

REQUEST FOR A NEW UNIT OF INSTRUCTION REV 4/14/08

BACKGROUND

1. **Name of Institution:** Southern Illinois University Carbondale

2. **Title of Proposed Program:** Master of Science in Mathematics and Science Education (MSMSEd)

3. **Contact Person(s)** Dr. Frackson Mumba, Dr. Mary Wright & Mr. Harvey Henson
 - 3.1. Telephone 453-6162 (Dr. Mumba), 453-6582 (Dr. Wright), 453-7349 (Mr. Henson)
 - 3.2. E-mail frackson@siu.edu, mwright@math.siu.edu, henson@geo.siu.edu,
 - 3.3. Fax 453 4244 (Dr. Mumba), 453-5300 (Dr. Wright), 453-7393 (Mr. Henson)

4. **Level of Proposed Unit**

<input type="checkbox"/> Undergraduate Certificate (1-2 years)	<input type="checkbox"/> Post-Baccalaureate Certificate
<input type="checkbox"/> Undergraduate Certificate (2-4 years)	<input type="checkbox"/> Post-Master's Certificate
<input type="checkbox"/> Associate	<input type="checkbox"/> First Professional Certificate
<input type="checkbox"/> Baccalaureate	
<input checked="" type="checkbox"/> Masters	
<input type="checkbox"/> First Professional	
<input type="checkbox"/> Doctorate ¹	

5. **Requested CIP Code** (6-digits) 13.1299

6. **Proposed Date for Enrollment of First Class:** Spring, 2009

7. **Location Offered²:** **On-Campus** **Off-Campus** : Region Number(s) 9, 1 or Statewide

*The Fall and Spring semester coursework for the proposed program is to be offered in flexible on-line learning format, and/or via Distance Learning technology. Summer coursework is to be offered at Service Centers (such as Rend Lake College [RLC], John A. Logan College [JALC], SouthWest Illinois College [SWIC], Shawnee Community College [SCC] and possibly College of Lake County).

¹ To assist staff in specialized areas of instruction, IBHE will retain two outside consultants to review all new doctoral program proposals.

² Institutions may request approval to offer a program, simultaneously, on- and off-campus, including statewide. However, assessments of program objectives and outcomes should be developed that address all of the locations and modes of delivery for which the institution is seeking approval. Note that "on-campus" approval extends to the entire region in which the main campus is located. New off-campus programs to be offered outside the institution's region require approval.

MISSION, OBJECTIVES AND PRIORITIES

8. Mission

- 8.1.** Describe specific objectives and measurable contributions the program will make to the university's mission, paying particular attention to the program's consistency with the university's focus statement and priorities.

The vision for Southern Illinois University Carbondale (SIUC) articulated in the *Southern @ 150 Plan* calls for new and redefined programs, including new Master's degree programs. The document states, "Our graduate and professional students will be immersed in leading research in their chosen discipline. Our service to the region and the state will be thoughtful, consistent, and responsive to our local needs..." The proposed program, focused toward local needs and the development of a new research-oriented student-responsive Master's degree program, will assist SIUC to realize this vision. The mission statement for SIUC includes the assertion that "Critical thinking and problem-solving will be developed talents of every student." The MSMSEd program will enable elementary and middle school teachers to become better critical thinkers and problem-solvers by engaging them in inquiry-based courses and Action research. The program will also enhance communication between SIUC and school districts in Southern Illinois. SIUC faculty working with this body of students will become better teachers by becoming more aware of the issues facing local elementary and middle school teachers.

- serving a distinct student population;

The overall mission of the proposed MSMSEd program is to prepare highly qualified and effective teachers of mathematics and science at the elementary and middle school levels. The program will address mathematics and science (biology, chemistry, geology and physics) content and pedagogical knowledge, National and State Learning Standards, and educational leadership issues. The program will also address reflective teaching skills through Action research that will be conducted by the teachers in their classrooms and in the program content courses. Upon completion of the proposed program, candidates will earn a Masters degree in addition to endorsements in mathematics and science at the elementary and middle school levels.

The program is designed specifically for in-service elementary and middle school teachers. The No Child Left Behind Act (NCLB) of 2001 emphasizes the increase in student academic achievement in mathematics and science through increased numbers of highly qualified teachers in K-12 classrooms. However, at the elementary and middle school level, most teachers who teach science and mathematics are academically unprepared for the task. Although elementary and middle school teachers in Southern Illinois have bachelors' degrees in elementary education they need more training in science and mathematics to effectively teach the two subjects.

- occupational and student demand for the program;

The creation of this program is in response to a widespread need for improvement in mathematics and science education at the elementary and middle school levels indicated by both national and state-level reports. The National Science Board (2006) asserts, "*If the U.S. is to maintain its economic leadership and compete in the new global economy,*

the Nation must prepare today's K-12 students better to be tomorrow's productive workers and citizens. Changing workforce requirements mean that new workers will need ever more sophisticated skills in science, mathematics, engineering and technology. ... Even those students who do not pursue professional occupations in technological fields will also require solid foundations in science and math in order to be productive and capable members of our Nation's society." Also, *"Research shows that a child who has teachers with the knowledge and skills needed to teach mathematics and science effectively in pre-college grades is more likely to be able to close the achievement gaps that he or she experiences and be prepared as an individual for success in work and life (p.2-3)"*.

