Engineering Summer Camp for High School Students from Underserved Communities

T. Kunberger,[1] K. Csavina,[2] and L. Zidek[3]

Abstract – In the summer of 2012, the U. A. Whitaker College of Engineering at Florida Gulf Coast University hosted a week-long engineering summer camp for students from the rural underserved central Florida region. Forty high school students, mostly rising sophomores and juniors, from 10 high schools and 6 counties spent five days on the FGCU campus. The camp was designed to be highly interactive and contained four main types of activities: speed designs, discipline specific activities, broader impact activities, and a colossal challenge. This paper will present the general layout of the week-long program, as well as specifics for each type of activity. Results from pre and post Likert surveys from the students will be summarized as well as written feedback from the participants. Also included will be reflections from the organizers with respect to things to consider when planning and hosting such a program.

Keywords: summer camp, high school outreach, Rube Goldberg

BACKGROUND

The U. A. Whitaker College of Engineering hosted its first engineering camp for high school students this past June 2012. The Engineering Extravaganza Summer Challenge was developed and delivered by the authors with funding from the Heartland Educational Consortium, a partner in the FloridaLearns STEM Scholars [1] program, which was supported by the Race To the Top Fund. The week-long camp hosted 40 students from Heartland school districts with students from the following high schools: DeSoto, Moore Haven Jr/Sr High, Hardee, Clewiston, LaBelle, Avon Park, Lake Placid, Sebring, and Okeechobee's Freshman Campus and High School. All students participated with the STEM Scholars 2011-12 program and applied for participation through the Heartland Consortium for this Summer Challenge camp. The high school students stayed in campus dorms during the week for a full emersion in the campus experience.

The STEM-Scholars program was designed to address the gap in STEM education for gifted and talented students in Florida's small, rural schools. Aschbacher et al. indicate the experiences students have between 9th and 11th grade influence their desire and persistence in S(T)EM education [2]. In particular, this study found that interaction with people (family, teachers) in the S(T)EM fields promoted persistence in the pursuit of science based careers. Furthermore, the study indicated the breadth of the science exposure was also influential in this decision. The Sumer Challenge camp was one aspect of providing additional influential people and expanding the breadth of experiences for the students participating in the program. The model of hands on activities, tempered in a competitive design activity has been demonstrated to be an effective approach for attracting high school students to science and engineering careers [3].

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CAMP STRUCTURE AND ACTIVITIES

The summer camp highlighted the four disciplines of the engineering program at FGCU (Bioengineering, Civil, Environmental and Software Engineering) with half-day, discipline specific sessions filled with hands-on laboratory and design activities. Four different types of activities were incorporated into each day to create highly interactive activities with a focus on design and discipline specific labs; these activities were designated as speed designs, discipline specific activities, broader impact activities, and a colossal challenge. Speed designs were structured to challenge students to work as a team and think outside the box, as well as introduce students to the engineering design process. Discipline specific activities included an introduction to the specific engineering field and a number of activities focused on that discipline. A seminar on global engineering projects and two college student driven discussion panels on why engineering and why Florida Gulf Coast University were held as part of the broader impact activities. The overarching activity was a team colossal design challenge based on the Discovery Channel show "Unchained Reactions" and involved larger than life Rube Goldberg machines that encompassed large portions of a classroom. Students displayed their machines in motion on the last day with faculty mentors, students and parents watching from the side. A summary of the general camp schedule is presented in Table 1. Colored fields indicate activities within the same category. For example, speed designs are orange, colossal design challenge activities are blue, seminars and panels are in purple, discipline specific activities in green, and evening informal activities are pink.

