee

SCC Proposal # 04-05-802

Department/College: Mathematics Department
College of Liberal Arts and Science

Action Item:

Certificate of Graduate Study in Middle Grades Mathematics Education

Submitted by: Christy K. Kerr
(Provost)

Justification:

Approved: 1/25/05
Date

Signed: [signature]
Committee Chair

Notice of this action item will be **announced** at the full Board of Trustees meeting to be held on February 16, 2005 and will be forwarded to the Academic Issues Committee of the New Jersey Presidents' Council for **notification**.

	YES	DATE
AA/BOT	☑	1-25-05
FULL BOARD	☐	
STATE	☐	