5-8-2006

CMST (Computer, Math, Science, Technology): Teacher Track for Computational Science

The College at Brockport, College Senate

SUNY BROCKPORT

College Senate
State University of New York College at Brockport
350 New Campus Drive
Brockport, NY 14420-2925
(585) 395-2586 (Fax) 395-2246

Resolution # 35
2005-2006
COLLEGE SENATE

TO: Dr. John R. Halstead, College President

FROM: The College Senate passed: May 8, 2006

RE: ⇨ I. Formal Resolution *(Act of Determination)*
II. Recommendation *(Urging the Fitness of)*
III. Other, For Your Information *(Notice, Request, Report, etc.)*

SUBJ: ***CMST (Computer, Math, Science, Technology): Teacher Track for Computational Science*** *#45 05-06 GC*

Signed: _____ Date: 5/18/06
(Dr. Mark Noll, 2005-2006 College Senate President)

Please fill out the bottom portion and return document to the College Senate Office.

TO: The College Senate

FROM: College President

RE: ⇨ I. Decision and Action Taken on Formal Resolution (circle)
a. Accepted. Resolution Effective Date: 5/22/06
b. Deferred for discussion with the Faculty Senate on ____/____/____
c. Unacceptable for the reasons contained in the attached explanation

II, III. Response to Recommendation or Other/FYI
a. Received and acknowledged ____/____/____
b. Comment: _____

DISTRIBUTED BY PRESIDENT'S OFFICE TO: President's Cabinet

DISTRIBUTE ALSO TO: Originator, Academic Advisement, Registrar (as appropriate)

Signed: _____ Date: 5/22/06
(Dr. John R. Halstead, College President, SUNY College at Brockport)

Page 1 of 25
College Senate 4/7/06
2005-2006-35.res.doc

COLLEGE SENATE OFFICE RESOLUTION PROPOSAL COVER PAGE

Routing Number	#45 05-06 GC

ROUTING NUMBER TO BE ASSIGNED BY SENATE OFFICE

DEADLINE FOR SUBMISSIONS: FEBRUARY 23

Proposals received after the deadline may not be reviewed until next semester.

INSTRUCTIONS:

- Submit proposals individually rather than packets with multiple documents.
- Complete this cover page for each proposal (available online at www.brockport.edu/collegesenate)
- Prepare proposal in Word format using committee guidelines (available online)
- Submit proposal electronically with this cover page to senate@brockport.edu, facprez@brockport.edu
- All updates must be resubmitted to the Senate office with an updated cover page, use routing number
- Questions? Call the Senate office at 395-2586 or the appropriate committee chairperson.

1. PROPOSAL TITLE:

Please be somewhat descriptive, for example, *Graduate Probation/Dismissal Proposal* rather than *Graduate Proposal.*

CMST Teacher Track for Computational Science Master's program

2. BRIEF DESCRIPTION OF PROPOSAL:

CMST (Computational Math, Science, and Technology) has emerged as a new pegagogy for teaching mathematics and science at the pre-college level through the use of simulation and modeling tools to illustrate mathematical and scientific concepts in an engaging and non-threatening manner. This proposal seeks to provide prospective teachers a track in which to learn these tools and simulation and modeling concepts. The track consists of 12 credits of core courses dealing with CMST tools and pedagogy, 6 credits of culminating research experience, and 12 credits of electives related to students' teaching interests or area of initial certification.

3. SUBMISSION & REVISION DATES: PLEASE DATE ALL UPDATED DOCUMENTS

First Submission	Updated on	Updated on	Updated on
2/20/06			

4. SUBMITTED BY: (contact person)

Name	*Department*	*Phone*	*Email*
Osman Yasar	Computational Science	395-2595	oyasar@brockport.edu

5. COMMITTEES TO COPY: (Senate office use only)

Standing Committee	*Forwarded To*	*Date*
__ Enrollment Planning & Policies __ Faculty & Professional Staff Policies __ General Education & Curriculum Policies ***xxGraduate Curriculum & Policies*** __ Student Policies __ Undergraduate Curriculum & Policies	Committee Chair Executive Committee Senate Floor College President Other	*3/2/06* *4/10/06* *4/17/06 – vote 5/8/06*

**(ROUTING NUMBER WILL BE A CHRONOLOGICAL NUMBER SEQUENCE FOLLOWED BY COMMITTEE INITIALS)*

Proposed CMST Option (track) for Computational Science MS program

A. Academic rationale

The current MS program in Computational Science is an excellent preparation for individuals wishing to be employed in a scientific computing environment within industrial, academic, or government settings. It requires learning of mathematical and programming tools to solve scientific and industrial problems on supercomputers. For people outside of the mainstream of scientific research, there are new software tools which hide the mathematical and programming steps in order to model and simulate a system. Also, today's laptops and PCs offer as much power as yesterday's supercomputers. As a result, computational modeling has become a common approach in business, anthropology, psychology, philosophy, sociology, history, and many other fields outside the traditional sciences. It has also become a vehicle to teach difficult math and science topics in higher education and grade schools.

B. Evidence of demand

Under a National Science Foundation grant (EHR# 0226269, PI: Yaşar), the department of Computational Science formed an institute with participation by members from other departments and local/national institutions. The NSF grant promotes the *Computational* approach to *Math*, *Science*, and *Technology* (CMST) approach; both as a new strategy to improve the technical workforce and as pedagogy for classroom teaching. New software tools have been acquired; including site licenses (Interactive Physics, AgentSheets, Geometer's Sketchpad, and STELLA) for the whole college. Furthermore, courses have been developed to support use of CMST tools outside of the traditional student body. Over the past 3 years, as part of a federal grant from NSF, the CMST Institute faculty developed graduate-level courses such as

- NAS 501: CMST Tools for Teachers I
- NAS 601: CMST Tools for Teachers II
- NAS 701: CMST Tools for Teachers III
- CPS/LST 726: Science, Technology, and Society,

We have team-taught more than 200 teachers in the past 3 years from local school districts, including Rochester City School District (RCSD) and Brighton Central School District (BCSD). Evaluations by outside consultants showed 95-100% course satisfaction. Of these math, science, and technology (MST) teachers attending the NAS 501 course, approximately 125 of them are from Rochester City School District, 12 from Brighton Central School District, and 12 from other local districts. Forty-two of these teachers moved on to the next course, NAS 601, and 15 more to NAS 701. Although these courses were initially offered in the summer time, they are now scheduled during academic semesters (to provide broader access to interested students and teachers). This has attracted teachers from other local school districts. NAS 501 and LST 726 (both taught by our department) attracted 29 and 42 teachers during academic semesters respectively.