Table 1: Engineering Extravaganza General Summer Camp Schedule

Time	*Monday*	*Tuesday*	*Wednesday*	*Thursday*	*Friday*
8:00-8:30		Breakfast	Breakfast	Breakfast	Breakfast
8:30-9:00		Marshmallow Design	Paper Airplane Design	Solar Oven Design	
9:00-10:45	Welcome & Pre Survey	Colossal Design Challenge	Colossal Design Challenge	Colossal Design Challenge	Colossal Design Set-up & Competition
10:45-11:00	Break	Break	Break	Break	
11:00-12:30	What is Engineering?	Colossal Design Challenge	Colossal Design Challenge	Colossal Design Challenge	Lunch & Closing Ceremony
12:30-1:15	Lunch	Lunch	Lunch	Lunch	
1:15-1:45	Maintain Your Brain	Global Engineering	Why Engineering?	Why FGCU?	
1:45-2:30	Intro to Bioengineering	Intro to Civil Engineering	Intro to Software Engineering	Intro to Environmental Engineering	
2:30-3:15	Slime Design Challenge	Surveying Lab	Software Engineering Lab	Water Quality Lab Tests	
3:15-3:30	Break	Break	Break	Break	
3:30-5:00	Bioengineering Lab Tours/Activities	Balsawood Bridge Design Challenge	Java Programming	Water Filtration System Design	
5:00-5:30	Bus to Dorms	Bus to Dorms	Bus to Dorms	Bus to Dorms	
5:30-6:30	Dinner	Dinner	Dinner	Dinner	
6:30-8:30	Game Night	Sport's Night	Pool Night	Game Night	

The faculty coordinators were assisted throughout the week by nine undergraduate engineering students who were available to the high school students for all activities. The faculty coordinators also enlisted three additional faculty members to help run the various labs and design activities in their disciplines. In addition, the Heartland Consortium sent four high school teachers as observers and chaperones for the evening activities. Parents of camp participants were invited to the Friday colossal design competition as well as the lunch and closing ceremony, where all participants were recognized for their involvement and presented with certificates of completion. Details for each type of activity are presented in the following sections.

Speed Designs

Speed designs were incorporated into each day as a fun and rapid activity to focus the students first thing in the morning before starting the Colossal Challenge (which will be discussed later in this paper). These activities were selected from various K12 resources available on the web. The activities usually required 15 minutes of directed, hands-on work from each team of four students and approximately 30 minutes to conduct the full activity with testing.

1. ***Maintain Your Brain***: Teams created a protective helmet for their model "head" – a water balloon. Students used any material provided at the front table, which included newspaper, scrap cloth material, string, rubber bands, Popsicle sticks, masking tape. Helmets could be no larger than 12" in diameter, and part of the balloon brain had to be exposed to prove that it "survived" impact from the drop test. At the end of 15 minutes, teams moved outdoors for the testing. One teammate went to the balcony, while the others went outside to check if their helmet "had what it takes" to protect the balloon brain.

2. ***Marshmallow Challenge***: Teams built the tallest freestanding structure in 18 minutes using provided material, including twenty (20) sticks of spaghetti, one yard each of masking tape and string, and one marshmallow (standard size – no mini or jumbo). The winning team was the one that had the tallest structure measured from the table top surface to the top of the marshmallow. The structure could not be suspended from a higher structure, like a chair, ceiling or chandelier, and the entire marshmallow had to be on top. This design challenge was developed by Tom Wujec, and is used for team building from kindergarten to adults [4]. This activity helped introduce students to ideas of prototyping and experimenting with design.

3. ***Paper Airplanes***: Each team member designed a paper airplane and had trial launches indoors to select the best design. Each team was then allowed to optimize the design and then test on an outdoor balcony. A large target area was masked on the ground and one person from each team launched from the balcony. Minimal material was required for this activity, and it was a great session to get students out of their chairs.

4. ***Solar Ovens***: Students created solar ovens out of pizza boxes, aluminum foil, plastic wrap, glue and black construction paper. This activity, detailed on Solar Town Kids' website [5], highlighted the discipline of the day, environmental engineering, and emphasized designs made with basic materials. Students assembled S'mores, placed them in the oven to "bake" outside, and enjoyed their creations after lunch.

