

## **Award 1347640-Annual Project Report**

### **I. Accomplishments- What was done, What was learned?**

#### **What are the major goals of the project?**

The expected outcomes from the STEM Professional Academy to Reinvigorate the Culture of Teaching (SPARCT) program continue to be (as noted in Y1):

- (1) Enhanced scholarship of teaching and learning (SoTL) by SPARCT faculty.
- (2) Improvement of evidence-based practices targeting the introductory STEM classroom.
- (3) Development of long-term FLCs in STEM instruction.
- (4) Development of professional peer-observation strategies for the STEM classroom.
- (5) Enhanced student learning in introductory STEM courses as a result of SPARCT faculty development.

#### **What was accomplished under these goals (you must provide information for at least one of the 4 categories below)?**

##### **Major Activities**

##### **Year 3 (2015-2016):**

##### **Aug. 2015 - April 2016.**

Planning, Development, and Research. The second SPARCT Faculty Learning Community (FLC) series of monthly meetings and the third SPARCT STEM Summer Academy (May 2016) were developed and planned. Approximately monthly 90 min. meetings with the planning team occurred during the academic year 2015-2016. The planning committee consisted of Drs. Frost (PI, Whitaker Center, Arts and Sciences), Serro (co-PI, College of Ed.), Greene (Sr. Personnel, College of Ed.), Ms. McCulloch (e-learning specialist) and Mr. Rob Nichols (Mathematics, Arts and Sciences). A minimum of 16 hours of planning meetings (does not include individual time outside meetings) has been documented. On September 10-11, 2015 our evaluator, Ludwika Goodson visited campus and met with all the SPARCT 2015 participants and the planning group to review our progress. Her report is attached.

During the course of the second year of SPARCT, at intervals, we asked the participants in the second cohort to reflect on their SoTL projects, their observations, and their experiences in the classroom with evidence-based practices. In year 2, we collected a total of five video segments. One of us (Dr. Greene) spent time transcribing the videos. We prepared several presentations for dissemination this year, so our work was again divided into areas as: 1) statistical analysis of student surveys; 2) qualitative analysis of video statements by SPARCT participants (transcribed by Dr. Greene); and 3) statistical analysis of faculty feedback from the academy and FLC meetings.

##### (1) Enhanced SoTL by SPARCT faculty.

All sixteen members of the SPARCT 2015 group engaged in a SoTL project in an introductory course they were teaching during the 15-16 academic year. The five members of the SPARCT 2016 group have begun thinking about a SoTL project for the 16-17 academic year.

(2) Improvement of evidence-based practices targeting the introductory STEM classroom. Faculty were asked to consider using an evidence-based practice in their targeted classroom. All 16 members of the 2015 SPARCT cohort described using an evidence-based practice in their targeted classroom.

(3) Development of long-term FLCs in STEM instruction. During the past academic year, the SPARCT 2015 group met monthly as a faculty learning community. In the Fall, these sessions were to debrief about their projects and classroom observations. During the Spring, the January meeting was a debriefing and we hosted several workshops for the SPARCT participants and other FGCU faculty as an extension of the SPARCT Academy professional development in teaching and

learning. The spring workshops included academic writing, POGIL, Team-Based Learning, and a seminar on SCALE-UP. (See attached schedule)

(4) Development of professional peer-observation strategies for the STEM classroom. Faculty were asked to perform observations during both the fall and spring semesters. Each faculty member was asked to perform two observations (one in their discipline and one outside of their discipline) and be observed twice during the academic year. Faculty were encouraged to consider selecting items from the RTOP protocol when having their classroom observed to focus the observer's attention on certain classroom items. Observers completed a one-page Strengths-Improvements-Insights form at the conclusion of their observation and provided a copy to the person they observed and to the SPARCT planning committee.

(5) Enhanced student learning in introductory STEM courses as a result of SPARCT faculty development. The SPARCT participant SoTL projects are directed toward understanding whether use of evidence-based practices enhances student learning in their introductory STEM courses. Some of the participants have presented this evidence.