Yet, according to the National Assessment of Educational Progress (NAEP) report, the proficiency of U.S. students in mathematics and science leaves a lot to be desired. Moreover, the *Keeping Illinois Competitive* report of 2006 asserts that, "Using standards and frameworks that are internationally respected, the National Assessment Governing Board that oversees NAEP regards 'proficient' as the acceptable level." (www.keepingillinoiscompetitive.niu.edu) As shown in Table 1 below, the National picture for 4th graders is not good, and Illinois students fare somewhat worse than the national average (<http://nces.ed.gov/nationsreportcard/pdf/stt2005/2006454IL4.pdf> <http://nces.ed.gov/nationsreportcard/pdf/stt2005/2006467IL4.pdf>).

Table 1: Fourth graders performance in math and science at State and National levels

<i>4th Grade Math Nationally</i>	<i>4th Grade Math in Illinois</i>
35% Proficient & above	32% Proficient & above
44% Basic	42% Basic
21% Below basic	26% Below basic
<i>4th Grade Science Nationally</i>	<i>4th Grade Science in Illinois</i>
27% Proficient and above	26% Proficient & above
38% Basic	38% Basic
34% Below basic	36% Below basic

Small, rural Southern Illinois schools and impoverished Mississippi Delta region schools have greater than average difficulty in hiring highly qualified teachers in science and mathematics. Even in schools deemed to be meeting adequate yearly progress (AYP), in many cases their minority and low-income students are not meeting expectations. By providing in-service teachers from these schools the opportunity to deepen their knowledge and pedagogical skills in mathematics and science, and to develop their teacher-leadership skills, this program will eventually empower greater numbers of Southern Illinois students to enter college and pursue professional occupations in technological fields.

The program will be designed for a cohort of 25 teachers per year. This should easily be sustainable given the size of the region served and the normal attrition in the number of elementary and middle school teachers.

- collaborating with and/or supporting other programs at the institution;

The proposed program is inherently inter-disciplinary, drawing on the knowledge and expertise of faculty from the College of Science (COS) and the College of Education and Human Services (COEHS). Faculty members from the COS departments of Chemistry and Biochemistry, Geology, Mathematics and Physics, and from the COEHS Curriculum & Instruction department already have a well-established history of cooperation in delivering short-term professional development in mathematics and science education for teachers in Southern Illinois through the Illinois Mathematics and Science Partnerships, NSF SIUC Heartland GK-12 and other programs. The proposed program expands this cooperation to include the departments of Plant Biology and Physics so that a well-rounded balance of physical and life sciences will be represented.

- meeting the needs of business, employers, and/or society

As noted above, “... *new workers will need ever more sophisticated skills in science, mathematics, engineering and technology. ... Even those students who do not pursue professional occupations in technological fields will also require solid foundations in science and math in order to be productive and capable members of our Nation’s society.*” High school is too late to start the kind of training described here. It must begin with the elementary and middle grades.

- 8.2.** Explain how the program will meet regional and state needs and priorities, making specific reference to *The Illinois Commitment*.

POLICY AREA ONE: ECONOMIC GROWTH

Higher education will help Illinois sustain strong economic growth through its teaching, service, and research activities.

Strong economic growth in Illinois will be impossible without a scientifically and technologically trained workforce. The proposed MSMSEd program will strengthen the mathematics, science and technological skills of future high school graduates by tackling the problem at its root: the mathematics, science and technology knowledge and pedagogical skills of teachers in the elementary and middle grades.

POLICY AREA TWO: P-20 PARTNERSHIPS

Higher education will join elementary and secondary education to improve teaching and learning at all levels.

“The Board recognizes the preparation of teachers as one of the most important contributions that higher education can make to the well-being of the state and its residents. Research shows that the single most important factor in increasing student learning is the quality of the teacher. To improve the preparation and continuing professional development of teachers, higher education needs to form local partnerships with schools to develop support programs for new teachers and to provide opportunities for experienced teachers to update their skills.”
– *The Illinois Commitment*, p. 4

The proposed MSMSEd program is growing out of recent partnerships between SIUC and several regional offices of education in Southern Illinois. It is a fundamental goal of this program to improve teaching and learning in science and mathematics at the elementary and middle school levels. It is expected that the effect will continue beyond the targeted grade levels. Everything in this program is designed to enable elementary and middle school

mathematics and science teachers to deepen their content knowledge, to enhance their pedagogical skills and to assist their students to meet or exceed mathematics, science and technology standards set by the State of Illinois.

POLICY AREA THREE: AFFORDABILITY

No Illinois resident will be denied an opportunity for a college education because of financial need.

By offering the proposed MSMSEd program in a flexible on-line and distance learning format during Fall and Spring semesters, in-service teachers will be able to continue their employment while pursuing this graduate degree. Summer semester offerings will be offered off-campus, at locations within a reasonable commute for the degree candidates. To the fullest extent possible, costs to the students will be kept low.

Candidates in this program will be eligible for the SIUC Saluki Opportunity Scholarship each semester in the program, provided they continue their employment as teachers. They will be encouraged to apply for the scholarship. The current value of the scholarship is \$250 per semester. (See http://www.siu.edu/gradschl/saluki_scholarship.htm.)

POLICY AREA FOUR: ACCESS AND DIVERSITY

Illinois will increase the number and diversity of residents completing training and education programs.

The MSMSEd program is specifically designed for residents of Southern Illinois – namely, in-service elementary and middle school teachers – to complete a Masters Degree program that is directly relevant to their profession.

POLICY AREA FIVE: HIGH QUALITY

Illinois colleges and universities will be accountable for providing high quality academic programs and the systematic assessment of student learning outcomes while holding students to ever higher expectations for learning and growth.