Discipline Specific Activities

As noted in Table 1, afternoons on Monday through Thursday were dedicated to each of the specific engineering disciplines within the College of Engineering. Each afternoon began with an introductory presentation that provided general information on the types of activities and projects, prospects for jobs upon graduation and examples of interesting projects for the specific discipline. More extensive information, as well as relevant websites, was provided in handouts – with the goal of the presentation to be interactive as well as informative. The remainder of the time was split between laboratory activities and design challenges, both specific to the associated discipline, and detailed below.

Figure 1: Slime Lab

Bioengineering: Laboratory activities for Bioengineering consisted of a round-robin set of laboratory tours. The group was divided into 4 smaller groups and rotated through the research labs, with each group having the opportunity to engage with motion capture equipment, tensile testing equipment, EKG circuits and monitoring and a confocal microscopy demonstration. The design challenge was an introduction to cross polymerization through the creation of "slime" generated by mixing white glue and borax (Fig 1).

Figure 2: Balsawood Bridge Design

Civil Engineering: Civil Engineering lab activities exposed students to modern Surveying equipment (Total Stations) in groups of 5 with the challenge to survey a triangular lot and determine the accuracy of the analysis based on standard geometric properties. Participants constructed trusses out of balsawood for the design challenge portion of the afternoon (Fig 2). Balsa bridge design is a typical project in the sophomore level Engineering Mechanics course at Florida Gulf Coast University.

Software Engineering: The design challenge for software engineering consisted of identifying and correcting errors in stored data using simple colored patters to represent information and sorting network optimization using a "network" created from masking tape on the floor (Fig. 3). The laboratory activity introduced students to the basics of Java programming and was conducted in a computer classroom which allowed each student to independently code an introductory level program.

Figure 3: Network Activity

Environmental Engineering: Environmental activities focused on water quality with lab activities relating to the conduct of a jar test, a typical lab activity in the Fundamentals of Environmental Engineering course. The design challenge was the construction of a water filtration system utilizing coarse and fine sand, various sized gravel, and coffee filters to determine the effectiveness of the various materials on removing fine particles from the water (Fig. 4).

Figure 4: Water Filtration System

Broader Impact Activities

Broader impact activities were selected to help the high school students think about preparing for engineering and considering what engineering is like in an undergraduate program. The organizers felt this content would be best received from the undergraduate students, so all sessions were student panel driven by the undergraduate engineering students assisting with delivery of the program (Fig 5). These 30-minute activities were scheduled on the second, third and fourth day of the camp, and topics included how to prepare for college, what makes FGCU unique, and engineering from a global perspective. All three sessions were well received by the high school students with each session receiving over an average rating of 4.0 on a 5.0 Likert scale. These activities are summarized below:

1. ***How to Prepare to Enter Engineering****:* Objects of this session included students (1) understanding which high school courses would best prepare them to study engineering, (2) developing an understanding of the differences between high school and college, and (3) developing an action plan for college preparation. The undergraduate students on the panel were given a list of questions prior to the discussion and were provided 5 minutes each to summarize the answers to some or all of the questions. Some questions included:
   - During your first year in college, what were you most unprepared for?
   - What classes in high school were most beneficial to you when you started college?
   - What one thing do you wish someone would have told you before you started college?
   - Why did you pick engineering? How do you know engineering is right for you?

   After students commented on these questions, the high school students were encouraged to ask questions of their own and then to write five action items they would need to complete before entering college.
2. ***Why FGCU****:* Objects of this session included students (1) developing an understanding of the engineering programs at FGCU and (2) understand the differences between FGCU and other institutions. Again, this was an interactive session, engaging students through questions and answers with a panel of current FGCU engineering students. Some questions included:
   - Why did you decide to come to FGCU?
   - Have you gone to other colleges? Can you compare your other experiences to those at FGCU?
   - Do the professors really get to know you at FGCU?
   - Is the small class size annoying or intimidating?
   - What is your favorite/ lease favorite thing about FGCU?

