University System of Georgia (USG) STEM Initiative

Annual Report Form for FY2014 (AY2013-2014)

I. STEM Initiative Program Overview

A. Program Implementation and Operation – This section covers the operation of your institution's STEM Initiative Program:

1. Identify and explain the **key programs and projects** (i.e. mini-grant program, FOCUS-derived project, etc.) that comprise the STEM Initiative at your institution. (You will be asked more detailed questions about these later.)

Increasing the number of undergraduate students who succeed in STEM courses and graduate in a STEM discipline continue to be institutional priorities at the University of Georgia (UGA). Through the STEM Initiative, UGA works to improve instruction and student achievement in core undergraduate STEM courses and to assist in the preparation and professional development of K-12 science and mathematics teachers. Specific STEM Initiative strategies include:

1. Supporting tenure-track faculty whose contributions are aimed at improving instruction in their respective areas;
2. Improving the recruitment of pre-service science and math teachers through targeted and interactive recruitment;
3. Offering a structured STEM mini-grant program to encourage innovative instructional strategies in introductory STEM courses in order to retain students who enroll in those courses;
4. Supporting innovative learning communities for STEM faculty and K-12 teachers to collaborate on ways to improve instruction;
5. Expanding the service-learning course "Fostering Our Community's Understanding of Science" (Project FOCUS) for undergraduate students to bring their science knowledge to K-8 classrooms through inquiry-based lessons and, in turn, gain an awareness of and appreciation for teaching science to young students; and

6. Offering a UGA STEM Institute on Teaching and Learning to provide opportunities for faculty professional development and a venue for dissemination of mini-grant research results.

2. Identify **key personnel** associated with your institution's STEM Initiative program and briefly describe **each person's role**. Be certain to include all personnel whose salaries have been paid, either fully or partially, by STEM Initiative funds. Include any faculty or staff receiving course release time or some comparable form of compensation to participate.

Institution-Specific Strategy: Promote Innovative STEM Programs through Key Instructional Personnel

Funding for tenure-track faculty lines in key STEM disciplines has been essential for the successful implementation of STEM Initiative activities at UGA. These faculty members have made important contributions to efforts aimed at improving instruction in their respective areas and increasing the numbers and STEM preparation of pre-service K-12 teachers. Below are the names, roles, and selected contributions of these faculty.

David Gay, Mathematics Department

- **Teaching and Service:** Courses for future high school teachers (MATH 5200/7200, MATH 5210/7210), doctoral supervision, undergraduate research supervision (both CURO and non-CURO), high school student research supervision (Camp Euclid), faculty mentor for UGA math circle, workshop organization (Banff International Research Station, March 2014).
- **Research:** Geometric and differential topology; mathematics education and outreach, especially mathematics research with undergraduate and high school students. In collaboration with R. Kirby, UC Berkeley, discovered groundbreaking new structure theorem (trisections) for 4-dimensional spaces.
- **Grants:**
    - NSF Award #DMS-1207721 "Probing smooth and symplectic topology using maps to dimension two," in the amount of $162,926, effective August 15, 2012 and expires July 31, 2015. This grant also includes a subcontract to Euclid Lab to run online high school research programs.
    - NSF Award #DMS-1435788 "Georgia Topology Conference," in the amount of $78,720, effective May 1, 2014 and expires April 30, 2017.
    - Began and spearheaded grant writing for 7-PI, 5-institution NSF Focused Research Group proposal "Heegaard splittings and trisections, new links between dimensions 3 and 4", with UGA as lead institution (submitted October 2014).

Ajay Sharma, Department of Educational Theory & Practice (formerly the Department of Elementary and Social Studies Education)

- **Teaching:** EDMS 5460 (Student Teaching in Middle School); EDMS 5020L/5030L (Educating Young Adolescents Lab). Graduate-level courses: ESSE 8050 (Theory and Research on Teaching); ESSE 6990 (Research Seminar in Early Childhood/Middle School/Social Studies Education).

- **Research:** Theoretical and ethnographic explorations of implications that climate change and neo-liberalism have for science education, the work of teachers, and the democratic agenda of schooling.

- **Grant Award:** The University System of Georgia Board of Regents (2013-2014) *Teaching climate change in middle and high schools*; Principal Investigator: Ajay Sharma; Co-principal Investigator: Jeff Hepinstall-Cymerman (Warnell School of Forestry and Natural Resources, UGA); Amount $25,600.00.

Joachim Walther, College of Engineering, Engineering Education Research

- **Teaching and Service:**
  - Designed a 4-course Synthesis and Design Studio sequence to introduce engineering students to the challenges of the 21st century engineering work characterized by the interaction of technical, social, economic, and ecological factors. Developed and implemented a group of four engineering education graduate courses within the College of Engineering. These courses foster a dialog between future engineering education researchers and future engineering education practitioners and thus address the mission of the college in the following two ways. First, these courses lay the foundation for engineering education research to grow as one of the key research areas of the new college and, second, the courses introduce graduate students from other engineering disciplines to the scholarship of teaching and learning in engineering thus preparing them to become effective engineering educators.

  - Taught two sections of the freshmen environmental engineering Seminar that is part of the Synthesis and Design Studio sequence (Fall).

  - Taught freshmen and sophomore design studios (Spring).

- **Research:**
  - Investigating students' professional development in engineering programs and the use of interpretive research methods within the emerging field of engineering education research.

  - Submitted interdisciplinary, collaborative proposal to the NSF Research in Engineering Education Program (under review). The proposal, "The Empathy Project: An Interdisciplinary Research Effort to Develop a Transferable Theory of Empathy in Engineering," investigates the role of empathy in engineering students' professional formation. The research team brings together engineering education and social work education researchers and is situated within an interdisciplinary educational initiative that develops a series of integrated course modules to directly foster empathy in engineering students. Drawing on the intellectual and pedagogical traditions of social work, we frame empathy from both a skill dimension in the sense of perspective taking and from a dimension of a moral orientation. With this theoretical framing and the pedagogical approach, empathy could play a key role in preparing engineering students to better communicate with diverse stakeholders in engineering projects and at the same time be prepared to embrace the growing social responsibilities of the engineering profession. Both these aspects are at the heart of an international discourse around the necessary transformation of our engineering education systems and are an integral part of the defined learning outcomes that underpin national accreditation processes.

- **Grant Awards:**
  - **NSF CAREER Grant Award (2012):** To foster a national dialog and build capacity around the issue of research quality across the diverse range of qualitative research methods that are currently adopted in the engineering education research community. This dialog will lead to an inclusive framework for research quality that will ultimately improve the adoption and acceptance of qualitative methods in engineering education research. A number of national and international workshops were conducted and an early quality framework published in the premier journal of the engineering education research community (Walther, Sochacka & Kellam, 2013 [in press]).

