Second-Year Evaluator's Report (2015)

SPARCT: STEM Professional Academy for Reinvigorating the Culture of Teaching

Introduction

Project

This external evaluator's report addresses progress through the second year for the STEM Professional Academy for Reinvigorating the Culture of Teaching (SPARCT) at Florida Gulf Coast University. The directors of the Whitaker Center coordinate programming for STEM Education and the Teaching, Learning and Assessment Initiative (TLAI). The FGCU PI team includes Laura Frost, Principal Investigator; and Co-Principal Investigators Tanya Huffman, Brian Johnson, Tanya Kunberger, and Linda Serro. Other individuals active in project planning and professional development activities with whom the evaluator met on September 10, 2015 included Jackie Green, Elspeth McCulloch, and Robert Nichols. This project includes the 36-hour three-week, half-day STEM Summer Academy in June 2014, 36-hour two-week academy in May 2015, and follow-up faculty development activities including learning community participation, peer teaching observations, and participation in a faculty development seminar series. This second-year report was prepared beginning in September 2015 and concluding in January 2016, following a site visit at Florida Gulf Coast University (FGCU) September 10 and 11, 2015.

This report was completed by:

Ludwika (Ludy) Goodson
2902 Clara Avenue
Fort Wayne, IN 46805
LudyGood@gmail.com

Data Sources

Data sources for this second-year report included a site visit on September 10 and 11, 2015, involving 16 interviews with 2015 SPARCT academy participants, three with 2014 SPARCT academy participants, discussions in a project planning team meeting, and a group session on the afternoon of the second day of the site visit; 81 video recordings of SPARCT 2015 participants, spanning April, May, August, and December of 2015, and January of 2016; and SPARCT academy materials and reports (schedules, written participant feedback and reflections, and the Annual Project Report).

Results

Document review, responses from participants, and project artifacts indicate that the STEM faculty successfully translated the research-based teaching strategies provided through the SPARCT project into applications in their own teaching practices, and they either have engaged in or are preparing for research on the scholarship of teaching and learning (SoTL). These findings demonstrate enhanced SoTL, use of evidence-based teaching practices, participation in communities of practice, reciprocal peer observation of teaching, and faculty reports of improvement in student engagement and learning. Supporting documentation for the success of this project continues in the remaining sections.

Document Review

Document review was accomplished before, between, and after on-site interviews that occurred on Thursday and Friday of September 10 and 11, 2015. Project reports were discussed in a meeting with the SPARCT planning group on Thursday, September 10, 2015. All the SPARCT academy and Professional Development topics identified in the documents also were identified by one or more participants during the on-site interviews.

- SPARCT Academy Schedule:
  - The 36 hours of the 2014 academy occurred over 10 days distributed over three weeks; the 2015 academy, with the same number of hours, occurred in eight longer days (30 minutes added to the end of each day) distributed over two weeks.
  - Topic additions listed on the 2015 schedule included Cognitive Science Research, SCALE-UP, Team-Based Learning, Assessment and IRB/SoTL, and the Alumni Panel with SPARCT Participant Presentations. SoTL and Assessment were not new topics in 2015, but were combined with the IRB discussion, and Cognitive Science Research was addressed in the same section as Course Design.
  - Topics in both the 2014 and 2015 academy included Student Engagement, Classroom Environment and Working with College Students, Real World STEM, Conceptual Change Model, Process Oriented Guided Inquiry Model (POGIL), Flipping the Classroom, and Problem Based Learning (PBL).
  - The 2014 topics of Implementation and Publications, Promotion, and Presentations were not listed as separate topics in the 2015 academy schedule, but were addressed in the faculty development schedule from August through April of both 2014 and 2015.
- SPARCT Faculty Development Schedule:
  - Topics for August through April of both years included: Observation Strategies and Implementation; Levels of Learning: Teaching and Assessment.
  - Topics in 2014 that were not repeated as explicitly separate topics in the 2015 schedule were: The Multimedia Principle, Testing What We Teach—STEM Education Seminar, and Academic Writing Workshop.
  - Topics addressed in 2015 that were not previously listed as explicit topics in 2014, were: Understanding Cognitive Science (anticipated focus on the "Make it Stick" book), POGIL Workshop, and Team-Based Learning Workshop (Advanced). The faculty development schedule in April of both years included Final Interviews and Wrap-Up Event.
- *Journal Responses in SPARCT Academy 2015:*
  The SPARCT academy included a daily application question for participant reflection in a journal during the first seven days of the academy. Refer to the "Evaluation Report Attachment: Journal Analysis Summary" generated as part of this evaluation report to view the distribution of responses.

  Abbreviations used in this summary of responses include: POGIL (process oriented guided inquiry learning), TBL (team based learning), PBL (problem based learning), iRAT (individual readiness assurance test over assigned material before PBL), tRAT (same test taken as a team), CCM (conceptual change model), and SCALE-UP (student centered active learning environment for undergraduate programs).

Journal entries indicated changes in the following areas.

Student engagement: 14 participants plan to add activities to increase student engagement, 1 reported finding the student panel informative, 1 provided no answer.

Cognitive science: 14 participants plan to add or continue using some aspect of cognitive science to engage students (1 of these reported already doing mini-lectures, others are adding), 1 does not see application to concept development, 1 provided no answer.

Conceptual change: 12 participants planned an explicit CCM activity or reported thinking about such an activity; 1 reported plans for adding clarity, sense and meaning in all lesson plans; 1 reported being unsure of CCM, 2 provided no answer.