There is a significant demand by teachers for a formal education in CMST-enhanced math and science education. We have received letters from teachers in our grant about their interest either in taking NAS 801 or a master's degree track based on core CMST courses.

C. Potential clientele

Given the interest in these new courses plus the availability of incentives from our NSF project in the form of scholarships for teachers seeking a master's degree in CMST, there seems to be a critical momentum to support a CMST track within our master's program. We have scholarship funds to support MST teachers and pre-service students seeking a master's degree with CMST option. The new track will enable teachers (and other students with a broad background and interest base) to learn CMST tools and integrate them into their fields or professions. We have partnered with RCSD and BCSD to recruit for this new track. The CMST Institute has also created a repository of examples demonstrating use of CMST tools in many fields, including lesson plans for secondary school teaching.

The potential clientele initially would be MST teachers from Rochester City, Brighton Central, and other school districts who want to update their educational technology skills. Letters of support are attached from district officials. Additionally, the CMST track is an option for teachers who seek a master's degree to satisfy professional certification (following initial certification), as stated in the attached letter from Sandy Selden, Coordinator for Certification, SUNY Brockport.

D. Entrance requirements

Minimal entrance requirements into the CMST track will be the same as for the current Computational Science MS program: a relevant undergraduate degree with a GPA of at least 3.0 and two letters of recommendation. As with all CPS applications, appropriate consideration will be given to previous work experience.

E. Program requirements

Proposed CMST Track within CPS
Required Courses (18 credits) NAS 501CMST Tools for Teachers I (3) NAS 601 CMST Tools for Teachers II (3) NAS 701 CMST Tools for Teachers III (3) CPS 726 Science, Tech, and Society (3) **Culminating (Research) Experience** (6 credits) CPS 699 Independent Study (3) CPS 700 Project Paper (3) **Elective Courses** (12 credits) 500-level and higher level graduate level courses taken under advisement

The difference between the new track and the regular track is in the Tools courses. While students in the regular track take courses in programming, the new track involves CMST tools allowing the user to spend more time with the problem solving aspect rather than developing the tool itself. Both tracks involve 12 credits of elective courses in the field(s) of interest (content area) and a culminating experience project which involves written and oral presentations. Students who want to have the 6-credit culminating research experience in a content (certification) area can do so with a relevant department.

F. Exit requirements (Culminating Experience)

In order to graduate, students must complete required and elective coursework and also do a presentation of the independent study and submit a project report to the department.

G. Academic administration commentary

1. Letter of review/comment from the Dean of School (Stuart Appelle) –Letter of support is attached.
2. Letter of review/comment from the Department Chair (O. Yaşar)- This proposal has been submitted and endorsed by the Chair.

H. Commentary from Drake Library and Academic Computing Services -pending

I. Course descriptions

Core Courses

NAS 501 CMST for Teachers I (A). *Prerequisite: Instructor's permission.* Enables teachers and teacher candidates in mathematical, physical, life, and earth sciences to learn computational tools, advanced graphing calculators, laptop computers, CD- and Web-based tools. Involves computational science as a process in solving real-world problems in sciences. Introduces technology tools (such as graphing calculators), math modeling tools (such as Excel, STELLA, and Geometer's Sketchpad), agent-based modeling tools (such as AGENTSHEETS), science modeling tools (such as Interactive Physics). Includes a section on NY State K-12 standards in math, science and technology. *3 Cr.*

NAS 601 CMST for Teachers II (A). *Prerequisite: NAS 501.* Teaches advanced computational tools and programming to secondary school teachers and teacher candidates. Science teachers will learn about computational approach as a scientific inquiry method in physical, life, environmental and social sciences. Mathematics and technology teachers will learn about applications of mathematical and computer skills in a variety of subject areas, aligned with the PreK-12 curriculum and textbooks in New York state. Covers training in advanced software tools for teaching and research. Offers further training in tools from NAS 501. Teachers and teacher candidates will develop lesson plans using computational tools and pedagogy learned in this course. *3 Cr.*

NAS 701 CMST for Teachers III (A). *Prerequisite: NAS 601.* A continuation of the NAS 501, NAS 601 course sequence. Provides more in-depth training on the use of CMST teaching tools and their effective implementation. Provides experience in the presentation of CMST lesson plans to teachers of varying levels of ability. Requires close interaction with other CMST participants and faculty. *3 Cr.*

LST 726 Science, Technology, and Society (A). *Prerequisite: Instructor's permission.* Science and technology continue to transform our world. This course discusses ways in which society and science have affected each other. It introduces a historical perspective of this relation for the past several decades, including the contemporary society. The course also identifies trends and changes within science and technology in relation to the larger society. Students attend lectures, read and discuss issues from textbook(s), and write essays at the end of each chapter. The course involves a final project paper highlighting a favorite scientist or topic. The course sharpens communication skills (verbal and written). The course is open to teachers in all subject areas, including humanities. Visual CMST tools are used to understand scientific topics in relevance to the historical presentation of scientists and their achievements. *3 Cr.*

Departmental Electives (Electives from other MST departments are also available)