  - **NSF Grant Award (2012-2015): "***Connected Ways of Knowing: Uncovering the Role of Emotion in Engineering Student Learning".* This engineering education research project seeks to understand how students' emotions play key roles in both learning engineering and their development of a professional identity. There is increasing evidence that emotion impacts learning, yet these connections are not yet well understood. By examining connections between motions and

learning, this project will inform the design of engineering degree programs which can connect scientific, technical, and social knowledge for the students and will design future solutions to societal problems.

- **NSF Grant Award:** *"A Long Way Coming: Understanding Engineering Educators' Transformations to Student-Centered Teaching".* This project explores the nexus between a history of engineering education research and the availability of evidence-based strategies to improve engineering education as set against the increasing concerns about the lack of significant, transformative changes in engineering programs. The project explores engineering educators personal trajectories of transition from traditional teacher centered to innovative learner centered approaches as the potential missing piece in the above challenge.

Institution Specific Strategy: Enhance STEM Teacher Recruitment

In FY14 we continued to focus recruitment efforts on secondary science education and mathematics education. STEM Initiative funds were used to support Dr. Georgia Hodges to work as a recruiter and advisor for BSEd, dual degree, and MAT students. Although the number of degrees awarded increased slightly from the previous year, the number of current majors dropped, perhaps reflecting difficulties in the job market. Clearly, proactive recruitment efforts should continue as job prospects increase and looming retirements of veteran teachers begin.

Georgia Hodges, Assistant Research Scientist and M.A.T. Coordinator, Mathematics and Science Education

Recruiter for secondary science teacher preparation

3. Identify **partnering departments, offices, or centers** participating in the STEM Initiative at your institution. Briefly discuss their relationship with the STEM Initiative and note any relevant contributions.

The UGA **Office of STEM Education (OSE)** provides campus-wide leadership for STEM activities. The OSE represents UGA in the USG STEM Initiative, whose goals have become the OSE goals: 1) to increase the number of students who succeed in STEM courses; 2) to increase the number of students who pursue baccalaureate degrees in STEM fields; and 3) to make science and mathematics teacher production a high priority. The mission of the OSE aligns with UGA's mission as a public research extensive and teacher preparation university and also the UGA Complete College Georgia Plan. The OSE reports directly to the Office of the Vice President for Instruction.

Specific goals of the OSE include:

- Promoting and developing collaborative partnerships among STEM faculty at UGA and K-12 school districts
- Serving as a knowledgeable source of information related to STEM activities for UGA faculty, staff, and students
- Liaising with state and national agencies involved in STEM education reform
- Assisting UGA faculty with funding opportunities related to STEM teaching and learning

The Office of STEM Education partners with campus, state, and national initiatives designed to improve the quality of undergraduate STEM education and increase the diversity of talented students pursuing STEM careers. Current partners include the Peach State Louis Stokes Alliance for Minority Participation (LSAMP), the Clarke County School District, and the Center for the Integration of Research, Teaching, and Learning (CIRTL). In 2013-14, the OSE provided letters of support for 10 proposals that incorporated a STEM-education component as part of the Broader Impacts section. The OSE is a partner on proposals funded by the National Science Foundation and the Great Lakes Higher Education Guaranty Corporation to strengthen the CIRTL Network and increase its impact on improving the teaching of future faculty in participating institutions. External grant funding contributions are discussed in section IV.B. of this report.

B. *Program Successes* – This section covers the key accomplishments of your institution's STEM Initiative program during FY2013:

1. Explain how your program has made progress toward Goal 1, **improving the readiness of P-12 students** for STEM in college. (You may wish to draw upon service learning programs, among other efforts. You also may wish to describe bridge programs or similar efforts directed at incoming freshmen.)

Fostering Our Community's Understanding of Science, Project FOCUS, is an ongoing partnership between the University of Georgia and the Clarke County School District to improve science instruction in our local public schools. Project FOCUS partners university students, majoring in a science-related discipline, with elementary and middle school teachers to help teach science to children in grades K-8. Project FOCUS students teach science lessons in compliance with Georgia Performance Standards two to three times each week during the 15-week semester. They also provide the school teachers with science expertise, hands-on lesson plans, and supplemental materials for continued use.

Both university students and Clarke County students include many individuals from non-traditional backgrounds in the STEM disciplines. For example, in spring 2014, 40 of the 80 university students were from non-Caucasian backgrounds, and 57 of the 80 were female. In Clarke County, 82% of all students qualify for free or reduced-cost lunches, indicating they come

from backgrounds of poverty. Of the county's total student population, 19% are white, 23% Hispanic, 51% black, and the remainder Asian, Native-American and mixed race.

2. Explain how your program has made progress toward Goal 2, **improving student success and completion rates**, by discussing how your program, a) **increased STEM majors**, b) **supported student retention and progression in STEM**, and c) **increased STEM degree completion**.

Improving student success and completion rates in STEM disciplines is the heart of the UGA STEM Initiative activities. Three faculty members supported by Initiative funding teach STEM and STEM education courses and have made significant contributions to efforts aimed at improving instruction in their respective areas. The mini-grant program, the learning communities, and the UGA STEM Institute on Teaching and Learning all have goals that are aligned with Goal 2. Participation in STEM Initiative activities has benefitted UGA faculty by providing financial resources and professional development opportunities that encourage the testing of new approaches to STEM teaching and learning in the courses that students take early in their career. Faculty members from the Colleges of Arts and Sciences, Engineering, and Education have been active in the mini-grant program and learning communities. Mini-grant research has resulted in significant innovations and in closer examination of teaching practices in undergraduate classes. A large number of the projects reported improvements in teaching practices and student learning, and many of these conclusions were supported by data collected as part of their grants. In addition, results of mini-grants awarded the past year were presented at the annual UGA STEM Institute on Teaching and Learning hosted by the Office of STEM Education. Grantees also disseminated their results at annual meetings of state and national professional organizations. Participation in learning communities provides UGA faculty with an insight into new teaching strategies being tested in K-12 schools and an awareness of what students will know and be able to do when they complete high school and enroll in college.

3. Explain how your program has made progress toward Goal 3, **improving the pre-service P-12 STEM teacher preparation and production**.

In collaboration with the Colleges of Education and Agricultural & Environmental Sciences, the OSE has partnered with the Clarke County School District on several initiatives to create effective pathways to post-secondary education and STEM careers by improving teacher preparation and providing K-12 and UGA students the tools they need (engagement in learning, interdisciplinary understanding and problem solving, critical inquiry and authentic learning) to be successful. Currently the partnership includes: the *Professional Development School District*, a program which has created the needed connections between educational practice and research; and the *Teach to Learn* program focused on streamlining and strengthening the process of supporting teachers through their crucial first two or three years of teaching. In 2014, "Experience UGA" was added to the partnership with the intent of exposing all Clarke County

School District students to curriculum-appropriate field trips to the UGA campus that will encourage them to consider college after graduation.