High school students were encouraged to ask questions of their following the panels comments to the questions.

3. ***Global Engineering**:* This session was designed to highlight programs that currently offer international experiences e.g. Engineers Without Borders, Engineering World Health, and others. The session was designed for participants to (1) understand the global impact of engineering and (2) to consider student opportunities to become involved with engineering beyond our borders. The session opened with a video from PBS's Design Squad and included a discussion by students involved with Engineers Without Borders.

Colossal Challenge

Morning activities on Tuesday through Thursday were focused on the colossal design challenge. This activity was based on Discovery Channel's show *Unchained Reactions*, which provides two teams with a warehouse full of material and challenges them to create a larger-than-life Rube Goldberg conforming to a specified theme. Many camp participants were familiar with either the show or the concept of Rube Goldberg machines which facilitated an interactive discussion. On the first morning students were presented with both the requirements, as well as several milestones for the challenge as follows:

Requirements:

- Design seven links connecting eight stations (tables).
- All stations must be at a minimum spacing of 24 inches from each other.
- Two stations (one link) must have minimum 48 inch spacing.
- More than half of the spaces between links must be able to be walked between after construction and before testing.
- No human intervention should be required after the initial start of the first link.
- The chain should conclude with a grand finale.
- Upon completion of the colossal challenge the room should show no evidence of the challenge having taken place.

Milestones:

- By Tuesday at noon the team should have had a rough sketch of the entire chain of seven links.
- By Wednesday at 10 AM the team should have been able to successfully demonstrate the first link in their chain.
- By Thursday at 12:30 the complete chain should have been tested at least once.
- Final Demonstrations of completed chains occurred Friday morning (with limited time for set-up prior to testing).

Students were grouped in teams of 10, with two teams sharing a classroom which was divided down the center with rolling whiteboards. All teams were provided with the same set of supplies including items such as yarn, springs, pulleys, balls of various sizes and weights, rulers, blocks, balloons, rubber bands, bandanas, buckets, weights, paper, tubing, etc. In addition, on Thursday morning, in keeping with the pattern of *Unchained Reactions*, the teams were presented with a "missing link" that they were required to integrate into their design. For this particular challenge, the missing link was a wacky fun noodle, which teams ultimately utilized in 4 distinctly different approaches. In contrast to some of the more time limited and structured activities, the colossal challenge was a broader and more open ended event that challenged the creativity of the participants as well as allowing time for testing and redesign.

The culmination of the colossal design was the final day demonstrations, which were conducted on a team by team basis in front of all camp participants, as well as the families of participants. The excitement in the rooms was clearly evident, and can be seen in the related YouTube video [6].

Results and Assessment

A pre/post program survey was used to assess the effectiveness of the program. The high school students were asked to complete a pre-program survey at the beginning of the camp, prior to any camp activity. The same survey instrument was administered at the end of the program, following the final activity. Figure 5 and Table 2 depict the mean and standard deviation of 15 survey questions. As indicated, the high school students self-reported a better understanding in every category at the conclusion of the camp with the most significant gains in an understanding of engineering design and in each of the disciplines: bioengineering, civil engineering, environmental engineering and software engineering.