Degree candidates in the MSMSEd program will be expected to develop deep content and pedagogical knowledge as outlined in the ISBE *Content Area Standards for Educators* as well as National Professional standards (i.e. NCTM, NSTA and NETS). Assessment of learning outcomes will be based directly on these standards.

POLICY AREA SIX: ACCOUNTABILITY AND PRODUCTIVITY

Illinois colleges and universities will continually improve productivity, cost effectiveness and accountability.

The MSMSEd Board of Directors and Advisory Board will monitor the productivity and cost effectiveness of the program.

- 8.3.** Identify similar programs and sponsoring institutions in the state. Compare these programs with the proposed program. Discuss the possible impact of the proposed program on these programs.

At the time of this application, similar programs are being developed at Aurora University, Illinois State University (ISU), Bradley University and the University of Illinois in

Champaign to serve their respective regions. No detailed information is available about these programs other than that they should lead to a Masters degree and the coursework should allow the candidates to earn endorsements in elementary and/or middle school mathematics and science education*. The teams involved in developing these programs meet periodically to compare notes, brainstorm, and share insights. This may result in some common elements among the programs. It is likely that each program will be structured to meet the unique needs of the region it serves.

*A proposal is being developed at the ISBE level for a mathematics/science specialization modeled in some respects on the ISBE reading specialization.

8.4. Discuss estimated future employment opportunities for graduates of this program. Compare the estimated need for graduates with the estimated number of graduates from this program and existing programs identified in 8.3 above. Where appropriate, provide documentation by citing data from such sources as employer surveys, current labor market analyses, and future workforce projections. Describe any special need for this program expressed by state agencies, industry, research centers, or other educational institutions.

Twenty-two percent of all Bachelor's degrees conferred by SIUC are in Education. By comparison, 0.3% are in mathematics, 3% are in biological sciences and 0.6% are in physical sciences. (<http://www.irs.siu.edu/webRoot/CDS/2007/sectionj.htm>) This gives an indication of the *lack* of popularity of mathematics and science as a major, or as a concentration for elementary education majors.

SIUC graduates a large number of Elementary Education majors per year. Of these, typically fewer than 10 have a concentration in either mathematics or science. The vast majority of graduates from the ELED program at SIUC are NOT adequately prepared to teach science and mathematics. Their depth of understanding of K-8 science and mathematics is perhaps 25% of what it should be, given the increasing drive for students to develop mastery of these subjects. In the foreseeable future, the focus on science, technology and mathematics competency both at the national and state level will only increase. Thus, graduates from this program will be assured job security as they prove themselves to be effective teachers and teacher-leaders in science and mathematics.

After several years of short-term professional development efforts and based on emerging research in the field, the Illinois State Board of Education has determined that a Master's Degree program in content and pedagogy is the most effective way for teachers to develop the specialized skills they need to meet the growing demand for a technologically and scientifically literate citizenry. This led to the current iteration of the Illinois Mathematics Science Partnerships program in which 24 new and innovative Masters Degree programs for teachers are being developed and submitted to the IBHE. As noted previously, of those 24 programs, 5 are focused on elementary mathematics and science: Aurora University, Illinois State University, Bradley University, the University of Illinois at Champaign, and SIUC. Each program is initially limited to 25 students per year. The large geographic region that we serve, with its educational concerns and needs, provides an opportunity to offer an innovative and flexible MSMSEd program, which should be sustainable for years to come.

9. Program Description

9.1. Provide a brief narrative description of the program, including a list of its central academic objectives. Explain how the curriculum is structured to meet the program's stated objectives. Provide a complete catalog description for the proposed program, including:

- program admission and graduation requirements; and
- curriculum design, including course descriptions.

[SEE ATTACHED CATALOG DESCRIPTION AND COURSE DESCRIPTIONS]

This interdisciplinary M.S. degree program is designed to offer advanced training in mathematics and science education for elementary and middle school teachers. It is designed specifically for in-service teachers seeking additional content knowledge, pedagogical content knowledge, and leadership skills in mathematics and science education. This is a non-thesis program that includes completion of a classroom-based Action Research* project in lieu of a thesis or research paper. Although a formal Action Research project will conclude the program, Action Research will be integrated throughout. Upon completion of the program, candidates will be eligible for an endorsement in mathematics and science for the elementary and/or middle grades. Program faculty are drawn from various departments in the College of Science and the College of Education.

*Action Research is research done by teachers for themselves. The researcher identifies a research question (or group of questions), collects and analyzes data and develops an action plan based on what the data reveals. The goal is to gain insight, to develop reflective teaching practice and to improve student outcomes in the local classroom. Typically, Action Research is teacher and classroom or school-based research that employs both quantitative and qualitative methods. Action research is done by teachers and students and not on them by another researcher.

Primary Goals:

1. Increase elementary school teachers' mathematics and science content and pedagogical knowledge.
2. Increase elementary school teachers' knowledge and skills for conducting and applying educational research in their classrooms.

Secondary Goals:

3. Develop long-term relationships between teachers and SIUC scientists and mathematicians growing out of the intensive contacts that will necessarily be part of the proposed program.
4. Enhance existing partnerships and create new ones among SIUC and schools in Southern Illinois. The proposed program is being developed to be responsive to teachers' needs in science and mathematics. The dialogue with teachers that has already been part of the planning process will necessarily continue and expand to other groups of teachers.

All the program courses and activities will be organized around National Content Standards for Teachers (*NCTM, NSTA, NETS and NSES*), the *Illinois Content Standards for Teachers*, and *Illinois Learning Standards*.