4. Discuss **other key successes** of your institution's STEM Initiative program.

The OSE is promoting use of the SCALE-UP (Student-Centered Active Learning Environment for Undergraduate Programs) instructional model in introductory undergraduate classes. The aim of SCALE-UP is to bring a hands-on, small-class approach to a larger-sized class, presenting and reinforcing the key concepts of subjects such as Physics, Chemistry, and Biology through group activity and inquiry-based instruction. Even the physical layout of the class is changed in a SCALE-UP classroom to promote interaction, group activities, and problem solving. With enrollments of over 10,000 students per year in these core STEM subjects, the SCALE-UP classroom model has the potential to impact virtually every UGA undergraduate.

Preliminary evidence supports the efficacy of the SCALE-UP pedagogy in introductory UGA physics courses. Using the Force Concept Inventory (FCI) as a measure of student performance, the instructors found that students in sections of PHYS 1251 showed a normalized gain of 45%. This is in line with SCALE-UP physics courses at other institutions, and is much higher than the 20-25% gain that is seen in a traditional lecture classroom.

C. *Program Challenges* – This section covers challenges that continue to face your institution's STEM Initiative program:

1. What challenges has your program encountered in **increasing the number of STEM majors**?

The institutional profile reveals that UGA admits well-qualified undergraduate students, many of whom are interested in a STEM major and enroll in introductory STEM courses. This situation reflects the successful and ongoing efforts of existing campus units (Office of Admissions, Office of Institutional Diversity, LSAMP, and individual departments) to recruit a high achieving, increasingly diverse group of high school students with career aspirations in STEM. Consequently, the recruitment of STEM majors is not a problem at UGA.

2. What challenges has your program encountered in **increasing STEM degree production**?

Data on the number of UGA students who graduate with a STEM degree has been of concern. The disparity between trends in the number of majors (rising) and the number of degrees awarded (flat) indicates that leaks, which are defined as diminished student persistence, exist in the UGA STEM pipeline. **Student retention**, especially in the **first two years** of college when many students turn away from STEM, continues to be a major focus of UGA's STEM Initiative efforts.

3. Are there any **program-specific** (i.e. mini-grants, service learning opportunities) challenges that your program has encountered?

Mini-grant recipients often struggle to provide a robust data collection and evaluation plan for their projects. To address this challenge, the OSE has retained the services of Dr. Karen DeMeester of the UGA Program Evaluation Group (see section IV.C for more details).

4. Are there any **other challenges** that your program has encountered that you have not described (i.e. departmental buy-in, personnel issues)

Each institution participating in the STEM Initiative conducts a range of activities designed to meet the three core goals. What has been lacking are overall coordination of program activities among institutions and group strategic planning. Also missing is a general sharing of information. While the annual conference hosted by Georgia Southern University partially fills this information gap, exchange of information needs to occur throughout the year. Although one senses that individual institutions are moving the needle in the direction of meeting the core goals cited above, more needs to be done to enhance the impact of the STEM Initiative on the **entire University System of Georgia and the K-12 community**. The creation of Regional STEM Hubs is one attractive strategy to address the shortcomings noted above. Discussion of this and other possible strategies should be a focus of the STEM Initiative leadership this coming year.

D. Did you implement the STEM Initiative program at your institution **as described in your project proposal** for FY2013? Please describe any notable changes from the proposal that you made (additional project components, project deletions).

The UGA STEM Initiative program was implemented as proposed except for the two areas described below:

- Dr. Ji Shen officially resigned from UGA. Funds from his line were used to hire replacement instruction.
- Dr. Wendy Dustman also resigned from UGA. Funds that had been allocated for her mini-grant project were redirected to other activities.

II. Data Sheet Addendum

A. If you reported **engineering majors** in FY2013 (Row 12), please identify relevant subfields (mechanical engineering, electrical engineering, engineering technology, etc.) and specify the number of majors in each.

- Agricultural Engineering/BSAE 120 majors
- Biological Engineering/BSBE 157 majors
- Biochemical Engineering/BSBCHE 110 majors
- Civil Engineering/BSCE 109 majors
- Computer Systems Engineering/BSCSE 131 majors

- Electrical and Electronics Engineering/BSEE 34 majors
- Environmental Engineering/BSENVE 134 majors
- Mechanical Engineering/BSME 121majors

B. If you reported majors in the field **"Other"** (Row 13), please identify those degree programs and specify the number of majors in each.

None.

C. If you reported **engineering degrees awarded** (Row 73), please identify the specific degrees (i.e. BS in mechanical engineering, BS in electrical engineering, etc.) and specify the number of awardees for each.

- Agricultural Engineering/BSAE 22 degrees awarded
- Biological Engineering/BSBE 14 degrees awarded
- Biochemical Engineering/BSBCHE 8 degrees awarded
- Computer Systems Engineering/BSCSE 5 degrees awarded
- Environmental Engineering/BSENVE 20 degrees awarded

D. If you reported **degrees in the category "Other"** (Row 74), please identify the specific degrees and specify the number of awardees for each.

None.

E. If you have any **additional notes** to offer relevant for the data sheet, please enter those here.

* Data collected for "Majors" were from fall 2013
* Data collected for "Majors" and "Degrees Awarded" was collected from the website of the UGA Office of Institutional Research (OIR) http://oir.uga.edu/.
* Data on "STEM Education Majors" and "STEM Education Degrees Awarded" were collected from the College of Education. Course grade data for "Introductory STEM Courses" were collected by special request to the Associate Director of the Office of Institutional Research.

III. Programmatic Components

A. Faculty Mini-grants

1. Please provide a list of the mini-grants provided by your institution as part of its STEM Initiative for FY2013. You may use the following table or some alternate format, but please be sure to provide all of the information requested:

A total of 12 mini-grants were awarded from a pool of 17 proposals submitted in 2013-14 through a Request for Proposals process. Proposals were invited from faculty who teach undergraduate STEM courses. Innovative projects that sought to improve instruction and student learning in undergraduate STEM courses and /or increase the number of students majoring in and graduating in STEM disciplines were eligible for support. Collaboration between two or more UGA faculty was strongly encouraged.

1. **Engineering Community Engagement Module – Strategy on the Retention of Engineering Majors**

Foutz, Timothy L. -- College of Engineering

Amount Awarded: $6000

The overarching question addressed in this research project is *Can an instructional module positively influence first semester first-year students' perceptions of engineering's role in society without increasing the academic load of an already packed engineering curriculum?* During the semester, Engineering Community Engagement (ECE) events involving alumni were offered for students to engage in conversations about career paths, and how STEM courses affect those paths. Participation was voluntary and no additional coursework was associated with participation. A quantitative instrument, used by the investigator since 2011, was used to assess freshmen opinions, knowledge, and skill awareness related to an engineering program of study prior to participation in the ECE and subsequent to participation. Results suggest that the extra-curricular activities did not impact student learning as anticipated. The project did influence the structure of the College's engineering projects; a stand-alone first-year course is now offered where students engage in professional practice in a traditional learning setting.

