

Rowan University
Board of Trustees
Academic Affairs Subcommittee

SCC Proposal # 03-04-806 COGS in Secondary Math Ed.
Department/College: Mathematics Dept.

Action Item:

Certificate of Graduate Study in Secondary Mathematics Education

Submitted by: Christy L. Scini
(Provost)

Justification: This program is being developed in response to the NJ
mathematics core curriculum content standards (NJCCCS), which has
prompted considerable changes in mathematics curricula. This program
addresses the need for mathematics teachers to update their content
knowledge and instructional methods.

Approved: 5/17/04
Date

Signed: [Signature]
Committee Chair

Notice of this action item will be **announced** at the full Board of Trustees meeting to be held on June 16, 2004 and will be forwarded to the Academic Issues Committee of the New Jersey Presidents' Council for **notification**.

AA/BOT	YES <input checked="" type="checkbox"/>	DATE <u>5/17/04</u>
FULL BOARD	<input checked="" type="checkbox"/>	<u>6/16/04</u>
STATE	<input checked="" type="checkbox"/>	<u>7-13-04</u>



Office of the Executive Vice President / Provost

July 13, 2004

Dr. Judith K. Winn
Chair, Academic Issues Committee
Bergen Community College
400 Paramus Road
Paramus, NJ 07652-1595

Dear Dr. Winn,

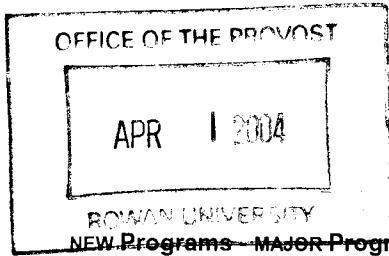
As a matter of information, Rowan University has approved a Certificate of Graduate Study in Secondary Mathematics Education. It is being offered by the Mathematics Department in cooperation with the Secondary Education/Educational Foundations Department. It was approved by the Academic Affairs Subcommittee of the Board of Trustees on May 17, 2004 and announced at the Rowan Board of Trustees meeting on June 16, 2004.

Sincerely,

Christy Faison,
Associate Provost for Academic Affairs

rw

Encl: 20 copies Form B



ETS
P. 6

PROCESS C

CURRICULUM PROPOSAL SCC #03-04-

NEW Programs - MAJOR Program Revisions - PROGRAM Name Changes

LIBRARY RESOURCE FORM REQUIRED

Deadlines: October 3, 2003 to be implemented Fall 2004 ~ February 13, 2004 to be implemented Spring 2005

PROPOSAL TITLE: COGS in Secondary Math Education

Sponsor(s): Eric Milou E-Mail: milou@rowan.edu Ext: 3786
Jill Perry E-Mail: perry@rowan.edu Ext: 3732

DEPARTMENT: Math

COLLEGE: CLAS

If Liberal Arts & Sciences CHECK : History/Humanities Math/Sciences Social/Behavioral Sciences
 UNDERGRADUATE GRADUATE

THE ATTACHED **NEW PROGRAM - MAJOR PROGRAM REVISION - PROGRAM NAME CHANGE** IS BEST DESCRIBED BY THE ITEM(S) CHECKED.

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

THE FOLLOWING SIGNATURES REPRESENT APPROVAL

Department Chair: Ronald J. Gohler Date: 9/15/03
Department Curriculum Chair: Abdulkred Hense Date: 10/1/03
Academic Dean: Guy Hon Date: 10/2/03

COLLEGE CURRICULUM COMMITTEE

CLOSED HEARING Date: 12/4/03 Approved Not Approved
COLLEGE CURRICULUM CHAIR: R Mil

UNIVERSITY CURRICULUM COMMITTEE

OPEN HEARING Date: 3-22-2004 Approved Not Approved
Senate Curriculum Chair Signature: Philip A. Lewis Date: Senate Announcement/Vote: 3-22-2004
Comments: _____