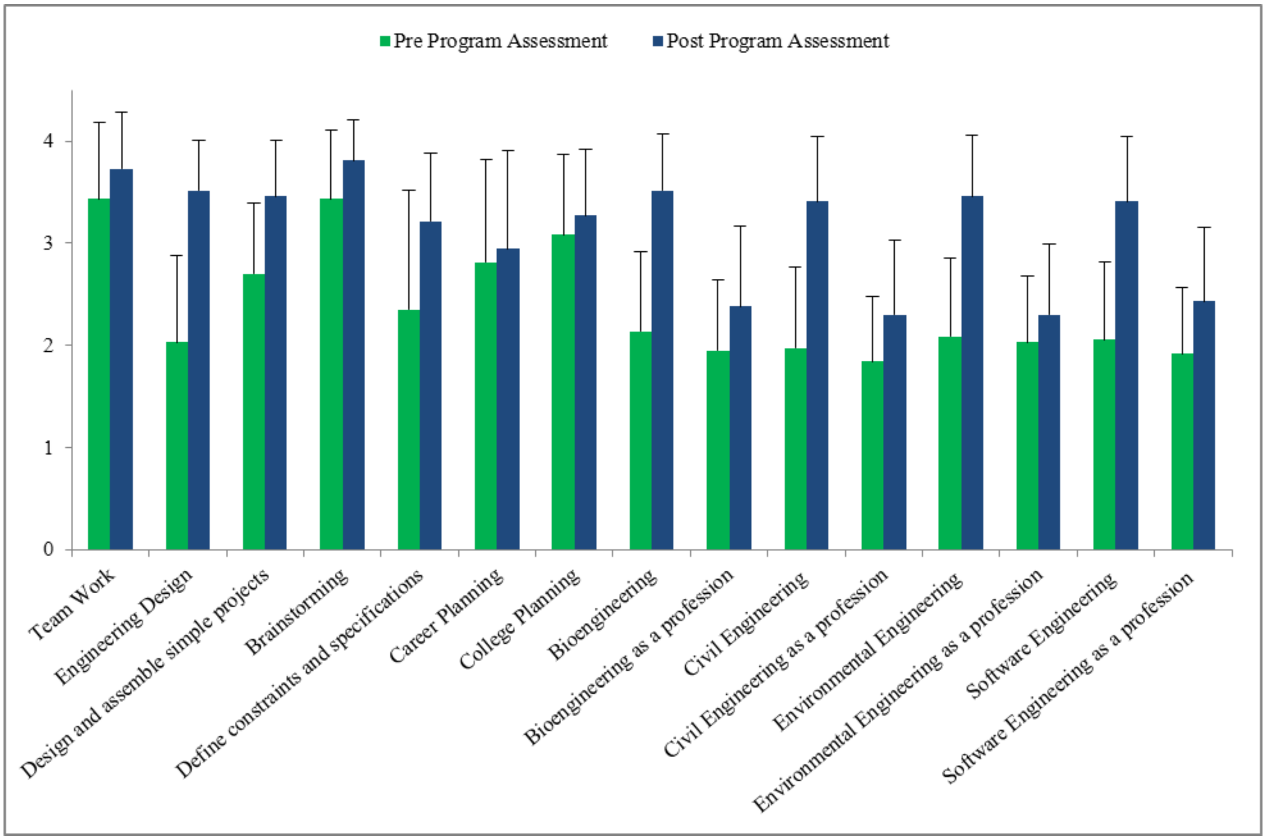

Figure 5: Pre and Post Assessment Survey Mean and Standard Deviation for Camp Activities (n=40)

An interesting observation was made regarding the standard deviation of survey responses. For the majority of the survey questions, the standard deviation was smaller in the post survey. Since the standard deviation is a measure of dispersion, the results indicate that not only did individual participants report a better understanding of the concepts, but the cohort also had less variation between the members. These results were inverse for each of the questions specific to the engineering disciplines as career options. When looking at the specific careers, the cohort had more variation post-camp than pre-camp. One explanation of this phenomenon is that the high school students were exposed to a career option for which they were unfamiliar; in exploring this career some of the students were inclined to further investigate the career possibilities and others learned the particular discipline was not of interest.