2. **The Impact of Blended (Hybrid) Teaching with a Social Networking Tool in an Upper Division Undergraduate Science Course**

Dustman, Wendy A. – Franklin College of Arts and Science, Microbiology

Amount Awarded: $0

This research planned to determine if hybrid instruction including recorded podcast lectures would result in improved student performance particularly on questions requiring critical thinking and problem skills. *Unfortunately, the researcher has left UGA and so the research was not completed and no funds were allocated to this mini-grant.*

3. The Development of Inquiry Based Exercises on Plate Tectonics/Volcanism, Earth Materials, and Ecosystems for Geography 1111L: An Introduction to Physical Geography Laboratory Sections.

Grundstein, Andrew -- Franklin College of Arts and Sciences, Geography

Amount Awarded: $4500

The project resulted in the development and deployment of three new active learning laboratory exercises intended to improve student learning in Geography 1111L. The topics addressed included Earth materials, plate tectonics and volcanism, and ecosystems. Four laboratory sections (two experimental and two traditional) totaling 115 students were involved in the project. Results demonstrated improved learning in the Earth materials lab. Students preferred the hands-on Biome lab activities over the in-class control section in which plant types were identified. Future work will refine the labs taking a closer look at focus, time on-task, and group size.

4. Incorporating HNMR Analysis into the Organic Chemistry Laboratory Curriculum

Hubbard, Richard – Franklin College of Arts and Sciences, Chemistry
Morrison, Richard – Franklin College of Arts and Sciences, Chemistry
Jackson, Douglas – Franklin College of Arts and Sciences, Chemistry

Amount Awarded: $4117

The Chemistry Department acquired three desktop HNMRs for the undergraduate organic laboratories. HNMR analysis is the most important analytical technique introduced in the introductory organic chemistry lecture course. Using these technologies, the group integrated PicoSpin NMRs into the undergraduate instructional laboratory to give students the ability to use advanced analytical techniques in the exploration of experimental results. This experience both strengthens the concept of NMR spectral analysis and provides students with the opportunity to employ technology commonly used in academic research facilities. The Morrison research group recently developed and patented a novel approach to amino acid decarboxylation that provides facile access to biologically important alkaloids and neurotransmitters. NMR technology was used to analyze the products of this original decarboxylation experiment utilizing microwave chemistry in addition to the products of a more traditional Fischer esterification experiment. The integration of the new analytical technology proved successful as students correctly identified their unknown starting material from their product spectra. Specifically, 42 out of 50 students (84%) correctly identified their decarboxylation product and 233 students out of 260 (90%) correctly identified their esterification product. We hope to continue to integrate this important technology more extensively into the instructional labs in the future.

5. Building Creative Confidence in Mechanical Engineering Students through the IM Creative Studio

Kellam, Nadia and Walther, Joachim – College of Engineering

Amount Awarded: $6400

The purpose of the project was to develop hands-on design activities called IM Creative Studio that will be used in the Mechanical Engineering Design Studio during a student's first year at UGA. This type of learning activity is intended to help students to think of themselves as creative individuals and to become more engaged in studying mechanical engineering. The initial project involved students in Product Archaeology in which teams of students deconstructed and reconstructed an appliance as well as conducted research on the history of the appliance, cost for use, materials involved, environmental impact when discarded as well as potential design modifications for use in other countries. These students were also required to role play and consider their appliance from the perspective of an environmentalist, designer, physicist, archeologist, and machinist. Other design projects included students' designing for a specific user group and making high resolution prototypes—using 3d printers and arduino micro controllers. Data were collected in the form of interviews with students. Initial results have been positive both in student learning and in revised teaching practices.

The two conference papers that have been submitted as abstracts are:

Carberry, A., Kellam, N., Brunhaver, S., Sugar, T., and McKenna, A. "Excavating the Impact of Product Archaeology," Proceedings of the 6th Research in Engineering Education Symposium, Dublin, Ireland, 2015.

Lande, M., Kellam, N., and Jordan, S. "Making the Engineering Curriculum: Translating Research on Student-Centered Teaching into Practice," Proceedings of the 6th Research in Engineering Education Symposium, Dublin, Ireland, 2015.

6. Midterm Student Evaluations and Instructional Coaching: Investigating How Graduate Student Laboratory Instructors Use Feedback About Their Teaching

Miller, Kristen and Evans, Mara – Franklin College of Arts and Sciences, Biology

Amount Awarded: $4117

The primary goal of this research study is to determine what elements of a Midterm Evaluation (MTE) approach are perceived useful by Graduate Student Lab Instructors (GLIs)

and to learn what motivates GLIs to obtain feedback about their teaching, and how they experience feedback from their students. The project engaged the expertise of trained teaching consultants to conduct GLI evaluations. Interviews from GLIs who volunteered to be evaluated during the term along with those who did not were transcripted and randomly assigned to three subset groups for review. The review is expected to generate overall trends and themes. This clarification of GLI instructional success will indirectly have potential to improve student learning.

7. Flipping the Organic Chemistry Lecture

Morrison, Richard – Franklin College of Arts and Sciences, Chemistry
Caughran, Joel – Franklin College of Arts and Sciences, Chemistry
Gokal, Rupa – Franklin College of Arts and Sciences, Chemistry

Amount Awarded: $9000

A concern that students sometimes express is that exam questions are nothing like what has been discussed in lecture or the end-of-chapter problems. One pedagogical solution that has been used in physics is to 'flip the classroom.' Students learn basic concepts by reading the textbook, viewing video lectures, watching demonstrations, and working on definitions and basic concepts outside the classroom. Lecture time is available to work on more advanced concept application. The goal of this project is to develop a library of video lectures that cover the topics taught in a traditional organic chemistry course and supplement them with currently available demonstrations and animations so students can master basic concepts before coming to class. The group will also develop pre-class questions and in-class questions that cover the preparatory materials to encourage students to prepare before class. At the conclusion, all course materials developed will be made available to faculty teaching organic chemistry at UGA. Results will be submitted to the Journal of Chemical Education, or other suitable journal.