Graduates of the program will have a deeper awareness and understanding of the content described in the ISBE standards for mathematics and science teachers. They will be prepared to apply current research on best practices in elementary and middle school mathematics and

science education. They will have the knowledge, the confidence and the skill to use inquiry-based methods in their classrooms. They will have experience with technologies appropriate for teaching and learning K-8 science and mathematics and will be capable of integrating those technologies into their instruction in a meaningful way.

Admission

Prospective graduate students should have an undergraduate degree in Elementary Education, or closely related field, and should already be certified elementary or middle school teachers in Illinois who have passed the Illinois Test of Basic Skills, the Elementary Education Content Test and the Elementary Assessment of Professional Teaching Test. Consideration may be given to applicants who have comparable qualifications from another state. Students are required to submit official transcripts from all U.S. schools attended during their last two years of undergraduate study, and also for all graduate work completed.

Curriculum Design

Students in the MSMSEd program are expected to complete the program in 2 academic years and 2 summer terms. Courses offered during the academic year will be offered in a flexible on-line or distance learning format. Laboratory or field experiences may require an additional commitment to 2-3 Saturdays each semester. Laboratory experiences will be integrated into SCI 503A, BIOL 500, CHEM 4XX, GEOL 585 and PHYS 575. The labs will be taught by the instructor. Students will come to the SIUC campus 2 or 3 Saturdays during Fall and Spring semesters for the lab work. In the case of courses with an integrated lab that are offered during the Summer, the SIUC service centers where the courses are taught have more than adequate lab facilities.

(First semester – Spring 2009)

MATH 411-3 Mathematical Topics for Teachers

SCI 503A-3 Science for Elementary School Teachers (Lab is integrated)

(Second semester – Summer 2009)

BIOL 500-3 Contemporary Biology for Teachers (Lab is integrated) (New course)

CHEM 436-3 Chemistry Topics for Teachers (Lab is integrated) (New course)

(Third semester – Fall 2009)

GEOL 585-3 Earth and Space Science for Teachers (Lab is integrated) (New course)

MATH 511-3 Advanced Topics in the Teaching of Mathematics

(Fourth semester – Spring 2010)

PHYS 575-3 Special Physics Topics for Teachers (Lab is integrated)

CI 530-3 Teaching Problem Solving in School Mathematics (Grades K-8)

(Fifth semester – Summer 2010)

CI 522-3 Integration of Technology into Mathematics and Science Teaching (New course)

CI 428-3 Science Methods and Curriculum Development for K-8 (Modified course)

(Sixth semester – Fall 2010)

CI 593-3 (d) (for science) OR CI 594 (e) (for mathematics) Individual Research in Education (Action Research)

CI 537-3 Leadership in Science and Mathematics (New course)

Course Descriptions

BIOL 500-3 Contemporary Biology for Teachers (New course)

An introduction to fundamental biological concepts. Emphasis is placed on exploring plant and animal model systems using contemporary methodologies. Examples of biological processes will be covered from genomics to ecosystems. Prepares teachers to introduce biological principles and innovative approaches to understanding biological systems in the classroom. Prerequisite: SCI 210A & B or equivalent.

CHEM 436-3 Chemistry Topics for Teachers (New course)

This graduate-level chemistry course covers topics, methods and activities that target the needs of elementary and middle school science teachers. The course consists of a combination of lectures and laboratory experiments. The specific subjects covered during the course change, depending on the needs of the current students. Sample topics discussed are: chemical reactions and bonding, forensic chemistry and phase diagrams. Prerequisite: SCI 210 A & B or equivalent.

CI 428-3 Science Methods and Curriculum Development for K-8 (Modified course)

The major focus is on acquisition and development of knowledge and skills in inquiry based teaching and curricula appropriate for K-8 science instruction. Knowledge and skills acquired by teachers will correlate with national and state learning standards in science and in teacher professional development. Course is limited to students admitted to the MSMSEd program. Consent of instructor required.

CI 522- 3 Integration of Technology in Mathematics and Science Teaching (New course)

Integrating technology in Math and Science teaching. Technology may include calculators, computer software, computer-based laboratories, data collection devices, interactive manipulatives, and other internet resources.

CI 530-3 Teaching Problem Solving in School Mathematics (Grades K-8)

Designed to acquaint teachers with problem solving processes and how to integrate problem solving into their teaching. Emphasis is placed on teaching the process of problem solving. Prerequisite: graduate standing or consent of adviser.

CI 537-3 Leadership in Mathematics and Science. (New course)

An exploration of current literature in math and science leadership and the application of principles and skills necessary for mentoring instructional development in math and science. Consent of instructor required.

CI 593 (d)-3 Individual Research in Science Education or CI 593(e)-3 Individual Research in Mathematics Education. The selection, investigation and writing of a research topic under the personal supervision of a member of the departmental graduate staff, in one of the following areas: (a) Curriculum, (b) Supervision for instructional improvement, (c) Language arts, (d) Science, (e) Mathematics, (f) Reading, (g) Social studies, (h) Early childhood, (i) Elementary education, (j) Middle school, (k) Secondary education, (m) Instruction, (n) Educational Technology, (o) Environmental education, (p) Children's literature, (q) Family studies, (r) Computer based education, (s) Gifted and talented education, and (t) Teacher education. Maximum of three hours counted toward a Master's degree. Prerequisite: consent of instructor

GEOL 585-3 Earth and Space Science for Teachers (lab/field trips integrated)

Class designed to help teachers gain an understanding of some of the earth science concepts they need to teach today's standards-based curricula. Develops an understanding of earth materials, how the earth works, earth resources, the causes of natural disasters, and the exploration of the bodies of our solar system. Prerequisites: A general physical science course or equivalent and consent of department.

