

College of Science and Mathematics Quality Enhancement Plan Proposal

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I. **Proposed Focus:** STEM Literacy for an Engaged Citizenry

II. **Rationale:**

Carl Sagan wrote in 1997 (from **The Demon-Haunted World**), *“Ignorance reigns in our society at a moment when science is on the cusp of doing amazing and wonderful things, but also dangerous things. Ignorance is not an option.”*

According to a 2007 study conducted by Jon D. Miller (Michigan State University, Director, Center of Biomedical Communications) and presented at the 2007 meeting of the American Academy for the Advancement of Science (Duncan, MIT Technology Review, N.p., Feb. 2007.), 72% of Americans are scientifically illiterate. Nobel Laureate Physicist Leon Lederman defines “STEM (Science, Technology, Engineering and Mathematics) literacy” as the ability to adapt to and accept changes driven by new technology, working with others, often across borders, to anticipate the multilevel impacts of their actions, communicate complex ideas effectively to a variety of audiences, and perhaps most importantly, find “measured yet creative solutions to problems which are today unimaginable.” Dr. Richard Larson of MIT presents a more comprehensive vision: “A person has STEM literacy if she can understand the world around her in a logical way guided by the principals of scientific thought. A STEM-literate person can think for herself. She asks critical questions. She can form hypotheses and seek data to confirm or deny them. She sees the beauty and complexity in nature and seeks to understand. She sees the modern world that mankind has created and hopes to use her STEM-related skills and knowledge to improve it.” Although scientific literacy has improved from 10% of the population at the time Sagan wrote **The Demon-Haunted World** to 28% when Miller conducted

his study, scientific literacy rates in the United States remain unacceptably low for a society faced with many challenges and opportunities that require an understanding of scientific principles to solve.

The present USA Federal STEM Education 5-Year Strategic Plan developed by the National Science and Technology Council states that “The health and longevity of our Nation’s citizenry, economy and environmental resources depend in large part on the acceleration of scientific and technological innovations...”. For this to become a reality requires not only significant advances within STEM disciplines; but, also a more STEM literate citizenry to support, understand, and capitalize on STEM advances. This will provide continuous improvement in all sectors of American life, and KSU students should be leaders in that role.

III. Justification and Overarching Goal:

Higher education is responsible for, not only preparing students for a professional career, but also for preparing students to become productive, contributing citizens. A citizen in today’s world must be scientifically literate. With more than half of KSU’s colleges in STEM related fields or having STEM related degree programs, the KSU community is strategically situated to integrate scientific literacy throughout a students’ University experience. The overarching goal of this proposal is to create an enhanced set of academic experiences, which ensures that a KSU graduate can lead in a world of scientific opportunities.

IV. Proposal Description:

Designing and implementing a QEP that focuses on “STEM Literacy for an Engaged Citizenry” will include a set of standards that integrate across the entire KSU curriculum, in and out of classroom spaces. All graduates should be provided the opportunity to expand their knowledge and application of science and see how science influences them personally, regardless of their major. With this in mind, the STEM Literacy QEP incorporates the following

components:

- A. A new School of Integrated Science Learning (SISL, housed within the College of Science and Mathematics) will facilitate teams of faculty and staff to identify places within the curriculum where STEM Literacy standards can be integrated. The American Association of Colleges and Universities (AAC&U) Scientific Thinking and Integrative Reasoning Skills (STIRS) will serve as the guiding set of standards for our QEP implementation. According to the AAC&U website, the STIRS Framework “outlines the need for college graduates in all fields of study to be able to discuss how evidence can be used to advance knowledge and/or to inform subsequent research; to apply an evidence-based decision-making approach, identifying elements which frame and drive decision making for problems in the sciences, social sciences, and/or humanities; to analyze the operation of complex systems using evidence and systems thinking; and to analyze ethics issues which are inherent in research and use of evidence.”
- B. Students will be encouraged to have Beyond-The-Curriculum STEM Integrated Experiences. Experiences such as internships, co-ops, or research will serve to allow KSU students to work in the sciences or see how science influences all aspects of our society. These activities will be supported by a QEP advisory council.
- C. University Level STEM Literacy Lecture Series. These seminars will bring to campus well-known, successful professionals whose experiences integrate with STEM disciplines directly or indirectly. These seminars will be directly integrated with curricular structures across campus. Disciplines from across the campus will be asked to provide exemplars for these university-level seminars.
- D. Creation of STEM literacy modules for incorporation into KSU’s first-year experiences for all students. A partnership between the CSM and University College and another one