8. Inquiry-Based Nobel Prize Experiments for UGA's Advanced Undergraduate Chemistry Laboratory Course

Salguero, Tina – Franklin College of Arts and Sciences, Chemistry

Amount Awarded: $9000

This project involves a complete revision of the inorganic chemistry portion of CHEM3512 taught during the Spring 2014 semester. The revision includes a new set of open-ended experiments, new lab manuals, restructured schedule, and revised expectations of course

requirements. The goal is to improve students' experimental abilities, enhance learning, increase appreciation for research that drives chemical innovation, help develop professional skills, and provide a tested curriculum of inquiry-based laboratory experiments that future instructors can use. While the initial sample size was relatively small (14), student feedback indicates that the new approach to student engagement was effective in increasing exploration and problem solving. The researcher will continue to expand the number of experiments utilizing this approach and to share results with colleagues in the department and elsewhere.

9. Student Perceptions of Engineering, from First to Final Year

Tanner, Hillary – College of Engineering
Domizi, Denise – Center for Teaching and Learning
Gattie, David – College of Engineering

Amount Awarded: $3700

The purpose of this research is to implement an assessment strategy that provides the instructor with information on student perceptions of engineering. This information helps instructors incorporate methods to dispel negative perceptions, reinforce positive perceptions, and ultimately improve student retention in engineering programs. For this study, the instructor used an open source tool called Academic Pathways of People Learning Engineering Survey (APPLES); it was pared down to a sampling of questions, eventually allowing for the entire survey to be used. Focus groups were used as a test run for the APPLES Survey. The majority of the 18 freshmen students completing the survey were Biological Engineer majors. Some preliminary results show the following – but the researcher notes that it is too early to draw complete conclusions. Almost all of the freshmen completing the survey (95%) agreed or strongly agreed they were prepared for the required science courses and most (82%) feel prepared for the math courses. Only about two out of three of the students (67%) completing the survey said they feel a part of the engineering community at UGA. Overall, this group of students thought they had received adequate information about the student organizations (72%), but fewer students (62%) said the college website had been a useful source of information for them. Math and science ability and application as well as critical thinking skills were the traits rated by the students as most crucial for a successful engineer. Half of the students said they experienced moderately high to high pressure trying to achieve balance between social and academic life.

10. An Analysis of Pre-Service Science Teachers' Interdisciplinary Understandings of Design Technology

Tippins, Deborah – College of Education

Amount Awarded: $5604

A coherent understanding design technology/engineering requires students to draw on knowledge constructed in multiple disciplinary contexts. In this study, the researcher sought to investigate pre-service teachers' understandings of teaching learning, and design technology through problem-solving tasks. The project also sought to analyze pre-service teachers' application of interdisciplinary knowledge, and to understand how pre-service teachers might engage their future students in design technology. Results suggest that there is a need for prospective teachers to have more in-depth experiences with design technology, and with children to better understand how design technology can be integrated into the curriculum. The results were presented at the Association of Science Teacher Educators (ASTE) and the National Association for Research in Science Training (NARST).

11. Computational Experiments: Beyond Abstruse Equations in Science and Engineering Education

Wang, Xianqiao – College of Engineering

Award Amount: $6400

This research study seeks to implement simulation-based engineering and science (SBES) strategies into an undergraduate engineering course to stimulate students to learn science and engineering in more profound ways. This is a departure from more traditional instructional methods in engineering in which the focus is on theoretical analysis as opposed to actual hands-on experimentation. A simulation of the tensile test using carbon nanotube materials was created and implemented into ENGR2120 – Engineering Statics. Results indicate that the virtual experiments provide a more interactive way to help students understand concepts such as force-displacement relationships and the consequences of force acting on a body. This simulation also offers an intriguing and active way for students to interpret abstruse physical equations and learn the fundamental meaning beyond the equations. Introducing virtual experiments into the course has stimulated learning of engineering concepts.

12. Evolution of Online Homework Usage Patterns in Introductory Physics

Wiegert, Craig – Franklin College of Arts and Sciences, Physics and Astronomy

Award Amount: $8479

The mini-grant partially supported a physics graduate student for the spring semester in 2014. This student had some previous exposure to our online homework system (LON-CAPA) prior to the project, and extensive computing experience both with the Python programming language and with database design. He wrote computer scripts that take "raw data" log files from LON-CAPA and extract the relevant details about resource access times and student submissions. With the volume of data that the homework system produces, we decided that working with textual or CSV (spreadsheet) data files would be counterproductive. Thus, the student next developed a database structure to combine the user access data with the information about the resources they access.

The researcher presented preliminary results from the project, on a limited data set, at the national meeting of the American Association of Physics Teachers. Although this graduate student's time on the project is now finished, and we have not analyzed the full data set, the project is in a state that he can hand off to another graduate or undergraduate student for further progress.

2. State the **funding rate** for mini-grants at your institution (i.e. number of grants funded vs. total number of proposals received)? Discuss how proposals were **judged and awarded**.

In 2013-14, award amounts typically ranged from approximately $4000 to $9000. A total of 17 proposals were submitted from which 12 were funded. One of those funded was not initiated due to the fact that the faculty member left the institution. A total of $74.126.35 was provided in support of the selected mini-grant projects.

Each proposal is reviewed by two to three peer reviewers and rated against the criteria provided to applicants in the mini-grant RFP (see below for review criteria). Peer reviewers are selected from the large group of faculty who have had successful grants in previous years and are active participants in the UGA STEM Initiative. The names of the peer reviewers and the completed reviewing forms are confidential. An awards selections committee formed each year is comprised of a representative group of faculty who are experts in improving teaching and learning in the STEM disciplines, as well as former recipients of STEM mini-grants themselves. The awards selection committee makes the final selection based on the strength of the peer-reviewers ratings, the alignment to the goals of the STEM Initiative and the RFP, the contribution of the proposed study to the improvement of retention of STEM majors and the design of the assessment Plan.

Mini-Grant Review Criteria:

Criteria	Possible Points
Identified need is challenging and compelling	10
Goals are significant and relate to goals for RFP	10
Impact on improving faculty instruction and student learning	10
Research plan includes activities that are based upon identified need and will lead to successful implementation of project	30
Assessment plan is well-designed and includes information on measuring the project's impact on student learning and instruction	20
Budget expenditures are reasonable, justified, and directly linked to proposed plan	10
Plan for disseminating results	5
Strength of faculty collaboration	5

3. For any of the mini-grants listed, do you **have evaluation data or other evidence suggesting the efficacy of the projects**? Also, please discuss the broader impacts for these projects (i.e. changes to instructional approaches, changes to departmental policies, etc.).

The very successful Mini-Grant Program continues to influence STEM instruction at UGA. The impact remains the same as stated in last year's report:

- The mini-grant program has become one of the primary mechanisms to foster STEM faculty involvement in scholarly teaching and the scholarship of teaching and learning (SoTL).
- Presentations were produced and disseminated from the results of the grant work.
- Selected faculty presented preliminary findings at the UGA STEM Institute of Teaching and Learning. The Institute provided a forum with grantees' peers to share and discuss ideas that might strengthen or improve their research projects.
- Faculty have used STEM Initiative funding as "seed money" for a pilot test to develop a grant proposal for external grant funds.