MATH 411-3 Mathematical Topics for Teachers

Variety of short courses in mathematical ideas useful in curriculum enrichment in elementary and secondary mathematics. May be repeated as topics vary. Does not count toward a mathematics major.

MATH 511-3 Advanced topics in the teaching of mathematics

Selected advanced topics in the teaching of mathematics chosen from such areas as: pedagogical theories; instructional strategies; applications of mathematics; problem solving. This course is counted by the Mathematics department only as part of an approved minor. Prerequisite: consent of instructor.

PHYS 575-3 Special Physics Topics for Teachers

Designed to meet requirements and the needs of K-9 teachers. This course will explore mechanics, heat, sound, electricity, magnetism, light, and some aspects of modern physics. Fundamental physics concepts will be used. Prerequisite: Science 210 or equivalent.

SCI 503A-3 Science for Elementary School Teachers (LAB is integrated)

In-depth studies of selected basic concepts in general science for teachers of upper-level elementary grades. Topics include cells and simple organisms, characteristics of vertebrates, plate tectonics, solar system, nature of matter and magnetism. Prerequisite: currently teaching in an elementary school.

Graduation Requirements

Completion of all required coursework and the Action Research project with a grade of C or better and an overall GPA in the program of 3.0 or better.

- 9.2.** Explain what students are expected to know and/or be able to do upon completing the program.

Upon completion of the program, candidates will be eligible for an endorsement in mathematics and science for the elementary and/or middle grades. They will

1. be well grounded in K-8 mathematics and science content, as outlined by the national professional organizations (NCTM and NSTA) and by the Illinois State Board of Education.
2. possess an expanded repertoire of research-based pedagogical skills for teaching that content.
3. understand best practices for incorporating technology to aid the effective learning of science and mathematics.
4. be prepared to take leadership roles for science and mathematics education in their buildings.

- 9.3.** Describe the strategies to be incorporated into the proposed program to promote student learning.

Instructors in all “content” courses will model the inquiry-based teaching methods that research suggests are most effective for the teaching and learning of science and mathematics. Pedagogy will be discussed hand-in-hand with content in each course. Technology will be incorporated as it is meaningful and appropriate for the elementary and middle grades. Assignments and coursework will be directly applicable to the elementary and middle school science or mathematics classroom. Graduates of the program will also become familiar with diagnostic tools to help other teachers understand why students are having difficulty with K-8 mathematics and science concepts and to devise methods to overcome those difficulties. (Examples of such tools include the MARS Toolkit for Change from Michigan State University and DTAMS: Diagnostic Teacher Assessments in Math and Science, developed by Dr. Bill Bush, University of Louisville). The Action research will expose teachers to both mathematics and science education research. They will also gain knowledge and skills for conducting and using Action research results in their classrooms.

RESOURCES

- 10.** Complete Table I to show student enrollment projections for the program.
- 11.** Complete Table II (even if no new state funding is requested in the budget year). Show all sources of funds, both state and non-state, and reallocations. Provide a narrative budget that includes the following:
- Projected increments in total resource requirements (line 1) in terms of projected staff requirements, equipment and instructional materials, library requirements, and contractual services for internships, practica, or clinical placements.

A cross-disciplinary team of faculty members with representation from both the College of Science and the College of Education and Human Services will take responsibility for overseeing the program. Initially, this team will consist of Mr. Harvey Henson (Geology, College of Science), Dr. Frackson Mumba (Curriculum & Instruction, College of Education and Human Services) and Dr. Mary Wright (Department of Mathematics, College of Science). These program directors will make decisions concerning admission to the program, advisement and registration of students in the program, etc. They will be responsible for ensuring that courses are listed on the SIUC schedule. They will make arrangements for delivery of all courses in the program, working with the Division of Continuing Education, Instructional Technology and SIUC’s Service Centers in the Southern Illinois region as appropriate. The program directors will work with the chairs of the appropriate departments to assign appropriate faculty to the courses. They will also work with the faculty teaching the courses to ensure that the necessary materials are purchased (e.g. laboratory materials for Science courses).

In the first year of the program, it is estimated that instructor salaries and benefits will total approximately \$59,000-60,000. Salary and benefits for a program director (part time) are estimated at \$50,000. Two graduate assistants will be needed (12 months each), for a total of approximately \$34,000 (the exact cost varies by department). GA support will be used primarily to help instructors respond to the content and pedagogy questions from the students in their courses. An administrative assistant will be needed for the program. This person will attend to the day-to-day running of the program – handling messages and correspondence and record

keeping as needed. Salary and benefits are estimated at \$36,000. Total personnel costs: approximately \$180,000.

In its initial stages, the program will require extensive technical support. The program will need its own website which will become the central source of information for the students enrolled in the program. A technical support team will be responsible for developing, expanding and maintaining the website, and for troubleshooting if and when problems develop.

Website development, maintenance and related technical support are estimated at \$10,000. The figures in Table II allow for a 5% increase each year.

In the first year of the program, instructional tools (such as Foss Kits for Science exploration in many science areas), appropriate software for mathematics and science education (such as Geometers Sketchpad) and consumable materials for science labs will be needed. Consumable materials will need to be replenished every year. Foss Kits vary from \$1700 to \$2700 each, depending on the science topic but do not need to be replaced from scratch each year.