between the Southern Polytechnic College of Engineering and Engineering Technology and University College have already started the work of incorporating scientific and quantitative reasoning into the first year curriculum. Packaging that successful material into integrated modules will help ensure students early access to STEM thinking and will prepare them for success in their Area A2 and D requirements.

E. The School of Integrated Science Learning will coordinate the implementation of this QEP.

A committee comprised of representatives from each academic college, senior university leadership, and student leaders will be charged with serving as resources for the campus community and as oversight committee of QEP activities.

V. **Budget:** The budget assumes a 3% annual merit increase for salaried positions

Project Year	Description	Budget	Total
Year 1:	Administrative Assistant (plus benefits)	\$35,000	45,500
	Stipend for CSM Associate Dean for Student Success	\$10,000	10,000
	Funds to facilitate Curriculum changes	\$50,000	50,000
	STEM Lecture series expenses	\$7,500	7,500
	Assessment Materials	\$5,000	5,000
			\$118,000
Year 2:	Administrative Assistant (plus benefits)	\$36,050	46,865
	Stipend for CSM Associate Dean for Student Success	\$10,000	10,000
	Funds to facilitate Curriculum changes	\$50,000	50,000
	STEM Lecture series expenses	\$7,500	7,500
	Assessment Materials	\$5,000	5,000
			\$119,365
Year 3:	Director of Q.E.P. (plus benefits)	\$90,000	117,000
	Administrative Assistant (plus benefits)	\$37,131	48,270
	STEM Lecture series expenses	\$7,500	7,500
	Stipend for Assistant Dean (director of Q.E.P. Assessment)	\$5,000	5,000
			\$177,770
Year 4:	Director of Q.E.P. (plus benefits)	\$92,700	120,510
	Administrative Assistant (plus benefits)	\$38,245	49,719
	STEM Lecture series expenses	\$5,000	5,000
	Stipend for Assistant Dean (director of Q.E.P. Assessment)	\$5,000	5,000
			\$180,229
Year 5:	Director of Q.E.P. (plus benefits)	\$95,481	124,125
	Administrative Assistant (plus benefits)	\$39,392	51,210
	STEM Lecture series expenses	\$5,000	5,000

Stipend for Assistant Dean (director of Q.E.P. Assessment)	\$5,000	5,000
		\$185,335

VI. Timeline:

A test of Scientific Reasoning will be administered to a representative student population starting year 1 while SISL coordinates the construction of the advisory council and works with faculty to develop integrated STEM modules. Implementation of the integrated curricula is targeted for Year 2 or 3 with follow up coordination of VALUE (Valid Assessment of Learning in Undergraduate Education, from the AAC&U) rubric implementation. The STEM lecture series will focus on 1 or 2 individuals in the first year and will expand out as more integrated STEM learning modules come online. We expect our first round of assessment to be completed by Year 3 with improvement plans in place before the start of Year 4.

VII. Assessment:

The Director of the QEP in conjunction with the QEP committee, will work with programs to evaluate the scientific reasoning of students across the degree programs using the AAC&U VALUE rubric as a method of comparison. In addition, we will subsample students in general education and capstone-level courses using the Madison Assessment ‘Scientific Reasoning Test,’ a professionally validated, multiple-choice test developed by James Madison University. This will allow us to evaluate our progress across a student’s education and our improvement over the life of the QEP years.

VIII. Special Note:

While the College of Science and Mathematics Office of the Dean serves as the lead on this proposal, this QEP proposal is supported by the Dean of the College of Architecture and Construction Management, the Dean of the Southern Polytechnic College of Engineering & Engineering Technology, and the Dean of the College of Computing and Software Engineering.