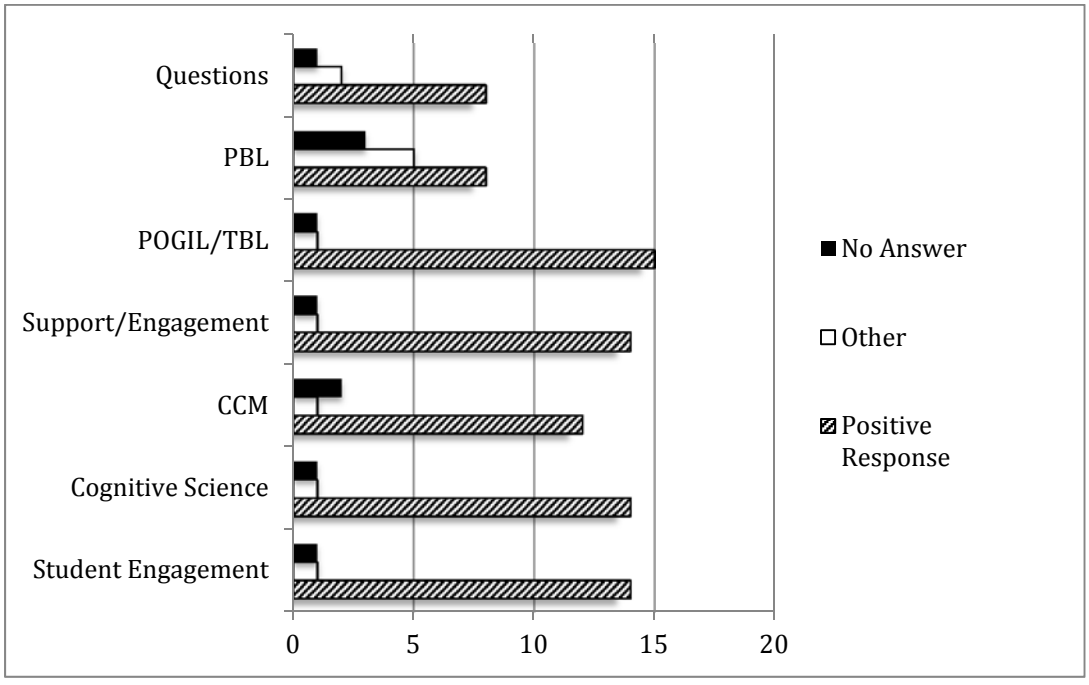
Learning support and engagement: 14 participants reported planning one or more specific activities to use before or at end of class, 1 reported seeing the importance of early engagement, 1 provided no answer.

Vision for POGIL or TBL: 15 participants plan to use one or more of POGIL, TBL, iRAT, tRAT, or SCALE-UP activities, principles, or elements in their courses; 1 reported being unsure of TBL.

Application of PBL: only 8 participants reported planning to apply PBL in their courses; 2 reported thinking of using PBL in different courses, e.g., upper level, not introductory; 1 reported plans to investigate the literature to consider PBL vs. CCM; 2 reported lack of clarity or uncertainty about PBL; 3 provided no answer.

Questions for SPARCT alumni: 8 participants generated different questions; 2 offered no questions, but added comments about something learned during the academy; 6 offered no response.

The following chart shows generally positive responses across SPARCT academy teaching strategies. "PBL" appears to not have connected as well as the other strategies; this seems due in part to participants seeing problem based learning as a grounding concept within POGIL, TBL, or CCM rather than distinguishing it as a separate teaching strategy. The "Questions" category only indicates the number of questions submitted on Day 7 in preparation for the SPARCT alumni panel planned on Day 8 of the academy.



Daily feedback from participants in the SPARCT academy generally showed very strong favorable ratings for topics addressed in the SPARCT academy concerning met expectations, appropriateness of materials, and clarity and ease of understanding directions. There were only rare ratings of neutral or levels of disagreement. Two topics received less favorable ratings.

> The "Flipping and SCALE UP" topic received lower ratings—several participants marked *neutral* on expectations, and 10 marked *neutral* or *disagree*, or *strongly disagree* on directions. Most participants gave strong favorable ratings on appropriateness of materials for this topic—only one participant marked *neutral*.
> The "PBL" topic received less favorable ratings—six participants marked *neutral* or *disagree*, or *strongly disagree* on expectations, four marked *neutral* on appropriateness of materials, and six marked *neutral* or *strongly disagree* on directions.

NOTE: Internal project documents contain detailed ratings and comments from participants.

Participants and Courses

Sixteen STEM faculty participated in the May 2015 SPARCT academy. During the on-site visit in September 2015, these faculty participants provided information about their plans and accomplishments in teaching their courses. Participating faculty included: Lyndsay Rhodes, Don Duke, Nora Demers, Jeff Hutchinson, Senthil B. (BeeJay) Girimurugan, Alayde (Alli) Barbosa, Rachel Campbell, John Reilly, Robert Humphries, Matthew Neubek, Ian S. Campbell, David Fugate, Joseph Cuiffi, Danvers Johnston, Antoine Nicolas, and Greg McManus. Interviews were completed on Thursday, September 10 and Friday, September 11, 2015.

Years of higher education STEM teaching experience varied from 2-32 years, with four reporting two years of teaching experience, most (11) reporting a range of more than two years up to 18, and one reporting 32 years. The distribution was: 2 years, 2 years, 2 years, 2 years | 2 years part time and 3 years full time; 3 years part time and 3 years full time; 6 years, 7 years, 7 years, 8 years, 9 years, 11 years, 12 years, 13 years, 18 years | 32 years.

For the faculty participating in the August 2015 SPARCT academy, the courses in which new teaching strategies were planned and being implemented included Biological Sciences (BSC 1010C), Process Biology (PCB 2336, PCB 3023C), Interdisciplinary Science (ISC 3120C), Physics (PHY 2048C), Environmental Studies (EVR 2861), Applied Mathematics (MAP 3162), Math Calculus and Precalculus (MAC 2311), Geology (GLY 1000C), Chemistry (CHM 1045, CHM 1046), Oceanography (OCE 1001C), Engineering: Support (EGS 1006L), and Engineering: General (EGN 3343C). Four courses included lab sections. Some courses have 20-35 students, some 40-50 in a class, some over 90.

Course descriptions and the semester for initiating implementation of planned teaching strategies are provided as follows.

> BSC 1010 C, General Biology with Lab (Fall, 2015): Intended for science majors. The principles of biology are studied from the molecular to the cellular level. Topics may include basic biochemistry, the cell doctrine, the physical phenomena of life, elementary bioenergetics and biosynthesis, cellular and organismal reproduction and the gene concept. The curriculum is inquiry based and fully integrated with a laboratory that emphasizes active learning strategies.
> PCB 2336, Human Genetics (Fall 2015): Basic concepts and applications of fundamental properties of human inheritance using Mendelian and molecular aspects of genetics.