CPS 504 Applied and Computational Mathematics (A). A survey of scientific computing methods, emphasizing programming methods, interpretation of numerical results, and checks for numerical sensibility and self-consistency. Organized into several modules, including: (1) representation of floating point data, truncation and rounding error, and basic considerations for accurate numerical computation; (2) iterative numerical methods; (3) numerical differentiation and integration; (4) numerical interpolation; (5) random number generation; (6) the Fast Fourier Transform; and (7) numerical solution of ordinary differential equations. Extensive programming required. *3 Cr. Fall*

CPS 517 Introduction to Computational Chemistry (A). *Cross-listed as CHM 517.* An introduction to classical and quantum simulation methods as applied to chemistry-related problems and computational chemistry software packages. Covers the topics in three parts. Part I: introductory material, potential energy surfaces, vibrational and electronic properties of molecules, and capabilities/limitations of computational chemistry. Part II: classical molecular simulation methods, molecular dynamics, molecular dynamics, Monte Carlo calculations, normal coordinate analysis, computer "measurement" of materials properties. Part III: Schrodinger equation, common electronic structure methods, basis sets, geometric optimization and molecular properties. *3 Cr. Fall*

CPS 521 Introduction to Computational Physics (A). *Prerequisites: PHS 202, CPS 304 and MTH 203.* An introduction to computational methods commonly used in physics applications, including three of the most famous equations in physics (Wave, Laplace and diffusion), as well as classical mechanics. Includes the classical equations of motion, detailed solution of the two-body l/r problem, planetary and astrophysical simulation methods and analysis of simulation data, wave motion and normal coordinate analysis, electromagnetic field and Laplace's equation, molecular simulation (N-body methods, liquid simulation, liquid structure, specification of initial conditions, constant temperature and pressure simulations, Langevin and Brownian dynamics, and correlation functions), diffusion and percolation. *3 Cr. Fall*

CPS 533 Scientific Visualization (A). *Prerequisites: MTH 424 and either CSC 203 or CPS 202.* Examination of scientific visualization as a critical portion of the analysis and interpretation of numerical simulations, and an introduction to a wide variety of methods used for scientific visualization. Topics include: basic 2 and 3 dimensional graph types, visualization of 3D data, interpretation of simulation results, grid generation and visualization, problem solution via graphical techniques, image processing, rendering and animation. Extensive programming in MATLAB required. *3 Cr. Spring*

CPS 555 Introduction to Computational Fluid Dynamics (A). *Prerequisites: CPS 101, CSC 120 and MTH 203.* A concise introduction to the analytical and computational techniques required for the investigation of fluid flow through computational means. Topics include: derivation of fundamental equations, dimensional analysis and the Pi theorem; stability of numerical methods; the CFL condition; first, second, and higher order numerical methods; shooting methods; wave equations; parabolic equations; boundary layers; cavity flows; and grid generation. *3 Cr. Fall*

CPS 561 Introduction to Computational Biology (A). *Prerequisites: CPS 202, BIO 111 and CHM 206.* An introductory survey of the applications of high performance computer modeling and simulation to biological problems. Includes topics such as molecular simulation for structure

determination and dynamical properties of biological molecule, and bioinformatics. Uses computational tools such as Biology Benchmark, MATLAB, and AMBER. *3 Cr. Spring*

CPS 602 Advanced Software Tools (A). *Prerequisites: CPS 202 and CPS 303.* High level tools for parallel computing, mainly the Portable, Extensible Toolkit for Scientific Computing (PETSc). Examples and programming assignments draw heavily from partial differential equations and eigenvalue problems from the applied physical sciences. In addition, employs other high level tools such as finite element simulators. Topics include: numerical solution of partial differential equations and eigenvalue problems, evaluating the parallel performance of tools, iterative methods for the solutions of linear equations, and finite element analysis of problems in the physical sciences. Extensive programming required. *3 Cr. Spring*

CPS 604 Computational Methods in the Physical Sciences (A). *Prerequisite: CPS 504.* A one semester survey of methods for the computer solution of ordinary and partial differential equations (ODE's and PDE's) that commonly arise in scientific applications, and for analyzing results. Part I: numerical linear algebra. Part II: finite difference methods for ODE's and PDE's, including truncation error and consistency; one-stage, multi-stage, and multistep methods, initial value and boundary value problems; and systems of equations. Part III: finite element methods for ODE's and PDE's, including choice of basis and weighting functions (collocation, subdomain and Galerkin methods): general procedures for elementwise integration; treatment of boundary conditions; and finite element methods in two and three dimensions. Requires extensive programming. *3 Cr. Spring*

CPS 632 Deterministic Dynamical Systems (A). *Prerequisites: either CPS 404 or CPS 504 and MTH 424.* A one-semester survey of methods for the modeling and analysis of deterministic dynamical systems found in chemical, biology, fluid dynamics and other applications. Part I: formulations of classical mechanics, conservation laws, and families of solutions in some model systems. Part II: detailed discussion of simulation methods in chemistry, ecology, biology, fluid dynamics and other fields. Requires extensive programming. *3 Cr. Fall*

CPS 633 Stochastic Dynamical Systems (A). *Prerequisites: either CPS 404 or CPS 504 and MTH 424.* A one semester survey of methods for computer simulations and other calculations involving some level of random (stochastic) behavior. Covers modeling and analysis of stochastic dynamical systems in science, engineering and business applications. Topics include: generation of and statistical properties of discrete and continuous random number distributions; numerical integration; solution of stochastic differential equations commonly arising in scientific applications; Monte Carlo methods; discrete event simulation, including general principles, queueing and inventory simulations, and the use of simulation software; and analysis of simulation data. Requires extensive programming. *3 Cr. Fall*

Note:

See College Graduate Catalog for graduate-level courses offered by the Departments of Mathematics, Biological Sciences, Environmental Science and Biology, Earth Sciences, Education and Human Development, which could be taken as electives in this track. Since the core (NAS) courses in the track could count towards the 12-credit science content requirements for professional certification, this might offer greater freedom to take non-content courses as part of electives.