Table 2: Pre and Post Assessment Survey Mean and Standard Deviation Graphed in Figure 5

Questions about understanding of the Engineering disciplines & skills	**Pre-Camp Survey Average**	**Pre-Camp Survey Std Dev**	**Post-Camp Survey Average**	**Post-Camp Survey Std Dev**
Team Work	3.4	0.8	3.7	0.6
Engineering Design	2.0	0.9	3.5	0.5
Design and assemble simple projects	2.7	0.7	3.5	0.5

Brainstorming	3.4	0.7	3.8	0.4
Define constraints and specifications	2.4	1.2	3.2	0.7
Career Planning	2.8	1.0	2.9	1.0
College Planning	3.1	0.8	3.3	0.6
Bioengineering	2.1	0.8	3.5	0.6
Bioengineering as a profession	1.9	0.7	2.4	0.8
Civil Engineering	2.0	0.8	3.4	0.6
Civil Engineering as a profession	1.8	0.6	2.3	0.7
Environmental Engineering	2.1	0.8	3.5	0.6
Environmental Engineering as a profession	2.0	0.7	2.3	0.7
Software Engineering	2.1	0.8	3.4	0.6
Software Engineering as a profession	1.9	0.6	2.4	0.7

Likert Scale: Accomplished (4), Competent (3), Developing (2), Beginning (1) n=40

Table 3: Post Assessment Survey Mean Values of Camp Activities and Events

Average Rating	***Directions: Use the following scale to assess the various activities over the past week*** **(5) Excellent, (4) Good, (3) OK, (2) Not So Good, (1) Did not like**
3.8	Icebreaker – Engineer BINGO
4.1	Introduction to Engineering
4.7	Team building activity – team name sign holder
4.7	Speed Design – Maintain Your Brain (Balloon helmet)
4.3	Introduction to Bioengineering
4.6	Bioengineering Activity – Slime
4.3	Bioengineering Lab – EKG, Tensile Testing, Motion Capture, Confocal Microscope
4.1	Speed Design – Marshmallow Challenge
4.3	Introduction to Colossal Challenge – What is a Rube Goldberg Machine.
4.3	Colossal Design – Brainstorming session
4.6	Colossal Design
4.0	Professional Development – Global Engineering

4.1	Introduction to Civil Engineering
3.2	Civil Engineering Lab Activity - Surveying
3.1	Civil Engineering Design Activity – Balsawood Bridge
4.2	Speed Design – Paper Airplanes
4.2	Professional Development – Why Engineering
4.3	Introduction to Software Engineering
4.4	Software Engineering Activities – Algorithms & Hello World
4.6	Speed Design – Solar Ovens
4.4	Professional Development – Why FGCU
4.4	Introduction to Environmental Engineering
3.9	Environmental Engineering Lab Activities – Jar Test
4.0	Environmental Engineering Lab Activities – Water Filtration System
4.8	Speed Design – Solar Ovens
4.7	Colossal Design Competition - Friday
4.4	Meals (Breakfast / Lunch / Dinner)
4.5	Snacks (Morning & Afternoon)
4.5	Evening Activities
4.6	Dorm Rooms

REFLECTIONS FROM COORDINATORS

The following information is offered as a reflection on aspects that helped create a positive camp experience for the high school students. Attributes that contributed to the success were undergraduate student involvement, group size, the campus emersion, schedule and funding. The undergraduate engineering students were involved in each session throughout the day, which not only contributed to the high school students' engagement in the activities, but also assisted with logistics for the coordinators. Both high school students and teachers commented that they appreciated and enjoyed the assistance from the undergraduate students; in future assessments the survey will specifically query the undergraduate student impact on the camp experience. Logistically the coordinators and the assisting faculty would not have accomplished the speed designs, lab activities and design challenges without the assistance from the undergraduates. Most activities were conducted in groups of four, and with the time constraints on each session, shear man-power was needed to keep students on task and engaged. Two to six undergraduates were usually available for each activity and signed-up for times according to their summer class and work schedules. Some undergraduates participated one day while others participated each day. It was important to capture a list of students by mid-May to create the schedule, because some timeslots were sparse based on the summer class schedule. As compensation the undergraduates were provided meals during the day and a stipend of $10/hour. As an antidote to the undergraduate involvement, the engineering students enjoyed and appreciated the experience of assisting with the camp activities and interacting with the high school students. Future camps will query the undergraduates for their perceptions and recommendations.