EXECUTIVE VICE PRESIDENT/PROVOST Signature: _____ Date: _____
 Approved Not Approved

REGISTRAR

Date: 7/14/04 Official Copy & Approval Sheet Filed
Date: _____ Course Description Received & Approved ~ Hegis Taxonomy & Course # _____
Course Description Received & Approved ~ Hegis Taxonomy & Course #: _____
Registrar Signature: [Signature]

NOTIFICATION FORWARD

- SCC Chair
- Academic Dean
- Department Chair
- Registrar
- IR
- CAP
- VP Student Affairs
- VP Student Affairs
- Others

JM 7/27/04

5-17-04 rw

Certificate of Graduate Study (COGS)
in Secondary Mathematics Education

Abstract

Dr. Eric Milou (Associate 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 Secondary Mathematics Education. This program is being developed in response to the NJ mathematics core curriculum content standards (NJCCCS), which has prompted considerable changes in mathematics curricula. Likewise, new federal legislation, No Child Left Behind (NCLB), has mandated that secondary school teachers be “highly qualified” in the subject that they teach. Thus, there is an urgent need for mathematics 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 mathematics core for the M.A. in Teacher Leadership.

The COGS comprises 15 semester hours – 5 courses. Nine (9) sh in the department of mathematics and six (6) sh in the Secondary Education Department:

Mathematics Core - 9 sh

Select two courses (6 sh) from:

Foundations of Mathematics – 3 sh (1701.500)

History of Mathematics – 3 sh (1701.522)

Discrete Mathematics – 3 sh (1703.550)

Number Theory – 3 sh (1701.503)

Linear Algebra & Matrix Theory – 3 sh (1701.502)

Required: School Mathematics from an Advanced Standpoint - new course proposal - 3 sh

Mathematics Education - 6 sh

Processes and Principles in School Mathematics - new course proposal - 3 sh

Problems in Math Ed I (0833.600) - 3 sh - research course in math education

It is anticipated that this COGS will begin immediately after approval. It is hoped that course offerings can begin in fall 2004. 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 Secondary Mathematics Education

Details

- a. Certificate of Graduate Study in Secondary Mathematics Education
- b. Sponsors: Dr. Eric Milou, Mathematics and Dr. Jill Perry, Secondary Education
- c. Scope or size of the program: A total of fifteen (15) sh of graduate courses in mathematics and mathematics education. Nine (9) sh will be taught in the department of mathematics and six (6) sh will be taught in the department of secondary education.
- d. Relationship to curriculum: The program will be housed in the Department of Mathematics in the CLAS. Five courses are required. Three of the five are currently offered (2 in the Dept. of Mathematics and 1 in the Dept. of Secondary Education); two are new and are attached to this proposal: *School Mathematics from an Advanced Standpoint* and *Processes and Principles in School Mathematics*. This COGS proposal may be used as the mathematics content portion of the MA in Teacher Leadership (currently being written). Several of the mathematics courses are shared with the MA in mathematics.
- e. Prerequisites or eligibility. Students must have an undergraduate degree in mathematics or secondary mathematics teaching certificate. 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 2004.
- g. Resource requirements (equipment, library, staff, space, etc.) Due to the material 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 secretary staff. Current staff is adequate.
- h. Recommended Library Resources : Library form completed by William Garrabrant is attached.

Rationale

What is the appropriateness and significance of the program?

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.

All of these changes in mathematics curriculum and teaching challenge conventional teacher education programs. Thus, mathematics teachers need to know more and somewhat different 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.

In further evidence of the need for graduate programs, the mathematics department surveyed the South Jersey community in the spring 2003 on their interest in applying to graduate programs. Respondents were given the following choices: M.A. in math education, M.A. in teacher leadership, M.S. in applied math, M.S. in statistics, Doctorate in applied math, Doctorate in math, and Doctorate in math education. Of the seventy nine (79) returned surveys, masters of arts in math education was the overwhelming favorite (49.3% of respondents were interested in graduate courses in mathematics education).