### **May 2016.**

The third SPARCT STEM Summer academy was held over 4 days with 16 hours of instructional time. These faculty did not receive summer salary for attending, only a commitment on the part of the Whitaker Center to support travel to present on any professional work (SoTL project) resulting from their participation in SPARCT. The Co-PIs each presented a session during this four-day academy. Other presenters included Dr. Greene and Dr. Susan Cooper, Asst. professor of Science Education. (See attached SPARCT schedule 2016 for a list of topics including evidence-based practices.) There were 5 participants, from the following disciplines: Engineering (1), Environmental Sciences (3), Mathematics (1). Participation over the three academies is distributed as follows: Geology (1), Physics (3), Biology (4), Chemistry (5), Marine and Env. Sciences (7), Engineering, (7), Mathematics (10).

### **June 2016-August 2016**

The planning group did some debriefing and reflection on the SPARCT 2016 Academy during this time and worked on this report.

### **Specific Objectives**

#### **Y3-2016**

Specific objectives of Y3 as they fall under the goals were as follows:

(1) Enhanced scholarship of teaching and learning (SoTL) by SPARCT faculty.

Objective 1 – Track participant progress through their SoTL projects via analysis of video reflections during the academic year.

Objective 2 – Record the number of presentations delivered by SPARCT participants

(2) Improvement of evidence-based practices targeting the introductory STEM classroom.

Objective 1 – Track participant progress through analysis of video reflections during the academic year.

Objective 2 – Examine results of Postsecondary Instructional Practices Survey (PIPS) taken pre- and post SPARCT year by the Year 2 (2015) SPARCT cohort.

(3) Development of long-term FLCs in STEM instruction.

Objective 1 –Attend monthly meetings to develop an FLC culture among SPARCT participants.

Objective 2 – Continue the SPARCT meetings during Year 3 and open presentations to all SPARCT participants (2014 and 2015).

(4) Development of professional peer-observation strategies for the STEM classroom.

Objective 1 – Track number of observations done during Fall and Spring semesters.

Objective 2 – Track participant feedback regarding observation via analysis of video reflections taken in Oct. 2015.

(5) Enhanced student learning in introductory STEM courses as a result of SPARCT faculty development.

Objective 1 – Request information from participants who travel to present their work regarding their student learning outcomes.

### **Significant Results:**

#### **Y3-2016.**

##### (1) Enhanced SoTL by SPARCT faculty.

Objective 1. Based on the qualitative analysis from the video transcripts, all sixteen members of the SPARCT 2015 group engaged in a SoTL project in an introductory course they were teaching during the 15-16 academic year. Those who completed research projects; i.e., projects resulting in a conference presentation or a journal article, unequivocally articulated they would not have completed the project without being involved in SPARCT. More than 80% of participants listed “becoming familiar with SoTL” as a reason they would give for a colleague to attend SPARCT.

Most SPARCT 2015 attendees were appreciative of the efforts by the SPARCT facilitators to help with the IRB process as most participants were not aware of the entire process or how to acquire IRB approval prior to SPARCT attendance.

Objective 2. Of these sixteen faculty, one presented the results of their SPARCT SoTL projects in 2015 at a professional conference (see products), two faculty from the 2014 cohort presented their research at a conference.

To date, we know that 4/16 (25%) of the SPARCT 2015 faculty have presented or intend to present on their in SoTL activities as a direct result of their participation in SPARCT. Two of these are external and two more will present this fall at an internal teaching and learning conference. To date 12 of the 16 (75%) SPARCT 2014 faculty have presented on their SPARCT activities.

Additionally, the planning team (Frost, Greene, Serro, and Kunberger) delivered five presentations (one as proceeding) in a variety of formats at national conferences discussing the SPARCT program.

##### (2) Improvement of evidence-based practices targeting the introductory STEM classroom.

Objective 1. Based on the qualitative analysis from the video transcripts, all sixteen members of the SPARCT 2015 group integrated an evidence-based practice into their targeted course. The 2015 cohort was very committed to their initial idea generated by the end of the SPARCT Academy regarding changes in their introductory STEM course.