PCB 3023C, Cellular Biology (Fall 2015): Cellular biochemistry and physiology with in-depth study of prokaryotic and eukaryotic cellular organelles including their morphology and function. Topics include cellular mobility, growth, bioenergetics, division, communication and regulation. The curriculum is inquiry based and fully integrated with a laboratory that emphasizes active learning strategies.
EVR 2861, Introduction to Environmental Policy (Fall, 2015): This interdisciplinary course surveys the history and current conditions of environmental policy development and decision-making in the U.S., introducing: the process of environmental policy making; the context in which environmental policy is made; and the conceptual structure, practical implementation, and underlying rationale of environmental policies and regulations.
ISC 3120C, Scientific Process (Fall 2015): Introduction to the philosophy, methodology and ethics of scientific practice via classroom discussion and literature review. Focus on philosophical and practical differences between physical and historical science; hypothesis generation and testing; experimental design; construction of a research proposal; composition of a scientific paper; oral presentation; and critical review.
PHY 2048C, General Physics with Lab (Fall 2015): First semester of a calculus-based two-semester sequence of general physics (mechanics, wave motion, sound, thermodynamics, geometrical and physical optics, electricity and magnetism) and laboratory for science, mathematics, and engineering students.
MAC 2311, Calculus I (Fall 2015): Introduction to the primary concepts and techniques of differential and integral calculus. Topics include limits and continuity, the derivative, differentiation and integration of algebraic and trigonometric functions, linearization of functions, Mean Value theorem, antidifferentiation, extrema and curve sketching, area and the definite integral, fundamental theorem.
MAP 3162, Probability and Statistics (Fall 2015): Introduction to mathematical statistics covering the main ideas and key theorems. Topics include enumeration, axiomatic development of probability theory, random variables, differential and cumulative probability distributions, moment generating functions, transformations of random variables, approximations to the binomial distribution, the Central Limit Theorem, hypothesis testing, point and interval estimation, and regression analysis.
GLY 1000C, Physical Geology (Fall 2015): A study of the history and processes of the earth, its internal dynamics and its superficial processes. Topics may include plate tectonics, formation of minerals and rocks, deformation of the earth, the hydrological cycle, and coastal processes.
CHM 1045, General Chemistry I (Fall 2015, Spring 2016): Intended for science majors. Explores the fundamental laws of chemistry including: states of matter, atomic and molecular structure, the periodic table, stoichiometry, chemical bonding, enthalpy, acid-base reactions, and the gas laws.
CHM 1046, General Chemistry II (Fall 2015): Intended for science majors. Examines solutions redox reactions, kinetics and equilibria, thermodynamics, electrochemistry, nuclear chemistry and descriptive chemistry.
OCE 1001C, Marine Systems: Interdisciplinary introduction to the study of the world's oceans. Students become acquainted with basic scientific and oceanographic concepts through a hands-on exploration of the marine environments of Southwest Florida. Topics may include the role of the oceans in determining weather and climate; environmental stress and marine mammals; building on moving beaches; and estuaries nurseries of the sea. Lecture, laboratory and field experiences are fully integrated in this general education course designed primarily for students with a concentration other than in the natural sciences.

EGS 1006L, Introduction to Engineering Profession (Spring 2016): The course provides an overview of the important aspects of the engineering disciplines offered at FGCU, including professional components, career opportunities, the role of the engineering approach to problem-solving, and the engineering design process. The course is built around active learning concepts as well as team-based learning.
EGN 3343C, Thermodynamics (Spring 2016): Fundamental concepts of basic thermodynamics including first and second law topics, equations of state and general thermodynamic relationships. Work, heat and energy transformations. Relation of properties. Laws, concepts and modes of analysis common to all applications of thermodynamics in engineering.

SPARCT Teaching Strategies

During interviews, SPARCT academy participants provided their perspectives on the teaching strategies introduced during the SPARCT academy as follows. (The following numbering of participant responses does not correspond to numbering elsewhere in this report. For example, *Participant 1* in the journal entries "Evaluation Report Attachment: Journal Analysis Summary" is not the same as *Participant 1* in this report of teaching strategies. These numbers simply separate one participant's responses from another.)

Participant 1 New approaches to active student learning were provided during the SPARCT academy. Participants were provided an opportunity to develop and try out one or more such strategies, for example, Process Oriented Guided Inquiry Learning (POGIL) and Conceptual Change Model (CCM).

Participant 2 Strategies introduced at the SPARCT academy included the flipped homework approach, interactive ways to teach, new theoretical basis for exercises, new ways to improve, examples of benefits to students, how to achieve deeper levels of learning, and provided valuable interactions with the IRB.

Participant 3 Different active teaching methods were introduced at the SPARCT academy, including the Conceptual Change Model. However, this instructor focused on POGIL and was inspired by the idea of students discovering concepts, strategies related to experiences and observations in science leading to theories to explain the world, and the concept of testing and making comparisons of results to develop an understanding.

Participant 4 POGIL strategies were the greatest benefit from the SPARCT academy.

Participant 5 Active learning strategies were introduced at the SPARCT academy. The team based learning strategies were of greatest value.

Participant 6 More ways to improve student learning were introduced at the SPARCT academy, providing more tools for the teaching toolbox, many of which were familiar but the academy provided new acronyms and labels. Individual team based learning methods were introduced.

Participant 7 Insights were provided at the SPARCT academy on how one should teach versus just teaching how one was taught or just doing what the individual instructor thinks teaching should happen. The concept change model was particularly relevant. The academy experience was integrated with other professional development experiences tailored to the subject area and with knowledge about brain-based learning.

Participant 8 One to two teaching methods were provided during each day of the SPART academy along with opportunities for interactions. The background for POGIL, and not just the POGIL model, was helpful in making the connection with the student's discovery process.

Participant 9 More active and more student-centered teaching methods were provided during the SPARCT academy. Of special interest were the use of concept maps, group work, think-pair-share, the concept change model, POGIL, and the exam wrapper.

Participant 10 Teaching techniques, ways of communicating and connecting with students, teaching and research resources, methods for documentation and measurement of impact of teaching strategies, steps to do before publishing SoTL research, and the kind of data that cannot be published about students were all addressed in the SPARCT academy. The academy opened up research and SoTL publication as part of the teaching experience.

Participant 11 New teaching strategies were introduced by speakers at the SPARCT academy. Participants made journal entry reflections at end of day, including reflections on journal articles about teaching strategies. Information on applying for an obtaining IRB approval and ways to conduct appropriate research were included.

Participant 12 The academy provided ways to introduce new research-based methods to the students and insight on the importance of understanding the student psyche.

Participant 13 Better ways to engage students, especially the POGIL model, were provided in the SPARCT academy.

Participant 14 STEM-specific teaching strategies from the SPARCT academy and the New Faculty Academy were great. They focused on active learning styles and ways to make the strategies work. The SPARCT academy provided a community of like-minded people who could bounce ideas off each other. The academy opened up SoTL as teaching research, a whole new line of research, and the concept of doing such research in a scientific way. Introduction to the IRB process was new. POGIL, team based learning, and the conceptual change model were the strongest teaching pedagogies.