The program directors and administrative assistant will need software (e.g. Adobe) for managing documents, web postings in an on-line environment.

Equipment costs, estimated at \$50,000 for Year 1, will likely decrease in Years 2 and 3 since some items purchased in Year 1 will still be available in later years.

Other costs (estimated at \$20,000 in Year 1) include telephone and duplication costs, fees related to establishing courses on line or delivering them through Distance Learning, or face-to-face delivery at an off-campus location during the summer, assessment and diagnostic tools (such as DTAMS, a set of diagnostic tools for math and science), and program evaluation. During the first three years of the program, extensive program evaluation will be required by the funding agency.

- Explanation of required new state resources (line 6) in the budget year in terms of assumptions and factors used to construct line items 7 through 11. If resource requirements in the budget year include non-recurring costs (e.g., one-time equipment purchases), describe how these resources will be reallocated in subsequent years.

This program will be funded through an Illinois Mathematics and Science Partnership (IMSP) grant from the ISBE during its first three years provided this degree program is approved. We are in the planning phase of an IMSP grant. The purpose of the planning phase is to develop a degree program such as this one. Upon approval of the degree program, we will be able to submit an application for the implementation phase. The implementation phase IMSP grants are for \$250,000 per year for three years. By the time grant funding ceases, the infrastructure should be in place so that the program can continue to run on a cost-recovery basis as new teachers are recruited and enroll in the program. If there is not sufficient interest to continue the program, it will no longer be offered. However, as long as mathematics and science education are a high priority in the United States, it will be important to offer teachers the opportunity to enhance their content knowledge and pedagogical skills and to become familiar with emerging science and technology. The program directors will continue to seek additional grant funding (such as an NSF-MSP institute partnership).

12. Describe the institutional resources available to develop and maintain a quality program. Include the following elements in your discussion:

- Faculty qualifications, evaluation, and reward structure;

At the time of this application the following faculty members are expected to be involved developing and/or teaching courses in the proposed program. Brief biographies are attached.

Henson, Harvey, Instructor/Research Project Specialist, Geology, M.S., Southern Illinois University Carbondale, 1989, MSMSEd Co-director.

Lefticariu, Liliana, Assistant Professor, Geology, Ph. D., Northern Illinois University, 2004.

Means, Jay C., Dean, College of Science, and Professor, Chemistry & Biochemistry, Ph. D. University of Illinois at Urbana-Champaign, 1976.

Mumba, Frackson, Assistant Professor, Curriculum & Instruction, Ed.D., Illinois State University, 2005, MSMSEd Co-director

Renzaglia, Karen, Associate Professor, Plant Biology, Ph.D., Southern Illinois University Carbondale, 1981.

Tolley, Luke T., Assistant Professor, Chemistry and Biochemistry, Ph.D., University of North Carolina, 2001.

Tsige, Mesfin, Assistant Professor, Physics, Ph.D., Case Western Reserve University, 2001.

Wise, Kevin C., Associate Professor, Curriculum & Instruction, Ed.D., University of Georgia, 1983.

Wright, Mary H., Professor, Mathematics, Ph. D., McGill University, 1977, MSMSEd Co-director.

All of these faculty members have experience teaching courses and leading professional development programs for in-service elementary/middle school teachers in their disciplines. The Deans of the COS and the COEHS and the chairs of the departments represented are committed to maintaining the program. In consultation with the Program Director/Advisory Council, they will ensure that new faculty in the program have expertise/experience in both elementary and middle school content and pedagogy and that they share the vision of the program for the development of elementary/middle school mathematics and science teachers.

- Adequacy of library and related resources;

Students in the program will have full access to Morris Library. The principal use of the library will be via the Internet. Instructors will use electronic formats (email, WebCT, LiveText, other internet postings, etc.) to share additional materials with students, as appropriate. Please see the attached letter from Dr. David Carlson detailing the databases and other library resources available on line.

- Adequacy of student support services, support staff, equipment, and other resources;

Students will have access to instructors via email, internet and telephone. The program directors members also will teach in the program and will be available to help resolve problems, should any arise. During the summer semesters, instruction will be “face-to-face” at an off-campus location (one of the SIUC service centers in Southern Illinois).

- Demonstration of teaching/scholarship effectiveness and course evaluation;

Course/Instructor evaluations will be collected for each course each semester.

Towards the end of the program, each student will be asked to complete a Program Evaluation.

QUALITY ASSURANCE³

13. Program/Student Learning Outcomes Assessment

13.1. Describe the program's assessment plan, which should include the following elements:

- Statement of program objectives and intended learning outcomes;

Upon completion of the program, candidates will be eligible for an endorsement in mathematics and science for the elementary and/or middle. They will:

1. be thoroughly grounded in K-8 mathematics and science content as outlined by the professional organizations (NCTM and NSTA) and the ISBE;
2. possess an expanded repertoire of research-based pedagogical skills for teaching that content;
3. understand best practices for incorporating technology to aid the effective learning of science and mathematics;
4. be prepared to take leadership roles for science and mathematics education in their buildings.

- End- or near-end-of-program assessment of student learning, in addition to course-by-course assessment such as: (1) evaluation of capstone experiences (senior projects, recitals, exhibits, portfolios, etc.); (2) pre-and post-testing (value-added assessment);

During the last semester of the program, all candidates will take an Action Research course. They will be required to develop and implement an Action Research project in their science or mathematics classroom and write up a detailed report. This will serve as a capstone experience in the program.