Essence of the Specialization /Concentration/ Minor/Achievement Certificate

a. Major goals of the program:

- To increase teachers' mathematics content knowledge to address the considerable changes in mathematics curricula.
- To increase teachers' pedagogical content knowledge to address the considerable changes in mathematics curricula.

- To increase teachers' familiarity with current and historical research in mathematics education
- To introduce teachers to multiple research methodologies in mathematics education
- To create a community of learners to facilitate teachers' engagement in reflective practice

b. Specific objectives of the program.

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. respond critically to current and historic research in mathematics education
5. analyze and evaluate multiple research methodologies
6. integrate into their teaching awareness of conceptual barriers students face in the learning of mathematics
7. integrate into their teaching knowledge of the historical, cultural, and scientific roots of mathematical ideas
8. engage in reflective practice as members of a community of learners

c. Structure of Organization:

I. Mathematics core - 9 sh

Select two courses from:

Foundations of Mathematics (1701.500) – 3 sh - Strategies and tools for problem solving, including computer use, will be applied to specific problems from number theory, geometry, analytic geometry, algebra, discrete mathematics, logic, and calculus.

Linear Algebra & Matrix Theory (1701.502) – 3 sh – This course includes linear systems, linear dependence and independence, linear transformation theory, multilinear forms, matrices, determinants, inner product spaces.

Number Theory (1701.503) – 3 sh - This course includes divisibility properties of integers, mathematical induction, modular congruence, linear congruences and diophantine analysis, congruences of higher degree, quadratic residues, famous problems of number theory.

History of Mathematics (1701.522) – 3 sh - Topics include: Babylonian, Egyptian, and Greek mathematics as well as topics in current mathematics. Attention will be given to the development of trigonometry, algebra, analytic geometry and the calculus.

Discrete Mathematics (1703.550) – 3 sh - This course provides an advanced approach to topics in discrete mathematics for persons with substantial background in traditional mathematics. Selected topics are explored in depth and related to concepts from other areas of mathematics. Topics normally included are logic, combinatorics, number systems, data structures, and representations, Boolean algebra, induction, graphs and trees.

Required:

School Mathematics from an Advanced Standpoint - new course proposal - 3 sh
 This course is intended to develop a deeper understanding of school mathematics and a new appreciation of its beauty, logical structure, and applicability. The course will take into account not only the many interconnections among school mathematics topics, but also their relationship to higher mathematics.

II. Mathematics Education - 6 sh

Processes and Principles in School Mathematics - new course proposal - 3 sh
 In 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.

Problems in Math Ed I (0833.600) - 3 sh – Students investigate recent developments and relevant research in mathematics education. The student identifies a problem and develops a proposal for investigating the problem as a project. The project may be either local or national in scope but must deal with a problem in mathematics or computer education.

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)
School Math from an Advanced Standpoint Math Core Choice	Problems in Math Ed I	Math Core Choice	Processes and Principles in School Mathematics Math Core Choice

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:

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

New Courses

- a. Processes and Principles in School Mathematics
- b. School Mathematics from an Advanced Standpoint

See attached proposals.

Library Support for a Mathematics Course

Describe the resources available in the library to support this course/program, including reference, monographic, electronic databases, audio-visual materials, etc. A summary statement is sufficient.

Recent reference works include the *Encyclopedia of Mathematics Education* (2001), the *CRC Concise Encyclopedia of Mathematics* (1999), and the *CRC Standard Mathematical Tables and Formulas 30th Edition*. There are both recent and older mathematical dictionaries, encyclopedias, and tables. Over 250 shelves of circulating monographs are located in the stacks on the third and fourth floors. We have online access to such databases as Academic Search Premier, MathSci Net, WebSPIRS, JSTOR, Science Direct, and of course the Educational Resources Information Center (ERIC). Taken together, these databases provide access to thousands of articles on mathematics and related sciences, many full-text and some full-image. Our collection of audio-visual materials in mathematics consists of two shelves of videotapes of Educational Video Research and NOVA-type programs on PBS, but future acquisition of materials should perhaps be in DVD format or delivered via Internet.