Participant 15 Evidence-based pedagogies were introduced in the SPARCT academy. SoTL and the concept of thinking about education in scientific terms was introduced, opening up a new path of research and realization that not every form of research is a controlled experiment. The academy opened up the use of SoTL, not just for research, but as a path for publications and support toward promotions. Along with this, the academy opened up the role of qualitative research.

Participant 16 Active strategies for classroom learning were introduced in the SPARCT academy, including the positives and negatives of all the teaching models and the names by which they are known.

Challenges and Changes

In the following notes about challenges and changes in STEM courses, faculty who participated in the interviews are identified only by number. Instructors reported on their different stages of activities with faculty learning communities, participating in a book club or teaching circle, giving and receiving teaching observations, participating in SPARCT monthly meetings, and making SoTL progress.

Changes Influenced by SPARCT

Participant 1

Before: The original class was traditional lecture-based. In this class, students seemed to be less motivated to learn, a typical pattern in lower level classes. Students have several major conceptual challenges.

After: After the SPARCT sessions, the instructor dropped the lecture approach, prepared active learning exercises, focused on the CCM. The instructor now asks questions before the lab rather than after. The instructor reported that students seemed more engaged and less bored after these changes. The instructor also has developed a POGIL exercise with plans to implement it in the future.

Participant 2

Before: In the original class, less attention was provided to the unmotivated and less successful students. The instructor had the attitude that good learning comes from good students. Because of this, the instructor reported that some students were left behind in their learning achievements.

After: The instructor's new goal became to add strategies of effective teaching, not just from this project, but from an accumulation of previous learning in other seminars and academies, such as previous exposure to project-based learning. The instructor's goal includes reaching out to students who have not been so well prepared and to go beyond the Socratic method when teaching students. Changes include more in-class activities, more videos with companion exercises, continual group activities, stopping at different points in a lecture to ask questions, asking for student input (such as, what do students like about the teaching so far), improving problem-based learning activities. The instructor focused on bringing D-level students up to the B-level of accomplishment and reported satisfaction in ramping up the less prepared students. This instructor now continually uses specific POGIL techniques with a structured series of questions, starting with basics and progressing to higher concepts. An additional change includes skill in the scholarship of teaching and learning (SoTL) in a formal structured way and sharing the results.

Participant 3

Before: The challenge always is to teach students to think. Student achievement has been near the national norms. Students just "don't get" some important concepts, even with a variety of explanations, even with analogies. In the previous year, students gave "push-back" on the lecture videos they were asked to review outside of class time.

After: New goal is to exceed national norms. Teaching strategies, now reflect a paradigm shift, going beyond basic clicker questions to targeting broad concepts, and adding new hands-on/minds-on activities to require students to apply chemistry concepts. From review and discussion of a brain-book in a faculty learning community, this instructor realized that if students are terrified, they are less likely to be able to learn. For this reason, the priority is of impact is to find that students are happier and less fearful—this will be the indicator of success even if student achieve the same grades.

Participant 4

Before: The original course was based on lectures and group work on problems provided in the textbook. Content was presented to students in *big chunks*. Students performed poorly on exams. Three years of item analysis showed what questions students got wrong and review showed where questions had problems with wording. Students had trouble with remembering content and seeing patterns in course content.

After: Students now experience a POGIL activity for the second of the three days that the class meets. The instructor has added explanations to the students of their responsibilities in preparing for and coming to class, emphasizing the impact of preparation on other classmates in their POGIL groups. For problem solving, the instructor begins by explaining and showing the work for two problems, and students tackle a third problem in their groups. New teaching strategies are designed to apply cognitive science research, such as in the use of an exam wrapper that engages

students in reflection on how their behaviors influence exam performance and strategies for change. The instructor has further reflected on the reason for placing content in a certain sequence and chosen a new textbook, overall has replaced the lecture method with active teaching methods throughout the course, and added information on how to use videos to support learning. New strategies extend to teaching assistants who support this course.

Participant 5

Before: The DWFs had been constant, with one third of the students not passing the course. The instructor was already using a lot of active learning strategies.

After: Strategies include having students work problems at the board and preparation work in online activities. Students read assignments, take short quizzes, and discuss concepts and misconceptions. Class time is devoted to practice on problems and applying concepts. Team based learning activities are included. Students receive immediate feedback on a commercially purchased scratch-off assessment form. Analysis of exams shows questions on which students perform poorly and for those areas, supplementary content and activities are posted online.

Participant 6

Before: The class included some active learning, but more stand-and-deliver training. In this class, there is a diversity of freshmen students and they are challenged to understand fundamental concepts and basic content that needs to be memorized.

After: POGIL-type activities have been introduced a little at a time. The strategy is to work with small changes, then make improvements, and add a variety of active learning strategies—something from all of the suggestions provided at the SPARCT academy.

Participant 7

Before: Because students have difficulty grasping concepts, project based learning and applications were among the teaching strategies.

After: Project based learning was improved. Assessment and evaluation were improved. The course has more active learning in groups, a semester-long project, more applications, and students come up with problems as well as solving them.

Participant 8

Before: The class was well organized with clear topic focus, included lectures and some activities.

After: Hands-on physical activities with a clear principle upon which to focus were added, followed by lecture and analysis. The lecture is motivated by a demonstration first. For the purpose of finding out the most effective learning methods, the lecture-based method is used for certain topics, while others have an associated activity.

Participant 9

Before: How to use the textbook was an important issue—students were not making effective use of the chapters. Lectures were a major part of the teaching methods.

After: Active learning has been introduced, using a sampling of methods, such as providing students with a sample for analysis where the instructor does not provide the answer, but the students discover it. In this way, the focus becomes not thinking about what the instructor is doing, but about what the students are thinking, and how their brains work. The whole course has

shifted to be more about the students. The course includes team based learning, think-pair-share, and elements of the conceptual change model. The exam wrapper also has been added for student's reflective feedback to help them in preparing for the following week. Students are participating more in the classroom, they are reading, and they are talking more.

Participant 10

Before: This course had a traditional classroom arrangement with homework assigned outside of class.

After: The course has gone through a partial flip by devoting the last half of class to the homework, responding to student questions, and completion of group activities in which students discuss with each other. The think-pair-share strategy also will be introduced.

Participant 11

Before: Previously, teaching relied mainly on lectures.

After: Lectures have been transformed by new ideas gained from the academy, for example, rephrasing a problem to trigger a different kind of learning, using the concept change model, and team-based learning.