Faculty members, primarily from arts and sciences, education, and engineering departments, have been active in the mini-grant program. Their work has resulted in innovations and in closer examination of teaching practices in their classes. Outcomes included improvements in teaching practices and student learning (Grundstein), changes in course structure or content (Foutz; Salguero; Morrison & Jackson), and surveys of students perceptions (Tanner et al.). (See section III.A.1. in this report for specific evaluation data that support the findings of each mini-grant.) Results of selected grants awarded this year were presented at the UGA

STEM Institute of Teaching and Learning hosted by the Office of STEM Education. Grantees also disseminated their results at annual meetings of state and national professional organizations.

B. Service Learning Opportunities (i.e. FOCUS-derived projects)

1. Briefly describe the **operation of your institution's service learning opportunity** or FOCUS-derived project for FY2013, including the following:

    a. Name of project(s) or other branding

Project FOCUS

    b. Key Partners for your Project (i.e. Departments/Schools at your institution, participating P-12 schools/school districts, area businesses, etc.)

Project FOCUS involves a partnership among the UGA Colleges of Agricultural & Environmental Sciences, Arts & Sciences, Family & Consumer Sciences, the School of Ecology, the School of Forest Resources, the UGA Office of Service Learning, and several elementary and middle schools in the Clarke County School District.

    c. Data regarding participants (students taking part in project, number/classes of P-12 students engaged through project, number of teachers taking part, etc.)

During 2013-2014, Project FOCUS partnered with 140 teachers in 8 elementary and 3 middle schools. A total of 140 UGA students participated in the program, which touched over 2500 K-8 students.

    d. Primary activities and their operation

Project FOCUS students are in their K-8 partner classroom for an hour and a half, two times a week for 13 weeks each semester (totaling 40 hours of classroom contact). Most of this time is spent teaching hands-on, applied activities that related directly to the curriculum standards in the STEM disciplines being taught by the teachers. During these times, FOCUS students not only make STEM subjects interesting and exciting, but they offer themselves as role models for the students, since all the FOCUS students are currently pursuing a STEM-related post-secondary degree. FOCUS students bring their enjoyment of science, talk about their major, and talk about the careers they are pursuing.

    e. Any outcomes data demonstrating the project's efficacy or effectiveness.

During the past year the popularity of FOCUS allowed it to increase its partnerships with district schools by over 30%. We were able to include two additional middle schools and two additional

elementary schools in the program and thereby positively influence the STEM learning of hundreds of additional students.

As an unexpected benefit of Project FOCUS, we have found that a number of university students enroll in the course partly to determine if they wish to pursue a teaching career. They enroll in this course rather than becoming an education major because most are not certain of their interest in teaching and can 'test the waters' with their Project FOCUS experiences. Over the years Project FOCUS has been offered, approximately 15% of the participants have expressed a desire to become teachers. These individuals, because of their experience in Project FOCUS are teaching and inspiring students, and would not have done so without our program.

C. Institution-Specific Projects

1. **Identify your institution-specific project(s)** outlined in your proposal for FY2013 (i.e. 4-Year Undergraduate Research Experience, Academy for Future Teachers, MESA, summer bridge programs, peer learning communities, STEM tutoring/learning centers, etc.). Discuss any specific branding.

STEM Faculty Learning Communities:

The UGA Office of STEM Education awarded funding to seven STEM Learning Communities (LCs) this year as part of the STEM Initiative. These collaborative groups are charged with developing and sharing professional knowledge to improve STEM student learning at all levels of education. A funding formula was used to determine the award to each LC. A stipend of $100 was offered to each K-12 educator. For those LCs that did not include K-12 teachers, funding was provided for resource materials directly related to the work of the learning community. The maximum level of funding was set at $1,000.

AP Statistics Professional Learning Community
Franklin, Chris -- UGA, Franklin College of Arts & Sciences, Statistics
Maddox, Kaycie -- Northeast Georgia Regional Educational Service Agency (RESA), Mathematics Specialist

The AP Statistics Professional Learning Community (PLC) met monthly during the school year, facilitated by Chris Franklin of the UGA Statistics Department and Kaycie Maddox, Mathematics Specialist of Northeast Georgia RESA, to support the AP Statistics teachers from local high schools. The major purpose of this group is that of ongoing collaboration and calibration of the AP Statistics learning objectives and implementation of instructional best practices to prepare students for the College Board exam. Members benefit from the opportunity to discuss, clarify, and explore the rigorous pedagogical content knowledge for this course with an internationally recognized expert in the field. This year, the group continued to work on learning objectives, identifying resources, tasks, and activities for each. Additionally, the group

facilitated an AP Statistics Mock Exam which provided an opportunity for students to practice for the actual exam held in May. Further the group maintained a Google site to aid in group dissemination and exchange of materials relevant to their teaching.

Chemistry Learning Community
Kutal, Charles -- UGA, Franklin College of Arts & Sciences, Associate Dean; Chemistry
Dava Coleman -- Jackson County Schools

The Chemistry Learning Community has been in existence since 2005. Its membership includes UGA faculty and graduate students, and high school chemistry teachers from the surrounding area. Attendance typically ranges between 6-9 members, with participants taking turns leading the discussion. This year UGA faculty members discussed their research interests and their motivation for tackling a particular question, while a teacher from Oconee County shared his experience attending the National Science and Mathematics Initiative conference. Current science teaching issues also were discussed such as standards, the assessment of standards, and changes to the AP Chemistry examination. Each meeting has time to share successes and challenges of teaching chemistry at the high school and university levels.

College Science Education Research Group Learning Community
Brickman, Peggy -- UGA, Franklin College of Arts & Sciences, Plant Biology

The University of Georgia has one of the largest groups of discipline-based science education researchers at the college level. Currently, more than 30 faculty, across five colleges, are engaged in nationally recognized STEM education research. The learning community on College Science Education Research has met for the last six years as a collaborative group of education research faculty from each of the science departments on campus as well as faculty from the colleges of engineering, education, veterinary medicine, and medicine. Past efforts include securing external grant funding for collaborative learning projects and hosting workshops with experts in the field. This year the group drafted an application to become an official **UGA SEER (Scientists Engaged in Education Research) Center**. The major goal of this Center will be to serve as a catalyst for interactions and research collaborations among research faculty across colleges as we share knowledge and research the effectiveness of student learning strategies for university students enrolled in STEM courses. Members of our group continue to engage in collaborative research projects such as testing novel methods of assessment for critical thinking, interactive animations, incorporating more writing in the discipline, and training future faculty in these areas.