J. Sample timetable

Fall, Year I	**Spring, Year I**
NAS501—CMST Tools I 500- or higher-level elective	NAS601—CMST Tools II 500- or higher-level elective
Fall, Year II	**Spring, Year II**
CPS726—Science, Technology, and Society CPS699—Independent Study 500- or higher-level elective	NAS701—CMST Tools III CPS700—Project Paper 500- or higher-level elective

Note:

a. NAS 501, 601, and 701 will continue to be offered in the summers as well

b. 500- or higher-level electives are chosen under careful consultation with advisor. These courses could be from math and sciences as well as education. A Plan of Study will be drawn for each student before starting his/her program.

An analysis of the graduate level courses (Graduate Catalog 2005-07) from the math and science departments in the School of Letters and Sciences provide us with ample assurance that graduates in the CMST track who seek professional certification will have sufficient courses (See Appendix) to choose from certification (content) areas such as mathematics and sciences to meet their elective requirements of the CMST track. In addition, our department offers the following content courses:

CPS 504 Applied and Computational Mathematics
CPS 517 Computational Chemistry
CPS 521 Computational Physics
CPS 555 Computational Fluid Dynamics (Physics, Earth Sciences)
CPS 561 Computational Biology
CPS 604 Computational Methods in Physical Sciences
CPS 632 Deterministic Dynamical Systems (Physics)
CPS 633 Stochastic Dynamical Systems (Physics)

The Department of Mathematics offers 15 courses at 500-level and 11 courses at 600-level. The Department of Biological Sciences along with the Department of Environmental Science and Biology offers 29 courses at 500-level and 6 courses at 600-level. The Department of Earth Sciences offers 18 courses at 500-level and 6 courses at 600-level. While some are irregularly offered, most of these courses are regularly scheduled. One difficulty could be the non-availability of these courses in the evening to facilitate teacher-candidates participation. We believe our sister departments on campus might favorably look at this need once they are convinced that there would be enough enrollments. The Department of Education and Human Development offers courses that could be taken as electives in this track. Since the core (NAS) courses in the track could count towards the 12-credit science content requirements for professional certification, this might offer greater freedom to take non-content courses as part of electives.

K. Staffing

We do not foresee additional resources as we have already been offering the core courses on a regular fashion during summer (by faculty) and academic semesters (via adjuncts). The required courses have always been under the purview of the Computational Science department. NAS501, 601, and 701 were originally designed as courses to be taught during the CMST Summer Institute, and to be taken in sequence. Some who have completed NAS701 have assisted in instructing NAS501 and 601.

NAS501 has been adapted into a full semester course and was taught first by a faculty member, then in later semesters by an adjunct. A similar strategy can be followed with NAS601 and 701: teaching by adjuncts, with support and some oversight by Computational Science faculty. CMST Summer Institutes and other grant-related activities have provided an initial seed of potential adjuncts. We expect this pool to continue to grow. Some grant funds may be used to support adjuncts for the next two academic years.

Graduate courses in our department are offered mainly in the evenings, with one meeting per week (for three hours). We will follow a similar schedule to facilitate teacher participation. Both NAS501 and LST726 have been taught in the MetroCenter and we will continue to consider this option as an outreach effort to the Rochester community.

L. Other letters of support

1. Margaret Crowley, Director of Math Instruction, Rochester City School District
2. Susan Ragan, Maryland Virtual High School, MD
3. Sandy Selden, Coordinator for Certification, SUNY Brockport
4. Kulathur Rajasethupathy (Liberal Studies Program)
5. Jerry Moon, Math Teacher, CMST Institute, Formerly Wilson Magnet HS
6. Ray Yeaton, Science Teacher, John Marshall High school
7. David Rogers, Science Teacher, Wilson Magnet High School, Rochester
8. Annette Pennella, Special Ed Teacher, Franklin High School, Rochester
9. Michael Baskin, Math Teacher, Fredi Thomas HS, Rochester
10. Helen Fox, Math Teacher, Frederick Douglas Preparatory School
11. Sarah Jacka, Math Teacher, Freddie Thomas HS
12. Kristin Schwartzmeyer, Science Teacher, Kendall High School

M. Competition from other Rochester area colleges

To our knowledge, Saint John Fisher College offers a Master of Science in MST Education (http://home.sjfc.edu/mcs/graduate_programs.asp), which is designed to help teachers see the commonalities among subjects in order to foster integrated, research-based approaches to learning that utilize technology, assessment and other resources effectively. Further, the program seeks to prepare leaders in the field of mathematics, science, and technology education so that constructivist, inquiry-based approaches to learning these subjects can occur for all students.

The CMST approach, developed in our department through the NSF support, has a unique technology-based constructivist approach using modeling and simulation tools. SUNY Brockport has the only Computational Science undergraduate program in the Rochester area and is therefore uniquely positioned to support integration of math, science, and technology via its

nationally known faculty and curricula. The proposed track would also offer a highly cost-effective alternative to other local and regional programs. Members of our department were invited to testify before the U.S. Congress about how to nationalize our integrated approach (via computational science) to math, science, and technology education. The in-service courses offer by the department has already served more than 200 teachers in the area. The proposed track offers a more comprehensive, institutionalized form of CMST training for aspiring teachers. By offering this track, we seek to build on Brockport's two well-established areas of competency; teacher training credentials and computational science. Finally, instituting such a track would fulfill a requirement for our NSF grant.