Participant 12

Before: Students did not meet expected levels of performance. They need more guidance. Providing such guidance in extra sessions would be excessively time consuming—the time just was not available to provide the guidance they needed.

After: Group work provides a more efficient alternative. Students study online as well as face-to-face. The conceptual change model provides a new structure for dealing with student misconceptions, along with a problem solving approach, and POGIL-type activities with some modifications to focus on problem finding, too. The progression of concepts and problem solving is incremental, moving in stages to the more complex levels.

Participant 13

Before: Student learning process was too passive. There were too many straight lectures. Some students had very low motivations, seemed to not even try to learn.

After: The POGIL model has been adapted to provide guided activities in the classroom. Concept mapping activities have been integrated with the teaching process in which students draw out and label the major concepts. Quizzes help learning to "stick in the right place." Learning is scaffolded so that students receive more guidance at first and gradually less guidance as they make progress in learning.

Participant 14

Before: The course had a traditional lecture format with a separate lab experience.

After: The course teaching strategies now integrate several common themes from the SPARCT academy—group learning, small group work, and peer interactions. Homework problems are done in class rather than outside of class. Students judge their own understanding before they work in the groups. Journal entries show whether students actually read the assigned materials and view the videos. The POGIL groups in this class have the added incentive of every member earning extra points if all in a group earn at least a B on the exam.

Participant 15

Before: The course was taught in large lecture classes and a separate lab. Students were mostly freshmen and nonmajors. They were not retaining what was taught and re-teaching had to be done in the next level class. The course DWF was 30-50%.

After: POGIL activities are now being used in this course. Students take a quiz before beginning their POGIL group work.

Participant 16

Before: Class challenges included sheer size, with over 90 students and sometimes fewer than 3 teaching assistants for support. Not as much attention was paid to the "so what?" question of the impact of previous active learning endeavors.

After: More logistical improvements have been made in active learning in the course. Materials are posted online and students are expected to come to class prepared to do group work. Demonstrations precede the POGIL activities. The classroom is set up in 16 tables of six. Group work is focused on problem solving.

SoTL Progress

Participant 1

The instructor's method of assessment will be classroom observations of student engagement. The instructor improved problem-based learning as a result of the SPARCT academy and wrote up and published the results.

Participant 2

The instructor is using SALG items for assessing impact of introduction the video and group exercise activity along with exam results for related topic areas. Student consent forms have been prepared and the instructor is positioned to write up results.

Participant 3

The instructor plans to complete the CITI training, develop a consent form, and begin the IRB process. The focus will be comparing impact on students who experience a POGIL activity compared to those who, retroactively, have not had this experience.

Participant 4

The instructor has begun the CITI training and collected research articles related to the teaching strategies being implemented.

Participant 5

The instructor has completed CITI training and begun the IRB process. Performance an ACS final exam will indicate student improvements in achievement and the questions with which they continue to have difficulty.

Participant 6

The instructor has completed CITI training and set SoTL goals. An increase in test scores and student evaluations will indicate whether more POGIL-type strategies make a difference compared to a stand-and-deliver teaching style.

Participant 7

The instructor completed CITI training and began the IRB process.

Participant 8

The study design has been articulated to allow comparison of teaching methods across classes and topics, but the IRB process has not yet begun.

Participant 9

The instructor is considering use of a knowledge/confidence survey to indicate students' estimates of their knowledge and skills before and after instruction.

Participant 10

CITI training and IRB process has begun. Preparation included review process for surveys. Next steps are to implement the new instructional strategies and gather data from the students, a process that will be completed whether or not IRB approval comes through because of the value of knowing impact on learning.

Participant 11

CITI training has been complete and the proposal initially submitted for IRB approval is undergoing some revisions. The plan is to compare the impact of the concept change model and team based learning. A survey will be administered online to obtain feedback from students.

Participant 12

This instructor plans to complete the CITI training and submit an IRB application. The goal is to determine if the activities, readings, and explanations enable the students to solve more complex problems and to find out how students react to these new activities. A survey will collect data on their perceptions; exams and grades will provide indicators of achievements; assessment will include a determination of how many problem sets the students can do.

Participant 13

The instructor has prepared the IRB application. Average scores across semesters will be compared, and the instructor will focus on the questions that address the higher level learning outcomes. The instructor has done a literature review related to the teaching methods being used.

Participant 14

CITI training has been completed. The instructor is working on the IRB proposal. Pre and post-test scores will be compared. The question is what combination of activities makes the greatest difference.

Participant 15

CITI training and the IRB proposal are under way. Pre and post-assessments will be used. Student perceptions will be gathered through the SALG. The goal is to decrease the number of repeaters, the number of DWFs, to see gains in the scores, and to follow students through to the next level and check for improvements in retention.

Participant 16

CITI training, the IRB application, and an electronic consent form have been completed.

Challenges and Progress for Instructors

Teaching Strategies

Participant 2

It is not yet clear how to apply or adapt active teaching strategies to advanced classes. Good POGIL questions are difficult to write.

Participant 4

Some students complain about POGIL, claiming that the class structure requires them to teach themselves and wondering the value of the instructor.

Participant 6

There are challenges in applying active learning strategies for content that must be memorized.

Participant 7

The instructor expressed caring about motivation of students, adding to students' comfort during the learning process, and continuing to improve personal teaching skills.

Participant 8

Notes from the SPARCT academy, and additional time for reflection, allow thinking about a deeper level of application, and more opportunity to plan ahead than was possible during the academy itself.

Participant 8

The goal is to do the best for the students, and the method of doing a study to compare methods and results will help to identify evidence-based ways to improve teaching. Participant 9 In addition to strategies from the SPARCT Academy, the New Faculty Academy provided inspiration for how to make class time more interactive, and more about the students than about the instructor.

Participant 14

With a lot of new teaching models and new terms, it was difficult to delineate the teaching strategies from each other. It was hard to distinguish the reasons for using the respective teaching strategies. It would be better to know more about the costs and benefits of the strategies and the context of when the different models fit together.

SoTL Challenges

Participant 1

There are no data from prior classes, an obstacle to comparison of the impact of changes.

Participant 8

It is difficult to find control groups for comparisons.

Participant 12

Even though the IRB process was addressed in the academy, along with a sample application, the instructor was still surprised when beginning the process of filling out the application.

Faculty Learning Communities, Book Club, and Meetings

During the September 10 and 11 interviews, participants reported the following kinds of participation in follow-up activities to the SPARCT academy.

Participant 1

This instructor reported no knowledge of Faculty Learning Communities.