- Multiple performance measures, if necessary, that reflect the uniqueness of the academic program and discipline such as: (1) standardized or other comprehensive examinations; (2) certification examinations;

Courses in the program will have embedded assessments, including but not limited to lesson plans, mini-research projects, portfolios of science experiments/activities, mathematics activities (etc.), as well as quizzes and examinations over basic content, where appropriate. By the end of the program, candidates will demonstrate through their coursework and professional activities that they meet all criteria for the endorsement in mathematics and science for elementary/middle grades.

- Feedback from key stakeholders (current students, alumni, employers, graduate schools, etc.);

After implementing their enhanced knowledge and skills degree candidates will be able to document improvement in student achievement and greater student engagement in their

³ Quality assurance processes are those ongoing reviews that maintain program and instructional standards.

science/mathematics classes. A program review will be conducted approximately 5 years into the program to provide extensive and objective feedback on all aspects of the program. This will begin with a self-study in year 4.

- Evidence of a formal feedback/improvement mechanism, i.e., that the program/unit has a regular review process in place and that the results of this process are used to improve curriculum, instruction, and learning.

The Program Directors and an Advisory Board will meet at least once each year (more often initially!) to review the assessment process and the progress of the students in the program, to discuss any problems or issues that arise over time and to modify the program or the assessment process as necessary in order to meet the goals of the program.

13.2. Identify measures to be used to assess and improve student learning, curriculum, and instruction. Evidence of success should include, but not be limited to, such specific outcomes as the following:

- Percent pass rate of graduates on end-of-program certification examinations;
- Enrollment of graduates in graduate and/or professional programs or other subsequent education;
- Percent of graduates employed in the field;
- Career advancement achieved by program graduates;
- Graduate/employer satisfaction with the program;
- Retention and graduation rates and time-to-degree completion;
- Percent of students involved in faculty research or other projects; and
- Percent of graduate students presenting or publishing papers.

Evidence of the success of this MSMSEd program includes:

- Percent of students who successfully complete the program. (Some attrition has to be expected due to “life events” – major illness, birth of a child, etc. – which cannot be foreseen at the time of initial enrollment in the program. Attrition for other reasons would be cause for concern.)
- Percent of graduates who earn an endorsement in elementary and/or middle school math and science;
- Percent of graduates who take on a leadership role in their building and/or within the appropriate professional organizations (NCTM, ICTM, NSTA, etc.)
- Percent of graduates who, in due time, can document higher student achievement in their classrooms.
- Percent of graduates who, in due time, can document greater student engagement and interest in mathematics/science in their classrooms.

OFF-CAMPUS PROGRAMS ONLY

14. In addition to responding to the above questions, if all or part of the proposed program is to be delivered off-campus and/or via the Internet, provide the following:

14.1. Describe the program’s mode(s) of delivery.

During Fall and Spring semesters, courses will be delivered in a flexible on-line or distance learning format. During the Summer semesters, courses will be offered at an off-campus location (SIUC service center) within a reasonable commuting distance for all members of the cohort.

14.2. Describe the process for assuring the quality of the off-campus program in the following areas: (a) faculty qualifications and evaluation; (b) student access to necessary library resources; (c) where appropriate, student and faculty access to technical support, including computing.

- (a) SIUC faculty with appropriate experience will teach the courses. Department chairs will make the assignment, in consultation with the Program Directors/Advisory Board. Instructor evaluations will be collected for each course each semester.
- (b) Students will have access to Morris Library. Generally they will need and use only electronic access. Additional resources of interest to the students will be shared with them electronically via email or Internet posting (e.g. LiveText).
- (c) A typical home computer (Mac or PC) with internet access should be sufficient for all students in the program. Additional access to specialized technology (e.g. science labs) will be arranged by means of campus visits or field trips 2-3 Saturdays during the course in question. Courses that are offered via Distance Learning will rely on the resources at the cooperating sites – SIUC and the SIUC service centers in the Southern Illinois region. These resources are well-maintained and regularly updated.

14.3. Has this program been approved for on-campus delivery?

Not at this time.

Table I

STUDENT ENROLLMENT PROJECTIONS FOR THE NEW PROGRAM

	Budget Year	2nd Year	3rd Year	4th Year	5th Year
Number of Program Majors (Fall headcount)	25	25	25	25	25
Annual Full-Time-Equivalent Majors	25	25	25	25	25
Annual Credit Hours in EXISTING (or modified) Courses ¹	9*25 = 225	12*25 = 300	450	450	450
Annual Credit Hours in NEW Courses ¹	9*25 = 225	6*25 = 150	0	0	0
Annual Number of degrees Awarded	0	22-25	0	22-25	0

¹Include credit hours generated by both majors and non-majors in courses offered by the academic unit directly responsible for the proposed program.

There are 6 courses that already exist, 5 that are new, and 1 course is a modification of an existing course. It is expected that in Year 1 of the program, 3 of the courses (9 credit hours) offered will be existing courses and 3 will be new courses (9 credit hours). The cohort of 25 students who begin the program in Year 1 will continue in Year 2, taking 4 courses (12 credit hours) in currently existing (or modified) courses, and 2 courses (6 credit hours) in new courses designed for the program. A new cohort of 25 students will enter the program in Year 3, taking the courses that were offered in Year 1. In the 4th year of the program the second cohort will take the courses designed for the second year of the program and so on. After the 3 years of grant support expected from the ISBE, the program should be able to run on a cost-recovery basis.

We do not anticipate enrollment of students from other majors or programs in these courses, only in-service elementary teachers pursuing the MSMSEd degree.