Appendix

A. List of possible math and science electives

MTH 512 History of Mathematics	Spring only
MTH 521 Number Theory	Fall only
MTH 532 College Geometry	Every Semester
MTH 541 Statistical Methods I	Fall only
MTH 541 Statistical Methods II	Spring only
MTH 546 Probability and Statistics II	Every Semester
MTH 551 Advanced Calculus	
MTH 552 Applied Analysis	
MTH 556 Advanced Differential Equations	Spring
MTH 557 Real Analysis	Every Semester
MTH 561 Deterministic Mathematical Models	Fall
MTH 562 Stochastic Mathematical Models	Spring
MTH 563 Graph Theory	Spring
MTH 571 Numerical analysis I	
MTH 581 Discrete Mathematics II	Every Semester
MTH 599 Independent Study	
MTH 605 Problem Solving in Mathematics	
MTH 612 History of Contemporary Mathematics	
MTH 619 topics for Teachers I –Mathematical Modeling	Fall
MTH 621 Algebra	
MTH 628 Applications of algebra	
MTH 629 Topics in Algebra and Number Theory	
MTH 639 Topics in Geometry	
MTH 641 Mathematics Statistics	
MTH 651 Real Analysis	
MTH 659 Topics in Analysis	
MTH 669 Topics in Applicable Math and Statistics	

BIO 500 Plant Diversity	*Fall*
BIO 505 Plant Ecology	Odd Fall
BIO 506 Wildlife Ecology	Fall
BIO 513 Topics in Plant Biology	
BIO 514 Introduction to Immunology	Spring
BIO 515 Molecular Biology	Fall
BIO 519 Principles of Limnology	Fall
BIO 521 Limnology Laboratory	Fall
BIO 522 Population Biology	
BIO 523 Biology of Pollution	Odd Spring
BIO 526 Recombinant DNA	Spring
BIO 527 Animal Behavior	Fall
BIO 528 Microtechniques	
BIO 529 Electron Microscopy	
BIO 530 Ornithology	Even Spring
BIO 539 Conservation Biology	Spring

BIO 540 Herpetology	Odd Spring
BIO 543 Biotechniques III – Immunoassays	Odd Spring
BIO 545 Histology	Fall
BIO 559 Mammalogy	Odd Fall
BIO 566 General Endocrinology	Spring
BIO 567 Biochemistry I	Fall
BIO 568 Biochemistry II	Spring
BIO 570 Biochemistry Lab	Fall
ENV 577 Field Biology	Odd Summer
BIO 583 Aquatic Invertebrates	Odd Spring
BIO 584 Fish Ecology	Even Spring
BIO 588 Environmental Impact Analysis	Even Summer
BIO 590 Fishery Techniques and Fish Identification	Fall
BIO 614 Experimental Design	Spring
BIO 618 Experimental Endocrinology	
BIO 621 Water Chemistry	Spring
BIO 622 Biology Seminar	
BIO 623 DNA Cloning Laboratory	Fall
BIO 673 Neurobiology	Spring
BIO 692 Graduate Seminar	Every Semester
BIO 695 Topics in Biology	
ESC 512 Hydrology with Lab	*Odd Fall*
ESC 515 Physical Meteorology	Odd Fall
ESC 516 Thermodynamics and the Boundary Layer	Fall
ESC 517 Dynamic Meteorology	Odd Spring
ESC 518 Watershed Sciences	Odd Spring
ESC 520 Atmospheric Sensing Methods	Even Spring
ESC 521 Air Pollution Meteorology	Odd Spring
ESC 531 GIS Application in Earth and Env. Science	Spring
ESC 532 Topical Meteorology	Odd Fall
ESC 552 Mesoscale Meteorology	Even Spring
ESC 555 Soils Science	Fall
ESC 557 Marine Geology – Bahamas	
ESC 636 Water Resources Topics	Every Semester
ESC 671 Selected Weather Topics	Fall
ESC 672 Selected Oceanography Topics	Fall
ESC 675 Real-Time Weather Studies	Every Semester
GEL 508 Structural Geology	Even Spring
GEL 511 Stratigraphy and Sedimentology	Odd Fall
GEL 515 Geomorphology	Odd Spring
GEL 556 Field Geology of the Adirondacks	Summer Irregularly
GEL 557 Geochemistry	Even Spring
GEL 562 Groundwater	Odd Spring

B. The following is a list of possible education courses for those students seeking to use the CMST track to meet the requirements for **permanent** certification:

EDI 527 Cooperative Learning

EDI 571 Conflict Resolution
EDI 605 Inclusion
EDI 606 Teaching Adolescence Students with Mild Disabilities
EDI 607 Brain-based Teaching
EDI 610 Behavior-problem Children
EDI 611 Teaching Childhood Science
EDI 627 Education Change and Organizational Theory.
EDI 651 Teaching the Gifted and Talented
EDI 665 Classroom Management
EDI 685 Statistics and Research Design
EDI 689 Inquiry Teaching in Science, Math, and Technology

February 22, 2006

Dr. Osman Yasar
PI CMST Institute SUNY College at Brockport
128 Smith Hall, 350 New Campus Drive
Brockport New York, 14420

Dear Dr. Yasar:

A CMST Teachers MS (track) is a great way for teachers to complete their teacher certification requirements. When I was working on my educational requirements for my NYS certification I may have pursued my MS degree in the CMST track as it fits my teaching pedagogy. As a novice teacher of science, I have found the CMST teaching pedagogy to be very effective in the classroom. As a career research scientist with a masters and an MBA I believe this program will create a generation of teachers who integrate math and science in our classrooms. Both new teachers and students need this technology constructivist training and paradigm if we are to stay competitive and draw the video game generations into science and engineering.

I have participated in the past two CMST Summer Institutes and have learned so much about combining Math, Science and Technology into my teaching curriculum. It has been very effective in sparking the interest of my students, as they can enthusiastically relate to real world applications of mathematics. The software tools have proven to be excellent in providing visualization to abstract concepts, therefore providing the students a different prospective.

I think with the additional courses being provided with this unique MS track, it will help new science teachers in today's world. This would also offer a masters pathway to science teachers at Brockport, strengthening the offerings in science. I think that this masters offering will help math teachers fully integrate science problem solving into their classroom.

Thank you for considering the needs of teachers for an innovative approach to teaching math and science. I do hope that the CMST MS option becomes a reality.