Participant 3 and Participant 4

These two instructors reported benefits from review and discussion of the book on how the brain works. They reported experiences with a book club and teaching circles, but did not refer to faculty learning communities specifically.

Participant 4

This instructor reported that faculty learning communities do not match up with competing schedule demands.

Participant 6

This instructor reported actively participating in faculty learning communities, the book club, and monthly meetings.

Participant 11

This instructor had class schedule conflicts with the timing of the monthly meetings and faculty learning communities but has been able to make and receive observations of teaching.

Participant 12

Monthly meetings conflict with other schedule demands. Participation in the New Faculty Academy is scheduled. Teaching observations have been accomplished.

Participant 13

The instructor has been able to participate in some faculty learning communities, a book club focusing on brain science, and POGIL meetings. The instructor has given and received teaching observations.

Participant 14

Classroom teaching observations have been given and received.

Participant 15

The instructor participates in monthly SPARCT meetings, has teaching observations scheduled, participates in faculty learning communities, and the book club on the “Make it Stick Brain Book.”

Participant 16

This instructor participates in monthly meetings, faculty learning committees, book clubs and POGIL meetings.

From previous year's participants:

Participant A

This instructor did not see news about the faculty learning communities but did participate in the book club. In the previous year the instructor gave and received teaching observations, but not since then. This instructor's department does not actively support or encourage reciprocal teaching observations.

During the month of October 2015, video recordings showed SPARCT academy participants reporting on their teaching observations. In these reports, they identified what they gained from this reciprocal peer teaching observation process. Examples of benefits included insights on the following issues:

> pace of teaching and cognitive load on students;
> levels of guidance and scaffolding needed for students including prompts for where to locate materials posted online and review of basic terms;
> clarity of structure and explicit directions conveyed to students;
> media flexibility in non-SCALE UP classrooms and better use of SCALE UP classrooms;
> visualization strategies;
> transitions between concepts and signaling students of movement from one activity to another and of one stage of an activity to another;
> presentation strategies and details;
> differences in group interactions within the same class session;
> connecting current lesson to review of previous lab or lesson;
> differences in how many students actually take notes and answer questions during class (versus the impression of full participation);
> impact of physical space and student seating on levels of participation;
> method of anonymous coding on quizzes;
> sequence of demonstrations and explanations; and
> impact of skeletal outline on student notetaking.

Concept Development

Participant 3

It is not clear why students have difficulty with grasping certain concepts. It is still a challenge to figure out what creates the barriers for them. New teaching strategies may help make a breakthrough.

Effort

Participant 9

It can be exhausting to plan and manage the more active-learning methods, but "I love it."

Other Feedback on SPARCT Academy and Activities

Composite Summary from Participants

Overall, the academy was a great experience. The cross-disciplinary perspectives were valuable, but the pace was daunting. However, an intensive few weeks is better than topics distributed across months, though the monthly sessions do seem to be at a more reasonable pace.

Additions that would be helpful include providing a roadmap or checklist to follow toward goals to accomplish, maybe review of the strategies and checkpoints with the instructors in the following semester, and adding explanations of situations in which the teaching techniques are unlikely to work (or situation in which they would be a "best fit").

Participant Perspectives

Great Experience:

Participant 10 The academy was very well organized, motivating, a great experience, and provided a lot of learning.

Participant 11 The academy was a great learning experience. All presentations were strong, but the team based learning presentation was exceptionally clear. The concept change model was very good, too.

Participant 12 The academy was a wonderful experience, providing research-based structures for teaching methods.

Participant 14 The academy was great!

Participant 15 SPARCT was a great program, providing a lot of good information.

Participant 16 Reflection journal at the end of the day was very useful.

Pacing:

Participant 6 The intensity of the academy felt like an information dump, an assault of information. The monthly meetings are at a more reasonable pace.

Participant 8 The academy was like a fast-paced marathon, making it impossible at the time to think about the teaching methods at a deeper level.

Participant 10 The pace of the academy was daunting; information would be easier to comprehend in larger longer sessions, with breaks.

Participant 1 An intensive few weeks, as the SPARCT academy was structured, is better than a longer distributed pattern such as a few days strung across each month which is what is planned for professional development across the year.

Participant 15 The pace was at times overwhelming, so much front-loaded.

Participant 16 It was tough to get through the long days. Three weeks is too long.

Cross-Disciplinary Value:

Participant 5 The broader perspectives provided by the cross-disciplinary experiences have been valuable.

Participant 13 It was helpful to have an instructor from another discipline describe applications of active learning.

Participant 14 It was helpful to have a community of like-minded people exchanging ideas.

Participant 15 Activities allow participants to bounce ideas off each other.

Suggested Changes:

Participant 10 A roadmap to follow to plot a timeline or sequence of goals to achieve would be helpful, perhaps a checklist.

Participant 11 It would be helpful to receive more explanation on how and where different teaching techniques can work because some techniques will not work for certain situations.

Participant 12 A few more examples of IRB applications would be helpful.

Participant 15 Provide follow-up on the specific strategies in the Fall and add checkpoints with the instructors for how they are doing.

Participant 16 Separate the training with a 1-2 week break during which time faculty would have an opportunity to develop a lesson on active engaged learning and modify it for the different teaching methods.

Interviews of Faculty from Previous Academy

Four participants from the previous year's SPARCT academy also were interviewed during the September 10-11, 2015 site visit. They included Fernando Gonzales (Engineering), Mary Kay Cassini and Andrew Wilkinson (interviewed together), and Cara Brooks These interviews were free-response open sessions to allow the participants to express any issue, progress, or questions related to their SPARCT project experiences, their teaching, and their research.

Classroom Experiences and SoTL Progress

Profile A: This instructor has published two papers on the active teaching methods applied in the classroom. The instructor had coded the positive and negative comments from two different groups. The active learning methods introduced included challenge based reasoning and POGIL customized for engineering. The instructor reported that students were more engaged in learning and asked more questions in class than they had before the active learning strategies were introduced.

Profile B: Previously the teaching had been "didactic." Now, course materials are posted online to support active learning during the class time. Students have full expectations to complete the online preparation before coming to class where they complete a quiz before participating in the class activities. This was a part of the strategy for flipping half the class, with outside-of-class homework now replaced by continual explicit active learning throughout the semester. One presentation was made at a professional conference and one manuscript was published in a professional journal. IRB approved sources of data were included such as pre and post-test scores, and survey responses from students. The rate of DWFs also was examined.