Engineering and Technology Learning Community (new community)
Mativo, John -- UGA, Franklin College of Education, College of Engineering, Career and Information Studies

The initiative is a partnership with Barrow County School System to integrate STEAM (Science, Technology, Engineering, Art and Math) subjects into the curriculum. Mechatronics systems include mechanics, electronics, controls, and computer engineering, and the learning community facilitators use mechatronics to study forces in dynamic and static states. This mechatronics pathway transcends STEM disciplines to incorporate multiple subjects into the Barrow County School system curriculum.

Mathematics Curriculum Team
Laine Bradshaw (new) -- UGA, Franklin College of Arts & Sciences, Quantitative Methods
Adams, Malcolm -- UGA, Franklin College of Arts & Sciences, Mathematics

The Mathematics Curriculum Team (MCT) members met monthly for two hours each meeting. The team worked collaboratively to study the issues inherent in the implementation of the new Common Core State Standards for Georgia (CCGPS) and to share support for the Common Core through conversations with colleagues in high schools, RESAs, higher education and at the DOE. Of particular interest is the identification of resources to support the implementation of the mathematics standards. The MCT will continue to explore issues related to the implementation of CCGPS such as curriculum, instruction, assessment and resources, and use their positions of influence to disseminate their work.

Mathematical Pedagogical Problem Solvers (MPPS)
White, Dorothy -- UGA, College of Education, Mathematics and Science Education

The Mathematical Pedagogical Problem Solvers met fourteen times during the 2013-14 school year for approximately two hours each meeting. Work of the group centered on identifying and documenting students' mathematics strengths and solving pedagogical problems. Each meeting consisted of three parts: 1) teacher sharing of pedagogical problems or concerns encountered in the classroom or from articles, 2) teacher discussion of observations of students' mathematical strengths, what is difficult to assess, and how this revises the group devised taxonomy of students' mathematical strengths, and 3) discussing and implementing strategies to share the findings of the group with other mathematics educators. The group presented at the 2013 Georgia Mathematics Conference at Rock Eagle and prepared an article for *Mathematics Teaching in the Middle School*. Additionally, the group submitted a proposal for the 2105 NCTM Conference. This learning community continues to demonstrate the value of professional discussions with colleagues to make connections between pedagogical practice and student learning.

Physics Learning Community- Teaching Modern Physics

Wiegert, Craig -- UGA, Franklin College of Arts & Sciences, Physics and Astronomy

"Radiation in the Environment" continues to be a focus of the LC. The grant from Vernier Technology allowed UGA to purchase a pool of equipment that area HS teachers borrow so that they can have students study natural/environmental and artificial sources of radiation. In one popular lab, students can measure the half-life of radon by-products by collecting airborne dust on charged balloons and then using a Geiger counter to measure decay rates. In another, students explore the statistics of random events like radioactive decay by measuring the decays of a long-lived source over many intervals of time.

Convene a UGA STEM Institute on Teaching and Learning

The UGA Office of STEM Education hosted the *2014 UGA STEM Institute on Teaching and Learning* at the Classic Center on Saturday, April 5, 2014. This year's event marked the third year that faculty, staff, graduate assistants, and K-12 teachers convened to talk about teaching, research and students in STEM disciplines.

The event kicked off with a panel presentation focused on the topic of Braving the New World of STEM Education. Panel presenters included Dr. Myk Garn, Assistant Vice Chancellor for New Learning Models from the University System of Georgia, who took the online learning viewpoint; Dr. Janna Dresden, Director of the Office of School Engagement from the College of Education at UGA, who spoke from experiences with partnerships; and Dr. Norbert Pienta, Director of the General Chemistry Program at UGA, who engaged the participants with research relating to and examples of classroom innovations.

Following the panel presentation, participants chose from three concurrent presentations across the general focus areas of online learning, partnerships, and classroom innovations. Three such sessions were offered providing a total of nine presentation options. After the presentations, participants joined one of three discussion groups to learn more and share personal experiences related to online learning, partnerships, and classroom innovations.

Institute evaluations were very positive again this year. Value cited by several attendees included networking, learning more about projects at UGA, as well as the presentations offered in a new topic area for this year – online learning. Attendees liked the three session format and complimented the organization and logistics associated with the event. Suggested areas for improvement next year include improved marketing, greater outreach to K-12 and perhaps offering a companion poster format.

Design, Develop and Deliver a Multi-Institutional Precalculus Course

The University of Georgia through its Office of STEM Education led an effort to create a fully online accessible and affordable pre-calculus course that would implement a new instructional model and improve success rates in the gate keeper course. Below is an abstract of a recent presentation that provides a comprehensive summary of this initiative:

A common stumbling block for students considering a STEM major has been introductory math courses. The University System of Georgia (USG), which is the governing body for the 31 public institutions of higher education in the state, is addressing this problem by supporting the development of an online multi-institutional pre-calculus course. This course combines lessons learned from the Math Emporium model (Twigg, 2011) with elements of massive open online course (MOOC) delivery to create a highly interactive and support-rich online learning experience.

The Emporium model for mathematics instruction replaces the traditional passive lecture with an active learning experience in which students learn math by doing math, not by listening to someone talk about doing math. Students work on assignments 3-4 hours per week in a lab setting that offers interactive computer software and personalized on-demand assistance from instructional personnel. Attendance is mandatory to ensure sufficient time-on-task. Originally pioneered at Virginia Tech University, the Emporium model has been successfully adopted and, in some cases, modified to reflect local conditions, by several two- and four year institutions nationwide. Assessment studies generally have found enhanced student success in introductory math courses with a concurrent reduction in the cost of instruction.

The online Pre-calculus Emporium course is a prototype that extends the proven Emporium model of active student learning to a virtual environment in which content delivery, individualized and group support provided by an instructional team, and formative and summative assessments are delivered entirely online. Students have access to and interaction with a wide variety of materials and activities including text and video instruction, intensive practice, online discussion and expert support, quizzes, and proctored exams. In its initial offering in Spring Semester 2014, the course enrolled 212 students who were supported by a team of six faculty members and two graduate assistants, each assuming varying roles to maximize student learning and success. The course was built within the Coursera learning management system utilizing content from Cengage Learning and assessment support from WebAssign. High-stakes exams utilize an online proctoring model and partner (ProctorU). Supplemental tutoring services were provided through Smarthinking.com.

The institutions chosen for the pilot phase of the project are representative of the institutional, geographic, and demographic diversity of USG, while simultaneously possessing expertise and capacity in the development and delivery of online courses. The University of Georgia is serving as the lead institution. Additional team members represent Georgia Perimeter College, Georgia

State University, Middle Georgia State College, and Valdosta State University. The Georgia Institute of Technology is providing technology support related to use of the Coursera platform as well as evaluation and accessibility support. Student performance data and student /faculty perceptions of the course currently are being evaluated. This information will guide revision of the course, which will be offered again during Fall 2014.