List key periodicals available in the library to support this course/program.

We subscribe to print issues of the *Journal for Research in Mathematics Education*, *Mathematics Teacher*, *Mathematics and Computer Education*, *Mathematics Teaching in the Middle School*, and other, more general or subject oriented periodicals in mathematics. Other periodicals are available from online databases as noted above.

List specific resources that should be acquired to support this course. None

Through ten years of grants in mathematics education, we have our own library (MeSip and N7SS1) in Bosham with thousands of materials and an office staff.

Librarian comments and recommendations:

A review of government funded research by federal agencies other than ERIC, such as the National Science Foundation, and institutions, such as the Massachusetts Institute of Technology, might be indicated. Many other organizations are sources for published and online information, which occasionally is of such value as to be cataloged for the general collection if in print form, or linked to library resource pages if online.

William A. Garrabrant
Science Librarian and
Library Liaison
Mathematics Department
856-256-4979
garrabrant@rovan.edu



Office of the Dean, College of Education

September 23, 2003

Dr. Eric Milou
Mathematics Department
College of Liberal Arts and Sciences

Dr. Jill Perry
Department of Secondary Education/Foundations of Education
College of Education

Dear Drs. Milou and Perry:

I support your curriculum proposal for a Certificate of Graduate Study (COGS) in Secondary Mathematics Education. The collaborative nature of this curricular endeavor is an excellent example of the type of work that is needed to ensure that Rowan University's education programs meet state and national mandates. Learning to be an effective teacher requires a life-long effort, and Rowan needs to provide multiple avenues for teachers to pursue their craft.

This proposal for a COGS in Secondary Mathematics Education addresses New Jersey's Core Curriculum Content Standards for mathematics and the recent No Child Left Behind legislation that requires teachers to provide proof that they are highly qualified in the subjects they teach. In my conversations with teachers, I have learned that they are apprehensive about how they will meet the requirements of this legislation. This proposal provides teachers with an option for meeting these requirements and serves as a model for other curricular areas that may need to be addressed in the future.

Finally, another reason I support this proposal is that it complements a future proposal on which the College of Education is working. That proposal is the MA in Standards Based Teaching and Content (the title is in the final planning stage). Programs for teachers, either at the pre-service or in-service level, need to include both content and pedagogy. I endorse your efforts in the development of this COGS.

Sincerely,

Carol A. Sharp, Ph.D.

Dean



Dean of The Graduate School

August 28, 2003

Eric Milou, Ed.D.
Department of Mathematics

Jill Perry, Ph.D.
Secondary Education

Rowan University

Dear Drs. Milou and Perry:

Thank you for the opportunity to review the proposal for revision of a Certificate of Graduate Study (COGS) in mathematics education. I have carefully reviewed the proposal and am pleased to offer my support.

I believe that the program will address an urgent need in the region. As you note, there is a need to provide opportunities for practicing teachers to renew their knowledge in the math content area. Moreover, changes in state certification will require that many teachers return to higher education for additional coursework in the content areas in which they teach. Therefore, I believe that this program will have sufficient enrollment to be viable.

In addition, the proposed program takes advantage of existing resources, both faculty and library, that make it cost-effective. I believe that the collaborative nature of the program is a strength.

For all of these reasons, I am pleased to support this program. I look forward to working with you to implement this program.

Sincerely,

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



Department of Secondary Education/Foundations of Education

September 24, 2003

Dr. Eric Milou
Department of Mathematics
Robinson Hall

Dear Eric,

The Department of Secondary Education is pleased to support the proposal that you and Dr. Jill Perry have developed for a Certificate of Graduate Study in Mathematics Education.