Over 50% of the SPARCT 2015 cohort indicated they integrated more formative assessments into their targeted course. Formative assessments took the form of end of class surveys, One Minute Papers, Muddiest points, and midterm survey. Faculty also added formative assessment questions to their end of course student evaluation to guide their future practice. Some faculty indicated their retention rates increased and gave credit to their use of more engaged learning approaches such as POGIL, Team-based Learning, and the Conceptual Change Model.

Another new finding was participants' emerging awareness that lecture was not optimal classroom practice. Some used the phrase “I began to leave lecture behind;” they became acutely aware of the difference using more active learning techniques made in student motivation and classroom climate. Even when the data seemed to show their use of new techniques did not make a significant difference in test scores; they planned on continuing their use of more engaged learning techniques because of the difference in student engagement.

The last new finding concerned their own learning, especially in the area of the science of learning. Most participants articulated before SPARCT they had little or no awareness of the science of learning, how the brain functioned, or how to teach for optimal retention. After SPARCT, they were acutely aware of how to use new research into brain function to support student learning.

Objective 2. As of this writing, we have collected PIPs data (pre- and post- for the SPARCT 2015 cohort, but analysis is not complete.

(3) Development of long-term FLCs in STEM instruction.

Objective 1. Scheduling continued to be one of the more challenging parts to hosting an FLC and more professional development.

Objective 2. To date we have established an open FLC for 2016-2017 with other time set aside to meet with the SPARCT 2016 cohort. This was done to bring back earlier SPARCT faculty and include new SPARCT faculty for sustainability as the grant funding sunsets.

(4) Development of professional peer-observation strategies for the STEM classroom.

Objective 1. 93% of the participants received at least one observation of their classroom during the year. 100% of the participants conducted at least one, most did two observations of another person's classroom. This is up from 73% in year 1. Participants were only asked to conduct their SoTL project for one semester during the academic year.

Objective 2. During October 2015, participants were asked to reflect on their Fall observations through a video reflection. The comments from 2015 reinforced the comments from the SPARCT 2014 group. This suggests the strength of peer observations as a part of individual growth and development in classroom pedagogy. Both cohorts were unsure how observations would go, however, all participants articulated ways they profited from the experience. Two new findings in addition to those outlined in the 2014 report are added here:

Observation of faculty member A: This faculty member's class was an epiphany for the observers. Because of the nature of the class, class discussions are the basic means of teaching. Both SPARCT participants who observed this class made note of the faculty member's skill and ease of leading discussions on difficult topics. Because observers taught science courses with loads of content and little time for discussions they were amazed not only at this particular faculty member's skill but at the ability of the students to analyze, synthesize, raise difficult issues and participate at deep levels in thinking and communicating. Both observers realized the value of having such discussions. Their view of students was broadened in many ways. They were able to see students as capable instead of struggling to learn; a view both observers articulated as their primary way of thinking of students. They also considered that their content limited their ability to use or gain the skills displayed by this faculty member.

Observations of chemistry faculty using POGIL and/or Team-based Learning: The use of these techniques gave instructors a window into the thinking of their students that lectures and labs had not. Using these techniques raised faculty awareness of why and how students struggled to learn concepts and that students learn differently.

While the use of these techniques did not significantly raise student test scores, ALL articulated they were going to stick with these techniques because of what they saw in student's motivation. One faculty member tracked attendance and found attendance was up in the classes where these techniques were used and down for lecture.

(5) Enhanced student learning in introductory STEM courses as a result of SPARCT faculty development.

Objective 1.

Faculty projects included the following

- (1) Comparison of conceptual change and team-based learning for topics in probability and statistics. (Girimurugan)
- (2) Use of team-based learning in an introductory physical geography course (Barbosa)
- (3) Incremental learning to increase understanding and retention (Nicolas)
- (4) Using a wireless writing tablet to allow more accessibility to students during class (Campbell)

SoTL awareness was developed and heightened in all SPARCT 2015 participants.