The goals of the online Pre-calculus Emporium project are to (1) increase access to a high-quality pre-calculus course by providing an option that is broadly available and highly scalable, (2) reduce the percentage of students receiving grades of D, F, or W (withdrawal), (3) increase student success in subsequent math and science courses, and (4) inform affordability options and models for online courses across the entire System. When fully implemented, the course will be available to students at all institutions within the USG.

2. Provide data regarding the **level of participation** in each of these projects (i.e. number of faculty participants, number of student participants). Discuss their **scope** (i.e. oriented toward incoming freshmen, upperclassmen, STEM majors, education majors, all students, etc.)

Faculty Mini-grants

Twelve mini-grants involving a total of 16 UGA faculty members were awarded. The projects involved a range graduate and undergraduate students, including >2000 students enrolled in introductory chemistry, physics, physical geography, and engineering courses, 14 advanced chemistry majors, and ~10 pre-service teachers. The students were engaged as part of the research team collecting data or as direct participants in classroom-based activities.

Project FOCUS

During 2013-2014, Project FOCUS partnered with 140 teachers in 8 elementary and 3 middle schools. A total of 140 UGA students participated in the program, which touched over 2500 K-8 students. Expansion of the program to two additional middle schools and two additional elementary schools allowed us to positively influence the STEM learning of hundreds of additional students.

Learning Communities

In 2013-14, seven Learning Communities continued to serve an important networking function and to provide forums for discussion surrounding discipline specific trends and instructional solutions. Over 25 K-12 teachers representing more than 10 surrounding counties as well as local RESAs joined nearly 25 UGA faculty members and graduate students in monthly meetings. Often conversations were enhanced by email sharing as a result of shared interest among group members.

STEM Institute

Registrants for the STEM Institute totaled 87 individuals representing a variety of institutions beyond UGA including Athens Tech, Clarke County School District, Agnes Scott, and Georgia Tech. Those from UGA were predominantly faculty (38), but also represented were graduate students (36), visiting scholars (3) and post docs (1). K-12 participation totaled 3. The remainder included administrators and staff.

3. Discuss the **activities and operation** of your institution-specific project(s), including any efforts to connect multiple projects for synergistic impacts.

All STEM Initiative activities at UGA are coordinated through the Office of STEM Education and are structured, whenever possible and consistent with programmatic goals, to establish synergistic connections and partnerships among the participants. For example, members of a learning community share a common interest in a subject that can lead to submitting a mini-grant proposal as occurred in the Chemistry LC or a proposal to an external funding agency as occurred in a prior year in the Physics LC. Members of the College Science Education Research Group LC have self-assembled to submit an internal UGA proposal to form a Scientists Engaged in Education Research Center, which will afford a campus-wide forum for pursuing these interests and exploring external funding opportunities. Mini-grant recipients are strongly encouraged to share their findings at the annual UGA Institute on Teaching and Learning and at the annual STEM Initiative Conference held at Georgia Southern University.

4. Provide any available **outcomes data demonstrating the efficacy or effectiveness of the project(s)**.

Our success with Project FOCUS was recently recognized by the American Association for the Advancement of Science, which awarded UGA a grant (only one of seven nationwide) to establish an outreach program, dubbed REFOCUS, in which retired STEM professionals spend several hours per week in public school classrooms to enhance STEM teaching, learning, and career development, in much the same way as our FOCUS students. By expanding the pool of instructors to include STEM professionals, REFOCUS will leverage the experience and resources of FOCUS to touch many more K-12 students.

IV. Future Efforts

A. Please discuss **dissemination efforts** for best practices or research findings identified through participation in the USG STEM Initiative.

Every STEM mini-grant PI is encouraged to disseminate his or her findings at **national and state conferences**. This past year presentations were given at the annual meetings of the

Association of Science Teacher Educators, the National Association for Research in Science Training, the Georgia Scholarship of STEM Teaching and Learning Conference Costs, the University System of Georgia Teaching and Learning Conference, and UGA STEM Institute on Teaching and Learning. Learning community members are also encouraged to present their work at conferences.

The Office of STEM Education has developed and maintains a website for STEM Initiative research and project implementation (see http://www.ose.uga.edu/). Current mini-grant and learning community activities are featured on the site and past projects are archived there. Conference webpages contain PowerPoint presentations and other information related to the STEM Institutes.

B. Please identify any **external grants** (e.g. NSF, Department of Education, private/foundation) for which you have applied based on support received for the STEM Initiative. Indicate whether any applications have been successful.

UGA is a member of the Center for the Integration of Research, Teaching, and Learning (CIRTL) Network, whose goal is to improve the instructional preparation of future faculty (graduate students and postdoctoral students). CIRTL is comprised of 22 major U.S. research universities and has been instrumental in training science graduate students to be innovative in both the classroom and in their research. The CIRTL Network received a **$5M NSF** grant to help expand opportunities for preparation of future faculty. UGA's CIRTL Learning Community offers differing levels of involvement to its future faculty. The OSE is a contributing partner in this effort. See: http://www.cirtl.net/.

The OSE submitted a proposal to the NSF Improving Undergraduate STEM Education (IUSE) Program. The proposal was not selected for funding.

The OSE, along with faculty from the College of Engineering and the Department of Physics and Astronomy, submitted a proposal to the NSF Scholarships in Science, Technology, Engineering, and Mathematics (**S-STEM**) Program. The proposal was funded for a total of $638,254 over five years.

C. Will your institution's STEM Initiative program for FY2014 involve **any notable changes** from your FY2013 program? If so, please explain any changes and the rationale for them.

We shall establish a partnership with the Program Evaluation Group within the College of Education (COE) to provide guidance to mini-grant recipients regarding their research evaluation strategy. In particular, the partnership with Karen DeMeester, who is the Director of this COE unit, is expected to improve the data collection process, enrich elements of research design, facilitate conversations between and among similarly focused research, and to better position the

mini-grant projects to acquire grant funding through more competitive opportunities. Karen will serve as a mini-grant reviewer and will engage in conversations with funded recipients throughout the year.

The OSE will participate in a national project, coordinated by the Association of Public and Land Grant Universities (APLU), to develop a network of STEM Centers. APLU launched a national discussion on university-based STEM Education Centers through a grant from the Alfred P. Sloan Foundation. The project's goal is to foster communication and interaction among STEM education centers to learn more about them and explore if and how they could be mobilized to improve undergraduate STEM education. Seventy center directors completed profiles on various aspects of their centers (e.g. structure, size, funding sources, audience-served, and mission). From these profiles and discussions during the 2013 national meeting, we identified a range of functions of centers. These functions include:

- Improving the STEM learning experience of students on campus
- Improving the flow of students into STEM undergraduate programs, including students from underrepresented groups
- Improving the preparation of students for STEM undergraduate education offering
- Expanding the understanding of teaching and learning
- Broadening the impact of campus research by supporting
- Supporting national scale improvement in STEM education