Sincerely,

David W. Rogers, MS, Executive MBA,
Science Teacher RCSD,
Distance Learning Science Teacher Wayne Finger Lakes BOCES,
Research Scientist
1226 Jackson Road
Webster, NY 14580

Baskin's Mathematigram

To: Dr. Osman Yasar

From: Michael Baskin

Date: 10/23/2009

Re: MS in CMST

Congratulations on proposing to the SUNY Senate the idea of offering a MS in CMST at Brockport. This is welcome news and long over due. The use of CMST tools has produced dramatic change in the classrooms of the Math, Science and Technology teachers who have participated in the CMST Summer Institute the last 3 years. It is only fair that the pedagogy be shared with teachers on a larger platform.

In my classroom there isn't a day that goes by without my teaching with technology. The modeling programs the institute taught me how to use in addition to other software tools I've discovered has brought learning math from a "when am I ever going to use this stuff" attitude from my students to a, "Wow, so this is what that idea means and this is where it applies in real life" perspective.

Let's face it, today's students' require a great deal of stimulation, the kind of stimulation CMST tools provides. The constructivist approach of CMST tools allows students to learn experientially and to better connect math and science. No longer are the two subjects separate. There is a great deal of interconnectedness between the two. When a student enters my classroom for the first time they are blown away by the visual approach I use to help them understand mathematical ideas. I hear such phrases such as, "that is really cool", "please call on me so I can try that", and "why don't other teachers teach this way?"

The bottom line is, my kids love it and love it. I will never teach without the use of CMST tools. A fantastic way to spread this results oriented approach to teaching is via a MS program in CMST. The time is right, we have the documented success of almost 200 teachers who endorse the approach and we certainly have the test results to back up our claims.

Osman, continued success. I would love to see an MS degree in CMST become a reality. If there is anything further I can do to assist in making this a reality, please don't hesitate to call on me.

Gratefully,

Michael H. Baskin

CMST Original

Sarah Jacka
Mathematics Teacher
Dr. Freddie Thomas High School
625 Scio Street
Rochester, NY 14605

February 22, 2006

Dr. Osman Yasar
PI CMST Institute SUNY College at Brockport
128 Smith Hall, 350 New Campus Drive
Brockport, NY 14420

Dr. Yasar:

When initially looking in the Rochester area for a master's program that fit my needs as an educator in the field of mathematics I was greatly disappointed. Last summer when I entered into my first year at the CMST Summer Institute I found exactly what I had been looking for. The CMST approach is very much what my students need to see the importance and the connections of mathematics, science and technology.

I would be delighted to see a MS degree in the CMST track. Although I am halfway through my current master's degree in Mathematics Education, I would be much happier pursuing a degree such as CMST as it fits the needs of my students.

In the past several years we have been inundated with the message that we do not have enough students pursing a career in the sciences and mathematics. The CMST approach has helped hook my kids on mathematics through the use of technology and connections to the sciences. How the students of today respond to math and science will be the determining factor on whether the US becomes a leader in global markets or whether we fall behind. It only makes sense to give our students every advantage in tomorrow's world.

I would like to thank you for always keeping the needs of our children and students at heart and would like you to consider implementing a master's degree in the CMST track.

Sarah Jacka
Mathematics Teacher- Rochester City School District

Jerry Moon
CMST Coaching & Technology Coordinator
109 Smith Hall, 350 New Campus Drive
Brockport New York, 14420

February 22, 2006

Dr. Osman Yasar
PI CMST Institute SUNY College at Brockport
128 Smith Hall, 350 New Campus Drive
Brockport New York, 14420

Dear Dr. Yasar:

A CMST Teachers MS (track) is a great way for teachers to complete their teacher certification requirements. I am very interested in pursuing a MS degree in the CMST track as it fits my teaching pedagogy. As a novice teacher of mathematics, I have found the CMST teaching pedagogy to be very effective in the classroom.

I have participated in the past three CMST Summer Institutes and have learned so much about combining Math, Science and Technology into my teaching curriculum. It has been very effective in sparking the interest of my students, as they can enthusiastically relate to real world applications of mathematics. The software tools have proven to be excellent in providing visualization to abstract concepts, therefore providing the students a different prospective.

I think with the additional courses being provided with this unique MS track, that it will help me to convince my students of the importance of math and science in today's world. I hope to be able to persuade High School students of the great demand for them to pursue a continued education in Science, Technology, Engineering, and Math (STEM) fields. I believe that our country is in serious jeopardy of losing its technical advantage in the emerging global market, and that CMST provides pedagogy to help change the decline of US students completing higher educational degrees in the STEM fields.

Thank you for considering the needs of teachers for an innovative approach to teaching math and science. I do hope that the CMST MS option becomes a reality.

Jerry Moon
Coaching Coordinator CMST Institute, Mathematics teacher.

Sounthone Vattana
CMST/Adjunct Instructor
109 Smith Hall, 350 New Campus Drive
Brockport New York, 14420

February 27, 2006

Dr. Osman Yasar
PI CMST Institute SUNY College at Brockport
128 Smith Hall, 350 New Campus Drive
Brockport New York, 14420

Dear Dr. Yasar,

I believe that the CMST Teachers MS (track) can be a good option for teachers. Several years ago, I was a graduate student at the Computational Science program at the SUNY College at Brockport when I was a math/Computer teacher at the RCSD. I taught 8th grade math at Monroe Middle School in 2000-2001 school year. I also taught the computer programming I, II at Wilson Magnet High School (2002-2005). At that time, I realized that the CPS Master's program at SUNY College at Brockport was tough and difficult program for me to pursue it. Teachers want to learn things that will help them teach their jobs more effectively in the classroom while the regular CPS master's program prepare industrial programmers. I was very close to dropout from the CPS Master program at SUNY Brockport because many CPS courses as CPS 602 (Advanced Software Tools), CPS604 (Comp. Methods in Physical Science and CPS644 (Supercomputing) were intensive in programming for me at that time.

Having completed the current CPS master's program already, I also had a chance to attend the CMST Summer Institutes for 3 years in row. Based on my experience with both the current and the proposed CMST tracks, I can certainly foresee the support and interest your program will generate at Rochester schools.