**Key Outcomes or Other Achievements:**

Y3-2016

### **What opportunities for training and professional development has the project provided?**

One of the co-PIs (Johnson) was selected to attend a POGIL workshop facilitator training which facilitated us offering a POGIL workshop to the SPARCT participants.

See attached schedule for actual SPARCT activities which were training and professional development.

### **How have the results been disseminated to communities of interest?**

Dr. Frost presented a plenary rapid talk at the Science and Mathematics Teacher Imperative/National STEM Education Centers Conference in, San Antonio, TX. Dr. Kunberger presented a poster and authored a proceedings with Dr. Frost and Greene for the ASEE conference. Dr. Frost also delivered a poster presentation at the AAC&U STEM meeting in Nov. 2015 and an AAAS/NSF-IUSE conference in April of 2016. Dr. Serro participated in a panel discussion of WIDER initiatives at the Nov. Professional and Organizational Development Conference. Drs. Kunberger and Frost also attended a WIDER workshop on "Research Integration of Early Findings from Institution Transformation Projects" following the AAAS/NSF-IUSE conference in April. We have updated our website with several pieces of this information.

### **What do you plan to do during the next reporting period to accomplish the goals?**

(Goal 1) We continue to encourage all SPARCT faculty in their SoTL projects. This will include bringing a SoTL journal editor (also a SoTL scholar) to campus to meet with SPARCT faculty both as a group and 1-on-1.

(Goal 2) All SPARCT participants and non-SPARCT STEM faculty are invited to attend monthly Faculty Learning Community sessions during the upcoming academic year (2016-2017). Separate meetings with the SPARCT 2016 cohort will be scheduled to discuss participant progress toward the use of evidence-based practices in their classroom.

We look forward to a full analysis of the Post-secondary Instructional Practices Survey (PIPS) data on the SPARCT 2015 cohort.

(Goal 3) During 2015-2016, SPARCT faculty participated in a POGIL FLC (7), book clubs (4), and the SoTL FLC (2). We have established the SPARCT FLC for 2016-2017 in conjunction with the FGCU Teaching and Learning Center (called the Lucas Center) for all STEM faculty. We also continue to facilitate a POGIL-FLC and this fall a Team-based Learning FLC will begin. We look forward to examining participation among our SPARCT faculty.

(Goal 4) We had almost perfect participation with the observations from the SPARCT 2015 cohort. We will establish the observations with the SPARCT 2017 cohort and look forward to 100% participation.

(Goal 5) We now have student data from four semesters on student confidence and interest in the SPARCT faculty courses. We look forward to examining this data in the up-coming year.

## **II. Products - What has the project produced?**

Brooks, C.D.; Huffman, T. (2015). *Changing Teaching Practices to Influence Attitudes and Success in Mathematics*. SoTL Commons Conference. Savannah, GA.

Frost, L.; Greene, J.; McCulloch, E.; Serro, L. (2015). *Vertical and Horizontal Assessment of a STEM Professional Development Academy Using Videos*. SoTL Commons Conference. Savannah, GA.

Frost, L. (2015). *SPARCT: A Faculty Development Program Focusing on Introductory STEM Courses*. Science and Mathematics Teacher Imperative (SMTI) Conference. New Orleans.

Geiger, C.; Kunberger, T. (2015). *From Catch-all to Clarity: Revising a First-Year, Multidisciplinary Introductory Course*. ASEE 122nd National Conference. Seattle, WA.

Gonzalez, F.; Zalewski, J. (2015). *FAST Learning: Follow Accomplishments of Senior Teams*. ASEE 122nd National Conference. Seattle, WA.

Goodson, L.; Frost, L. (2015). *Developing and Evaluating a STEM Professional Academy and SoTL Culture*. SoTL Commons Conference. Savannah, GA

Lura, D.J.; Badir, A.; O'Neill, R. (2015). *Homework Methods in Engineering Mechanics*. ASEE 112nd Annual Conference. Seattle, WA.

Zalewski, J.; Gonzalez, F. (2015). *FAST Learning: A New Didactic Method in Software Engineering*. EDUCON 2015, IEEE Global Engineering Education Conference. Tallinn, Estonia.