We see a number of strengths in the proposal. It presents a good balance between disciplinary content and pedagogical content. It is focused on K-12 mathematics, an area where there is a continuing need for more and better prepared teachers. We also note that the students who complete this COGS will be in a good position to matriculate into our current master's in subject matter teaching in mathematics and also into a proposed new master's degree that is currently being developed in the College of Education.

Thank you for providing an excellent opportunity for close collaboration between SE/FE and the Department of Mathematics. We look forward to implementing this COGS.

Very truly yours,

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

cc: Dr. Carol Sharp, Dean, College of Education
Dr. Jacqueline Benevento, Chair, SE/FE Curriculum Committee
Dr. Ron Czocho, Chair, Dept. of Mathematics

Library Support for a Mathematics Course

Describe the resources available in the library to support this course/program, including reference, monographic, electronic databases, audio-visual materials, etc. A summary statement is sufficient.

Recent reference works include the *Encyclopedia of Mathematics Education* (2001), the *CRC Concise Encyclopedia of Mathematics* (1999), and the *CRC Standard Mathematical Tables and Formulae 30th Edition*. There are both recent and older mathematical dictionaries, encyclopedias, and tables. Over 250 shelves of circulating monographs are located in the stacks on the third and fourth floors. We have online access to such databases as Academic Search Premier, MathSci Net, WebSPIRS, JSTOR, Science Direct, and of course the Educational Resources Information Center (ERIC). Taken together, these databases provide access to thousands of articles on mathematics and related sciences, many full-text and some full-image. Our collection of audiovisual materials in mathematics consists of two shelves of videotapes of Educational Video Research and NOVA-type programs on PBS, but future acquisition of materials should perhaps be in DVD format or delivered via Internet.

List key periodicals available in the library to support this course/program.

We subscribe to print issues of the *Journal for Research in Mathematics Education*, *Mathematics Teacher*, *Mathematics and Computer Education*, *Mathematics Teaching in the Middle School*, and other, more general or subject oriented periodicals in mathematics. Other periodicals are available from online databases as noted above.

List specific resources that should be acquired to support this course. None
Through ten years of grants in mathematics education, we have our own library (McSiip and NJSSI) in Bosshart with thousands of materials and an office staff.

Librarian comments and recommendations:

A review of government funded research by federal agencies other than ERIC, such as the National Science Foundation, and institutions, such as the Massachusetts Institute of Technology, might be indicated. Many other organizations are sources for published and online information, which occasionally is of such value as to be cataloged for the general collection if in print form, or linked to library resource pages if online.

William A. Garrabrant
Science Librarian and
Library Liaison
Mathematics Department
856-256-4979
garrabrant@rowan.edu



Mathematics Department

October 2, 2003

Jill,

I have reviewed your proposal for the graduate course, *Processes and Principles in School Mathematics*. I understand that this course will be part of the new Certificate of Graduate Study in mathematics education. This course would be a valuable addition to the graduate curriculum for mathematics educators, and it has my full support.

There is a need for a course like this because the new NCTM standards require changes in pedagogy and students coming back to Rowan for graduate study need the opportunity to explore these new methods.

The course you propose complements the mathematics courses that are suggested to be part of the program and should provide a cohesive group of advanced courses for anyone teaching mathematics at the secondary level.

Sincerely,

Ronald J. Czochor, Chairman
Department of Mathematics



Mathematics Department

October 2, 2008

Hi,

I have reviewed your proposal for the graduate course, *Processes and Principles in School Mathematics*. I understand that this course will be part of the new Certificate of Graduate Study in mathematics education. This course would be a valuable addition to the graduate curriculum for mathematics educators, and it has my full support.

There is a need for a course like this because the new NCTM standards require changes in pedagogy, and students coming back to Rowan for graduate study need the opportunity to explore those new methods.

The course you propose complements the mathematics courses that are suggested to be part of the program and should provide a cohesive group of advanced courses for anyone teaching mathematics at the secondary level.

Sincerely,

Ronald J. Ozocho, Chairman
Department of Mathematics