The proposed CMST Teachers MS (Track) program contains many friendly, easier and wonderful simulation model tools that teachers can use in their classrooms such as Stella, Interactive Physics, AgentSheets and GSP to scaffold students' knowledge and basic concepts that they learned. Almost all of the simulation model tools have lesson plans that teachers can implement or modify for using in the classroom.

I definitely recommend the CMST Teachers MS (Track) program for teachers who are seeking for professional teaching certification. If you offer your courses at MetroCenter during afternoons or evenings, you would attract many RCSD teachers to this program.

The Maryland Virtual High School of Science and Mathematics
51 University Boulevard East
Silver Spring, Maryland 20901

February 23, 2006

To whom it may concern:

I have read the proposal for a CMST track within the Computational Science MS program at SUNY-Brockport, and I support this initiative wholeheartedly. As a veteran high school educator who has experienced the power of the integration of math, science and computational tools in her own career, I feel frustrated by the lack of opportunities for other educators to receive formal training in this area. Too often, classroom teachers pursuing master's degrees are limited to programs that focus on generic teaching methods or administrative and supervisory skills. Math and science teachers who wish to obtain a master's degree in their subject area often find that the programs are geared toward research that does not apply to their classroom teaching. The proposed CMST track fills the need for a master's program that will prepare teachers to use 21st century computational tools in their math and science classrooms.

A joint committee of the National Academies wrote in their landmark 2005 report "Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future" that

> "…the committee is deeply concerned that the scientific and technical building blocks of our economic leadership are eroding at a time when many other nations are gathering strength. We fear the abruptness with which a lead in science and technology can be lost – and the difficulty of recovering a lead once lost, if indeed it can be regained at all."

Their first recommendation was to "…increase America's talent pool by vastly improving K-12 science and mathematics education."

The first step in improving K-12 science and math education is to provide teachers with the advanced training needed to use computational technology in their teaching. Since many teachers model their classroom methods on their own experiences as students, even the new teachers who consider themselves computer savvy have virtually no idea how to use computational tools in their teaching. The Department of Computational Science at SUNY-Brockport has addressed that problem through its summer CMST teacher institute. Because of my experience preparing science teachers in Maryland to infuse computational science tools and techniques into their classrooms, I was invited to join the summer faculty for the CMST Institute. During the time that I have been involved with the Institute, I have seen several teachers in the program grow in their mastery of the integration of computational technology into their science and math classes. Institutionalizing and broadening this summer program by making it a master's degree option would benefit even more teachers, both in New York and across the country.

Susan Ragan
Project Director

Annette Pennella
Educator-Bioscience School @ Franklin
950 Norton St.
Rochester, NY 14621

February 25, 2006

Dr. Osman Yasar
PI CMST Institute SUNY College at Brockport
128 Smith Hall, 350 New Campus Drive
Brockport New York, 14420

Dear Dr. Yasar:

The Computational Math, Science and Technology, Masters of Science in Education Program is a wonderful way for teachers to complete their teacher certification requirements. It is a great opportunity for teachers to pursue a MS degree in the CMST track as it fits the needs of many teaching pedagogies. Both novice teachers and experienced educators, who are pursuing additional credits, will find the information from the CMST-MS Program to be very effective in the classroom.

Having participated in the CMST Summer Institutes for the past two years has greatly broadened my technology skills. I have also learned to incorporate Math, Science and Technology into my teaching curriculum. It has been very effective in motivating my students, as they can relate to real-world applications of mathematics and see how the curriculums work together. Students are able to comprehend material from various perspectives because the software tools are proven to be excellent in providing visualization to abstract concepts.

Additional courses being provided with this unique MS track will help me to convince new teachers of the importance of math and science in today's world. I hope to be able to persuade High School students of the great demand for them to pursue a continued education in Science, Technology, Engineering, and Math (STEM) fields. I believe that our country is in serious jeopardy of losing its technical advantage in the emerging global market. CMST provides pedagogy to help change the decline of US students completing higher educational degrees in the STEM fields.

Thank you for considering the needs of teachers with an innovative approach to teaching math and science. I do hope that the Computational Math, Science and Technology- Masters of Science in Education Program becomes a reality.

Annette Pennella
Special Educator

Bioscience School @ Franklin

Helen L. Fox
25 Charisma Drive
Rochester, New York 14606

February 24, 2006

Dr. Osman Yasar
PI CMST Institute SUNY College at Brockport
128 Smith Hall
350 New Campus Drive
Brockport, NY 14420

Dear Dr. Yasar:

I have attended two CMST Summer Institutes and plan to attend a third this summer. The CMST Institute has given me excellent professional development that I use every day in my 7th grade Mathematics classroom. I have been able to create models and to use already created models to give students a better perspective of Mathematics and the world we live in. The Institute has trained me to use software such as Stella, Interactive Physics, Agent Sheets, and Geometers' Sketch Pad which I, in turn, have introduced to my students. Students have also enjoyed online interactive learning websites used in conjunction with a Smart Board. Before becoming involved with the Institute I would never have attempted to use such sophisticated equipment in my classroom.

The Challenge Projects teachers developed in the CMST Summer Institutes have been invaluable pathways to create powerful bonds with urban students, while teaching them to create models using technology and expand their understanding of Mathematical processes and computers – far beyond their use of the computer for video games.

With the demand for teachers in Mathematics, Science, and Technology, the CMST Teachers MS presents a strong foundation to prepare highly skilled professional teachers to use technology in the classroom.

Dr. Yasar, I believe your vision of this MS program answers the needs of teachers and students alike in today's ever-increasing technological society and is aligned with our attempts to raise standards in New York State, the United States, and the world.

Helen L. Fox
Mathematics Teacher
Frederick Douglass Preparatory School
Rochester City School District

February 24, 2006

To Whom It May Concern:

I would very much like to see a CMST Master's Degree Program. As a Science teacher and past CMST participant, I have seen in increase in student learning due to my participation in the program. CMST tools are unique in creating a learning environment that is both engaging and demands that students take ownership of the concepts and understandings they see in class. It is one thing for a student to put down, on paper, answers to a question but it is quite another to have students create models of problems utilizing their understanding.