New products loaded for 2016 report highlighted below:

Shadle, S.; Ortquist-Ahrens, L.; Serro, L.; Sagmiller, K.; Ouellett, M.; Beach, A. (2015). *Catalyzing Institutional Change: A Model for Effective Practice*. POD Conference 2015 Interactive Session, San Francisco, CA.

Frost, L.; Greene, J.; Serro, L. (2015). *SPARCT: A Faculty Development Program to Transform STEM Teaching Culture*. AAC&U STEM Meeting, Seattle, WA.

Frost, L. (2016). *STEM Professional Academy to Reinvigorate the Culture of Teaching (SPARCT)*. Plenary Rapid Talk, SMTI-National STEM Education Center Conference, San Antonio, TX.

Frost, L. (2016). *STEM Professional Academy to Reinvigorate the Culture of Teaching*. Poster Session. AAAS/NSF Conference on Envisioning the Future of Undergraduate STEM Education: Research and Practice, Washington, DC.

Girimurugan, S.B. (2016). *Which is better in teaching probability and statistics? Conceptual change model or team-based learning? Engaging and Learning in Authentic Environments Conference*, UBC, Okanagan.

Huffman, T. (2016). Brooks, C. (co-author). *Project Based Learning as a Successful Approach to a One-Semester Calculus Course*. Joint Mathematics Meeting. Seattle, WA.

Cassani, M.K.; Wilkinson, A. (2016). *Role Play in Large Enrollment STEM*. SoTL Commons Conference. Savannah, GA.

Kunberger, T., & Frost, L., & Greene, J. (2016, June), *Integrating a Faculty Summer Workshop with a Faculty Learning Community to Improve Introductory STEM Courses* Paper presented at 2016 ASEE Annual Conference & Exposition, New Orleans, Louisiana. 10.18260/p.25781.

The website has been updated to include archived information on the SPARCT program results presented last year.

### **III. Participants & Collaborating Organizations – Who has been involved?**

*Here I listed all co-PIs, senior personnel as well as Jackie Greene, Elspeth McCulloch, and Rob Nichols.*

*This area asks for nearest person month worked. A person month is defined as 160 hours. So, if I thought someone put in more than 80 hours over the course of Y3, I gave them a 1. At present, Jackie has a 2 while Laura and Elspeth received a 1 and everyone else has a zero. If you feel you put in more than double that to raise your total over 80 hours, I will raise your person month to 1. This area also outlines the activities that you were involved with, so even if you have a zero listed, whomever reads this will know that you participated, just not more than 80 hours.*

### **What other collaborators or contacts have been involved?**

We had four visitors provide sessions during the SPARCT 2015 academic year professional development  
Ms. Ludwika Goodson, Instructional Design, IPFW - *Identifying Levels of Learning in Assessments*  
Dr. Mark McDaniel, Washington University, St. Louis – *Make it Stick*  
Dr. Tara Gray – New Mexico State University - *Academic writing workshop, Publish & Flourish*  
Dr. Shawn Weatherford, St. Leo University - *SCALE-UP Classroom use*  
Dr. Wayne McCormack, Univ. of FL - *Team-Based Learning Workshop*

*Note: The POGIL workshop was facilitated by Co-PIs Laura Frost and Brian Johnson who are both POGIL workshop facilitators.*

#### **IV. Impact – What is the impact of the project? How has it contributed?**

##### **What is the impact on the development of the principal discipline(s) of the project?**

*Describe how findings, results, techniques that were developed or extended, or other products from the project made an impact or are likely to make an impact on the base of knowledge, theory, and research and/or pedagogical methods in the principal disciplinary field(s) of the project.*

##### **Impact on Principal Disciplines (STEM faculty development).**

In introductory STEM instruction (as the principal discipline), all 16 SPARCT 2015 participants have introduced an evidence-based practice into their chosen introductory course as a result. All participants gained knowledge in pedagogical methods and indicated through our qualitative analysis that they were able to put this knowledge into practice. The observations were well received by the participants and also made an impact on the participant's own pedagogical practice. During 2015 we were able to round out the participation to include a reasonable number of faculty from all STEM disciplines.