The first cohort of 25 students will complete the program in 2 years. Although we would have every hope that all 25 of those who start would complete the degree, we understand that major life events will occur and that a 100% completion rate is unlikely. A second cohort of 25 students will begin a new cycle in Year 3.

Table II

TOTAL RESOURCE REQUIREMENTS FOR THE NEW UNIT

		Current	Budget	2 nd	3 rd	4th
		Year	Year	Year	Year	Year
1	Total Resource Requirements		250,000	250,000	250,000	Cost recovery basis*
2	Resources Available from Federal Sources ¹		N/A	N/A	N/A	
3	Resources Available from Other Non-State Sources ¹ Expected from ISBE through MSP implementation grant		250,000	250,000	250,000	
4	Existing State Resources ²		--	--	--	
5	Resources Available through Internal Reallocation ³		--	--	--	
6	New State Resources Required ⁴		--	--	--	
	Breakdown: New State Resources Required					
7	FTE Staff ⁵ (6) 3-hr courses per year – 1.5 FTE		1.5	1.5	1.5	
8	Personnel Services Faculty, GA's, administrative assistant, program directors		180,000	189,000	198,450	
9	Equipment and Instructional Needs		50,000	35,000	25,550	
10	Library		--	--	--	
11	Other Support Services ⁶		20,000	26,000	26,000	

*After the 3 years of ISBE grant support we hope to have NSF-MSP grant support to continue this program. Once grant support ends, if the program is not able to be self-supporting, it will likely be discontinued.

¹These lines reflect funds available (not incremental funds) from non-state sources in any given year.

²Existing state resources in each successive year are equal to the sum of the previous year's existing state resources (line 4); plus resources made available through internal reallocation (line 5); plus new state resources (line 6). If state resources allocated to a program in any given year (line 4) exceed state resource requirements needed to support the program in the following year,

state resource requirements should be reduced with a negative dollar adjustment on line 5. The sum of lines 2 through 6 will always equal line 1.

³Numbers can be either positive (allocated to the program) or negative (allocated away from the program).

⁴Reflects the level of state funding requested in the referenced year. Dollars reported are incremental.

⁵Reflects the number of FTE staff to be supported with requested funds. Not a dollar entry.

⁶Other dollars directly assigned to the program. Do not include allocated support services.

Budget Table – additional Information:

The information below is offered to provide some detail relating to the Personnel Services figure in Table II.

	Monthly Salary (est)	
A. Professional Staff		Average monthly salary of instructors in program (estimated): \$6370
Dr. Frackson Mumba (instruction Years 1 & 2)	6688	One course = 25% of one semester = 25% of 4.5 months;
Mr. Harvey Henson (instruction 1/2 course Year 1)	4394	Average cost of one course = $.25 * 4.5 * 6370 = \$7166.25$
Dr. Mary Wright (instruction 2 courses Year 1)	8653	Six courses = $6 * 7166.25 = \$42,997.50$
Dr. Mesfin Tsige (instruction Year 2)	6296	Plus benefits: \$16,012.
Dr. Karen Renzaglia (instruction Year 1)	6141	Grad students (2) \$34,000.00 (exact figure depends on department)
Dr. Liliana Lefticariu (instruction Year 1)	5941	Director (part time) salary and benefits: approximately \$50,000.
Dr. Kevin Wise (instruction 2 courses Year 2)	6855	Administrative assistant salary and benefits: approximately \$36,000
Dr. Luke Tolley (instruction 1 course Year 1)	6075	This puts total at just under \$180,000 for Personnel Services.
Dr. Cheng-yao Lin (instruction Year 2)	6287	
Subtotal	57330	
B. Other Personnel		
Graduate Assistants (2) (12 months)	34,000	

Notice of Intent

SOUTHERN ILLINOIS UNIVERSITY CARBONDALE

M.S. in Mathematics and Science Education (MSMSEd)
Regions 9, 1 or statewide

Southern Illinois Carbondale has informed the Illinois Board of Higher Education of its intent to offer the M.S. in Science and Mathematics Education in Regions 9, 1 or statewide

This interdisciplinary M.S. degree program is designed to offer advanced training in mathematics and science education for elementary and middle school teachers. The program requires 36 semester hours of graduate level coursework. Seven courses are focused primarily on science and mathematics content with integrated pedagogy; four courses emphasize inquiry and problem solving in K-8 mathematics and science, curriculum development, integration of technology into mathematics and science education, and teacher leadership in the areas of K-8 mathematics and science education. This is a non-thesis program that includes completion of a classroom-based Action Research project in lieu of a thesis or research paper. Upon completion of the program, candidates will be eligible for an endorsement in mathematics and science for the elementary and/or middle grades.

The proposed program is designed specifically for in-service teachers seeking additional content knowledge, pedagogical content knowledge, and leadership skills in mathematics and science education. During Fall and Spring semesters, courses will be delivered in a flexible on-line or distance learning format. During the summer semesters, courses will be offered at an off-campus location (SIUC service center) within a reasonable commuting distance for all members of the cohort. Students in the program will have full access to SIUC's Morris Library. The principal use of the library will be via the Internet. Instructors will use electronic formats (email, WebCT, LiveText, blackboard, other internet postings, etc.) to share additional materials with students, as appropriate.

The University estimates that approximately 25 students will enroll in the program every two years, and expects 25 students to graduate every two years beginning in its second year of existence.

Requests for additional information about the proposed program should be directed to Dr. John Haller, Vice President for Academic Affairs, Southern Illinois University Carbondale, Carbondale, IL 62901; Tel: 618-536-3479; email: jhaller@siu.edu