Creating a computer model is a marvelous tool for increasing problem solving skills. Students faced with learning new skills; incorporating prior knowledge and new knowledge; working in collaborative teams; and creating unique solutions often feel over whelmed and are hesitant to take risks. When lessons are presented using CMST technology and software students are immediately engaged. Students eagerly vie for the opportunity to play a part in the learning experience. I have seen students who traditionally respond in a lack luster fashion to most lessons, lead the rest of the class in creating a model. One student in particular not only became engaged in the lesson but created a project that demonstrated an in depth understanding of the material. This student had never before, in my classroom, showed interest in classroom material and was one whom I considered difficult to reach. The CMST approach is unique and so reaches students in unique ways.

The CMST program benefits a variety of teachers. It is not only science teachers but math teachers as well that can readily utilize technology in the classroom. A fellow teacher in my building has used the smartboard and geometers sketch pad in one of her lessons and exclaimed "I could not get the students to leave the room after we were done! They just wanted to keep going with the lesson!" Other teachers in my building have had similar experiences. Our physics teacher used CMST technology in his room and again was extremely impressed with the students increased grasp of concepts as they were asked to manipulate ideas and incorporate understandings into their projects.

CMST technology is something that our students are already interacting with on a nearly daily basis. So many of our students have computer experience and their familiarity with technology is usually far beyond that of most teachers. In nearly every industry today computer technology is a vital part of advancing industry. Computer modeling will likely take us places that traditional experimentation could not hope to bring us. The future of both math and science is married to technology. Our students already demonstrate both interest and aptitude in the computer sciences it is a missed opportunity not to include computer technology in our classrooms.

We need teachers that are versed in new technologies and are comfortable with introducing innovations to their students. All students want to feel that they are on the cutting edge of learning. CMST teachers bring to their classrooms not only new technology but a learning style that supports student exploration and innovation. This type of teaching style is far more likely to engage a larger number of students. It is more likely to create students who wish to advance further in math and science. Students can more easily see the value of their education when they are able to utilize concepts as they problem solve. When students become the scientists they taste the excitement of finding answers to questions. They feel the satisfaction of achieving goals. Students then gain confidence in their abilities and students who know they have abilities in a certain area are far more likely to pursue those areas later in life.

We need a CMST master's level program so that more teachers are exposed to these tools; so that more teachers can embrace technology; so that teachers are more effective; and so that teachers can lead students to places they themselves have never been.

Kristin Schwartzmeyer
Science Teacher
Kendall Jr/Sr High School

Raymond L. Yeaton, Jr.
Science/Math Teacher, Lead Teacher/Mentor
John Marshall High School
180 Ridgeway Avenue
Rochester, New York 14615

February 22, 2006

Dr. Osman Yasar
PI CMST Institute SUNY College at Brockport
128 Smith Hall, 350 New Campus Drive
Brockport New York, 14420

Dear Dr. Yasar:

This past week various leaders of local college communities met with Senator Schumer to discuss the creation of a center which would help graduate more math and science teachers in the Rochester area. He is looking to make it a national model. It is at once unique and coincidental that the word model is used. Modeling will be the future basis of many Math and Science programs in the area. Rochester is indeed fortunate to have one of the few and indeed perhaps the best modeling program in the nation. I speak of the Computational Math, Science, and Technology Institute at the State University of New York at Brockport.

The creation of a CMST Teacher MS (track) is a way I believe Senator Schumer would see as a way to create highly qualified Math and Science Teachers who are interested in pushing the envelope forward for our students. This creation complements the goals that the University here has for its future teachers. This MS track allows these new Math and Science teachers to better equip our future students in the Rochester area for the challenges that lie ahead of them.

NAS501, NAS601, NAS701 are rigorous courses that directly address the educational and the local industrial needs of our students. Students of teachers who have taken these courses alone have shown a documented increase in their state standard scores. These courses directly address the key Math and Science Standards of New York State. I myself have taken all three courses and can attest to their rigor and valid content for today's Math and Science Teachers.

In summary, I highly support the creation of a MS Track and would consider making this track my 2nd Masters degree after my Masters in Chemistry. I hope this can become a reality.

Respectfully submitted,

Raymond L. Yeaton, Jr.

Science/Math Teacher
Lead Teacher/Mentor

March 1, 2006

TO: Dr. Osman Yasar, Chairperson, Computational Science Department

FR: Dr. Christine E. Murray, Dean, School of Professions

RE: CMST track for MS in Computational Science

I have reviewed the proposed CMST track for the MS Computational Science program and have several comments.

I am in support of this proposal as it offers another alternative for teachers in math and science who are completing their master's degrees for permanent or professional certification. This would enable degree completers to apply directly to the New York State Education Department (NYSED) for their permanent or professional certification.

As graduates will be applying directly to NYSED careful advising and course selection is essential. It should be made clear to individuals who are seeking professional certification that the NYSED regulations require that they must complete 12 hours of study in the content area of their teaching certificate (the 12 credits of elective courses outlined in the proposal). Sandra Selden's letters to Dr. Rajasethupathy of February 28, 2006 and February 21, 2006 clearly outlines these requirements. You may wish to more clearly specify this in the program requirements outlined on page 2 of the proposal.

Also, some of the courses listed in the proposal are restricted to students matriculated in MSED programs and would require departmental approval for Computational Science students to be enrolled. Sandra Selden's letter of February 28, 2006 outlines the Education courses that currently are open to graduate students in other programs.

Thank you for the opportunity to review the proposal. I hope these comments are helpful to you.

xc: Dr. Eileen Daniel, Interim Chairperson Education and Human Development
Ms. Sandra Selden, Coordinator for Certification and EHD Graduate Advisement
Dr. Stuart Appelle, Dean, School of Letters and Science