As of this report, we have completed three sessions of the SPARCT summer academy with our grant funded two cohorts completed. There are ~130 STEM faculty at the university who are in departments where STEM introductory courses are taught. Thirty-seven of these faculty participated in SPARCT. This represents over one-quarter of this STEM faculty population at FGCU. According to the Diffusion of Innovation Theory, we have now reached into the Early Adopters phase which can have an effect on culture change within many of the departments.

##### **What is the impact on other disciplines?**

*Describe how the findings, results, or techniques that were developed or improved, or other products from the project made an impact or are likely to make an impact on other disciplines.*

FGCU currently has 526 faculty. The SPARCT model for faculty development has included co-PIs and senior personnel from FGCU's teaching and learning center. Some of the practices that have been developed for this programming have been transferable to faculty outside of the STEM disciplines. Additionally, we have brought speakers to campus for SPARCT that were able to interact with other faculty at the university during their time on campus. For example, we provided workshops on academic writing offered by the Textbook and Academic Author's Association as part of SPARCT. These workshops were offered to the general faculty and were well attended.

As SPARCT faculty model evidence-based practice in their classrooms, this has an effect on all disciplines, but especially on education majors who may be taking these courses as examples of effective classroom strategies.

##### **What is the impact on the development of human resources?**

*For example, how has the project:*

- *provided opportunities for research and teaching in the relevant fields;*
- *improved the performance, skills, or attitudes of members of underrepresented groups that will improve their access to or retention in research, teaching, or other related professions;*
- *developed and disseminated new educational materials or provided scholarships; or*
- *provided exposure to science and technology for practitioners, teachers, young people, or other members of the public?*

We see the impact on human resources as engaging even more STEM faculty through cohort two (SPARCT 2015) in evidence based practices, observation, reflection, and SoTL research. The planning committee continues to develop as new people come onto the project and others leave FGCU through job opportunities or retirement.

##### **What is the impact on physical resources that form infrastructure?**

Nothing to report.

##### **What is the impact on institutional resources that form infrastructure?**

As a result of our Team-Based Learning workshop offering, the office of student affairs is now using Team-Based Learning in all its student leadership courses.

**What is the impact on information resources that form infrastructure?**

Nothing to report.

**What is the impact on technology transfer?**

Nothing to report.

**What is the impact on society beyond science and technology?**

The success of the SPARCT Academy impacts the full university faculty.

The SPARCT Academy presenter, Dr. Wayne McCormack, president of the Team-Based Learning (TBL) Collaborative, delivered a team-based learning workshop to the SPARCT 2015 participants. Dr. McCormack further returned in Feb. 2016 to offer a second TBL workshop based on his popularity during May 2015. As a result of this, a book club examining Team-Based Learning will be led by two STEM faculty members who attended sessions on Team-Based Learning (TBL). In December of 2015 we welcomed Dr. Mark McDaniel to campus to host two sessions, one for SPARCT faculty and a second for all FGCU faculty to discuss the Science of Learning as outlined in [Make it stick: The science of successful learning](#). Because of his visit, the Whitaker Center director has been able to further disseminate several ideas from this book to nearly 100 K-12 teachers and another 100 non-FGCU university faculty through other programming efforts.

**V. Changes/Problems**

**Changes in approach and reasons for change.**

Nothing to report.

**Actual or Anticipated problems or delays and actions or plans to resolve them**

**Y3-2016**

We filed for a second no-cost extension during 2015-2016 allowing us to support travel for dissemination to SPARCT participants who have not completed their SoTL project analysis as of the end of the 2014-2015 academic year.

**Changes that have significant impact on expenditures.**

Nothing to report.

**Significant changes in use or care of human subjects.**

Nothing to report.

**Significant changes in use or care of vertebrate animals.**

Nothing to report.

**Significant changes in use or care of biohazards.**

Nothing to report.