Profile C: The instructor has made internal presentations on the changes in teaching strategies and has quantitative data from an attitude survey to suggest the impact of the problem-based learning activities on student perceptions. For SoTL research, the instructor has one control and one treatment class. A primary goal has been to increase student positive attitudes about what they are learning. The instructor is proposing an amendment to the IRB application to include attitude change, confidence change, as well as change in grade distribution, pass rate, and withdrawal rate. At a deeper level of professional impact of the SPARCT project experience, the instructor reported, "I have changed" and elaborated on the depth of new learning through the SPARCT academy and related support activities.

Participation in Related Activities after the SPARCT Academy

Participant A: The teaching observations from the previous year were valuable, but none have been done since that time. The instructor's department does not support or encourage reciprocal teaching observations. The instructor did not receive news about any faculty learning communities, but did participate in a book club.

Participant B: Participation in related activities was not discussed.

Participant C: Participation in related activities was not discussed.

Recommendations for Ongoing Support

Participant A: Plan a get-together at least once a year for the previous SPARCT academy participants. Continue to encourage pairs to observe each other. Consider an evening get-together to share progress with each other.

Participant B: No suggestions for additional support.

Participant C: No suggestions for additional support were made by the instructor. However, the instructor discussed uncertainty in knowing what procedures would be acceptable and appropriate for creating a valid survey that aligns with SoTL research goals. Although the SPARCT academy introduced commonly used instruments, the items on the instruments do not match the same constructs that are of interest to the instructor. The interview focus shifted to discussion of approaches for defining constructs and methods of rating them. This discussion suggests a session on survey design and qualitative research would be of value to the instructor.

Evaluation Report Attachment: Journal Analysis Summary

A separate 23-page log of journal entries was reviewed to create this summary. Abbreviations used in this summary of responses include: POGIL (process oriented guided inquiry learning), TBL (team based learning), PBL (problem based learning), iRAT (individual readiness assurance test over assigned material before PBL), tRAT (same test as a team), CCM (conceptual change model), and SCALE-UP (student centered active learning environment for undergraduate programs).

Question 1: What factors from today's sessions will impact how you engage your students in your focus course?

14 participants reported changes to improve student engagement:

Participant 1 plans to design course activities to benefit the different types of students;
Participant 2 plans to share student panel practices with class on first day and may add black box or horse trader activity and description of teaching philosophy;
Participant 3 plans to share strategies from student panel;
Participant 4 plans to guide students more in how to think instead of giving them the answers or calling on someone who is likely to know the answers;
Participant 5 no answer;
Participant 6 plans to use an activity similar to the black box activity;
Participant 7 plans to add videos for students to view before class and use class time for review, questions, mini-lectures, and group activities,
Participant 8 no plan reported, but found student panel informative;
Participant 9 plans to change attendance policy and add an activity similar to the black box to focus on differences in observations and inferences;
Participant 10 plans to use the web design model and bring in former students to answer some questions in class;
Participant 11 plans to develop activities like Rob's or Tanya's (differentiate observations vs. inferences);
Participant 12 plans to add "Clarification Station" and may add online office hours;
Participant 13 plans more observation/inference and more engaged learning activities;
Participant 14 plans to remind students it is not cheating to look and learn from each other and to make activities more FUN;
Participant 15 plans to stress the importance of sleep and not cramming for tests as recommended by successful upper level students;
Participant 16 plans to add team-based assignments, put course materials up before class, and build more choice into student assignments.

Question 2: What aspects of cognitive science will you used to engage your students in your courses?

14 participants reported plans to add or continue using cognitive science:

Participant 1 plans to use information processing knowledge to break lectures into smaller chunks with five-minute discussions or activities between;
Participant 2 plans to consider value of 15-20 lecture chunks, but does not yet see how to develop discussion and has difficulty seeing that strategies for memory relate to concept development;

Participant 3 plans to use mini-lectures and limit topics closer to 3-5 range;
Participant 4 plans to use segmenting and pre-training and place assessment early in course design process;
Participant 5 plans to lead off with major or threshold concepts and use mini-lectures separated by activities;
Participant 6 plans to add more visuals, animations, student drawing activities to visually conceptualize the processes they are studying;
Participant 7 plans to begin with supporting safety and emotional comfort; make content meaningful and useful; use 15-20 minute lectures separated by activities;
Participant 8 plans to divide EVERY lecture into 15-20 minute sections with a reflective activity between;
Participant 9 plans to add focus on positive emotions for learning rather than stressful;
Participant 10 plans to redesign the course and reduce lectures;
Participant 11 plans to continue current use of already doing mini-lectures;
Participant 12 plans to chunk material more, add more application, connect materials and concepts;
Participant 13 no response;
Participant 14 plans to make current mini-lectures more FUN;
Participant 15 plans to chunk lectures into 10 minute segments with activities between;
Participant 16 plans to divide lectures into smaller sections and add more active learning experiences;

Question 3: Describe the activity you considered for conceptual change and how polling could be applied during this activity?

12 participants provided an explicit CCM activity or reported thinking about such an activity; 1 reported plans for adding clarity, sense and meaning to lesson plans; 1 reported being unsure of CCM, 2 provided no answer.

Participant 1 planned an explicit CCM activity, but not polling because the class is small;
Participant 2 planned an explicit CCM activity with polling before and after;
Participant 3 thinking of a CCM activity for a build-test-and redesign activity with polling before and after;
Participant 4 planned an explicit CCM activity and game-based polling;
Participant 5 no answer;
Participant 6 thinking of a CCM activity with manipulatives, and Kahoots for end-of-chapter review;
Participant 7 planned an explicit CCM activity with polling for follow up;
Participant 8 planned an explicit CCM activity with pre and post-polling;
Participant 9 plans to design a CCM activity to develop students' metacognition; a drawing activity and analysis of drawings;
Participant 10 thinking of CCM activities in groups with pre and post assessment, polling after activities;
Participant 11 thinking of a CCM activity for 1-2 topics;
Participant 12 planned an explicit CCM activity that could be used;
Participant 13 plans to review lesson plans and add more clarity, sense, and meaning;
Participant 14 not sure about CCM;
Participant 15 no answer;
Participant 16 planned an explicit CCM activity.

Question 4: How do you support student learning before you come to class? After? What are some ideas you have to use new engagement techniques?

14 participants reported planning one or more specific activities to use before or after class, 1 reported seeing the importance of early engagement, 1 provided no answer.

Participant 1 reported SCALE UP is too impractical to use at this time, but plans to use exam wrappers;
Participant 2 plans to flip class, adding pre-training short video and questions on video before class, demonstrate problem in class, add a muddiest-point question;
Participant 3 plans to add reading and questions for preparation before class, then guided problems and questions, then activities in class;
Participant 4 plans to add group activities with roles about every two weeks;
Participant 5 sees importance of early engagement, e.g., freshman;
Participant 6 plans to add preparatory reading and a simple quiz before class; add online quiz to facilitate rapid feedback; and is thinking of breaking homework into daily after-class chunks;
Participant 7 plans to introduce syllabus, calendar, and online book; then online homework with fast feedback, have office hours and tutoring; then small group activities focused on conceptual change and scientific investigation;
Participant 8 plans to continue using mix of SCALE UP, boards, discussion of problems, and group work;
Participant 9 plans to assign members to group activities and reduce group size from six to three;
Participant 10 plans to give extra points for a group when each member achieves a standard, and to add exam wrappers;
Participant 11 plans to use exam wrappers and add pre-training work;
Participant 12 plans to add more application based questions structured around real-world problems;
Participant 13 plans to add a CCM activity and polling to check understanding;
Participant 14 plans to add more games;
Participant 15 no answer;
Participant 16 plans to give students expected learning outcomes before class.

Question 5: How do you envision POGIL and/or Team Based Learning being useful to you in your courses?

15 participants plan to use one or more of POGIL, TBL, iRAT, tRAT, or SCALE-UP activities or principles; 1 reported being unsure of TBL:

Participant 1 plans to add three POGIL or TBL activities;
Participant 2 plans to use peer review and some 4-S (brainstorming in group), maybe TBL, but not POGIL, not iRAT, not tRAT, not permanent teams because they become nonproductive;
Participant 3 plans to add TBL in class with preparation assigned before class;
Participant 4 plans to use POGIL or TBL for student discovery of new concepts and deep learning;
Participant 5 plans to use POGIL and TBL, designing questions in advance, maybe also iRAT and tRAT;
Participant 6 plans to use principles of TBL and POGIL to improve structure of

worksheets to guide students in a better sequence of thinking, but thinks RAT may not work in class of 50;
Participant 7 plans to add directed, convergent, and divergent questions; to progress from implement > explore > concept invention > deductive > application; and to organize students by GPA and rotate roles;
Participant 8 plans primarily POGIL but some TBL for small groups;
Participant 9 plans to shift from using POGIL as assessment to using it to build information, keep game style, and add convergent, but not divergent questions;
Participant 10 plans to use TBL and, after the activities, to return to talk about group answers;
Participant 11 plans to add TBL, but is not sure about iRAT and tRAT;
Participant 12 feels unsure about adding TBL activities due to quality needed in their design and may not be so useful for lower level classes;
Participant 13 plans to change vocabulary lists to crosswords, and add demonstrations and guided inquiry items;
Participant 14 plans to add POGIL teams and roles and have students stick better to the roles;
Participant 15 plans to use POGIL or TBL;
Participant 16 plans to use POGIL learning cycle to design questions and activities for TBL; also to use elements from SCALE UP.

Question 6: How do you see Problem Based Learning being useful in your course? Have you thought about a problem/project?

8 participants plan to apply PBL in their courses; 2 reported thinking of using PBL in different courses, e.g., upper level, not introductory; 1 reported plans to investigate the literature to consider PBL vs. CCM; 2 reported lack of clarity or uncertainty; 3 provided no answer.

Participant 1 plans to investigate literature and consider PBL vs. CCM;
Participant 2 reports PBL is unclear, seems similar to POGIL;
Participant 3 plans to apply PBL either by designing or finding and using existing activities;
Participant 4 plans small PBL teams;
Participant 5 plans many small PBL activities;
Participant 6 plans to use PBL structure and group grade bonus for all members achieving, or may use CCM or POGIL; plans to move lower-level learning outside of class time and raise pre-class preparation standards;
Participant 7 plans to use PBL by stating problem then introducing concept and guided application;
Participant 8 plans to increase use of PBL;
Participant 9 plans to add some PBL for motivation and add a POGIL activity;
Participant 10 no answer;
Participant 11 may use PBL in an upper level course;
Participant 12 no answer;
Participant 13 plans to add PBL to the repertoire;
Participant 14 uncertain about using PBL;
Participant 15 no answer;
Participant 16 plans to use PBL in a different course, not in this one.

Question 7: What questions do you have for alumni now that you have been through SPARCT? (collected on 3 x 5 card)

8 participants generated different questions; 2 offered no questions, but added comments about something learned during the academy; 6 offered no response.

Participant 1 no questions, but a statement of learning about IRB and SoTL and excitement about this year's SoTL project;
Participant 2 no response;
Participant 3 "Have you seen gains in student learning from your techniques?" "What was your largest concern in changing your class?"
Participant 4 "How did you identify a unit, concept, topic, etc. in your course that needed improvement (e.g., exam question grades, degree of student angst, etc.)?
Participant 5 "In what ways did you interact with IRB – help designing surveys, modifications to projects so they are better designed to meet SoTL goals and/or IRB confidentiality needs, other?" "How extensive and careful are you in designing classroom changes when they hyena is to judge them by SoTL standards…"—the participant added a longer statement about the cycle of making changes based on experience though all are not documented, and added "how much documentation, measurement, time and effort are required to turn those experiences into publishable (or conference-relatable) results?"
Participant 6 "What if any were unforeseen challenges in implementing their project?" "What if any were unforeseen joys/rewards in implementing their project?" "Were students excited to be part of research? Or did students have less confidence in your teaching?" "How did you assess effectiveness of change?" "How did you narrow down which evidence based practice to choose?" "To what extent did you change your class?" "What would you do differently?"
Participant 7 "What part of the learning/teaching experience are you analyzing?" "How do you plan to extract meaningful data from your classes? Survey? Data analysis?"
Participant 8 "Has anyone published (or is anyone in the process of preparation to publish) on the project they selected? If so, what kind of data did they report?"
Participant 9 no response;
Participant 10 no response;
Participant 11 "Developing and incorporating these active learning techniques into your course must have taken a lot of work, do you feel that the payoff was worth the effort?" "If you had to do this program over again what would you do differently?" "Did anyone present their projects to audiences outside of the FGCU community?"
Participant 12 no response;
Participant 13 no response, but comment on understanding option of PBL as a hook, rather then for the entire lesson;
Participant 14 no response;
Participant 15 no response;
Participant 16 "What types of new activities or assessments did you incorporate into your classes. What are/were the relative success of different types?"