Teams were configured for two group sizes. The colossal design was structured with ten students per team which resulted in four teams. This was somewhat of a logistics decision since the rooms reserved for the colossal design had to be available for the entire week for students to leave their "work in progress" each day. Two rooms, each divided by rolling white-boards, provided a half-room for teams to assemble their colossal design. All other activities were conducted in teams of four to ensure engagement by all high school students. These teams were compiled by the Heartland Consortium and were randomized among schools, rather than placing teams from a single school on one team.

Students appreciated the campus environment, and for several students this was the first time away from their family. Students and teachers were housed in university housing and enjoyed some of the recreational facilities including the volleyball and basketball courts and the aquatic center. While they did not have the opportunity to return to the dorms during the day, students enjoyed the evening hours for the social aspect. Engineering did not provide mentors during these hours; the teacher mentors served as the chaperones during this period, which alleviated costs that would otherwise be needed to pay chaperones.

The schedule of each day provided consistency for both the participants and those delivering the camp (see Table 1 for the week-long schedule). Students and teachers knew what to expect each day with speed designs, broader impact activities, discipline specific activities and the colossal design, all scheduled at the same time Tuesday through Thursday. Monday was slightly different with students arriving on campus that morning, and initial activities focused on introductions of participants, coordinators and undergraduate students. That afternoon began the first discipline specific session, so participants were familiar with the schedule by the end of the first day. This consistency in schedule provided a natural flow from one activity to another, and students knew when to expect meals and breaks.

Finally, the development and delivery of this program was funded by a $25K grant from the Heartland Consortium and the FloridaLearns STEM Scholars programs. The coordinators spent many hours developing the program and selecting appropriate activities for this five day program, and some of this funding was used to compensate the coordinators for their time dedicated to both development and delivery. The bulk of the money was used to fund the delivery of the program, including housing, food, supplies and stipends for students and assisting faculty. Future camps will be conducted in the traditional model of participants paying to participate in the camp, though the coordinators will likely seek some funding from local STEM partners in the community.

There are several logistics for faculty to consider if they do not have an events coordinator on campus. Planning started in earnest during the spring semester with all activities selected and summarized to include a materials list by early April. These planning documents were required by the Heartland Consortium; an example is provided in Appendix A. A spreadsheet documented materials, vendors, and estimates for each activity/day, and this was used to start purchasing material in May. Inexpensive, bulk materials were ordered through Oriental Trading Company or purchased from inexpensive supply stores like Dollar Tree. Typical construction material, mostly for the Colossal Design Challenge, was purchased at hardware stores. A week prior to the camp, coordinators organized all materials into large bins according to the day and/or activity. These bins were moved to the appropriate classrooms the night before each session.

Housing was contacted in spring to secure rooms, though timing of this is university dependent based on the extent of summer programs conducted on campus. Housing also helped secure rooms for dinner, which was eaten in a large common area at one of the dorms. A campus coordinator also provided contact information for campus catering, recreational activities, transportation (no buses ran on campus over the summer due to small student population), camp insurance and room reservation for all camp activities including the closing lunch. While room reservations were secured in March for the June camp, the other items were finalized in early June when participant numbers and undergraduate student help were confirmed. Campus catering set-up breakfast and lunch in a common area in the engineering building, and dinner was in the dorms. Logistically this worked well to ensure students were ready to start the morning sessions in the engineering building, and catering minimized the need to keep track of a large group that might otherwise need to walk across campus for food. Coordinators purchased all snacks, morning and afternoon, the previous week from Costco to help keep food cost at a minimal. Most of the details mentioned were finalized after the end of the spring semester, when typical academic constraints sometimes minimize faculty time. All coordinators of this summer camp had full teaching and academic loads during the spring planning time period, and all three met regularly during this development stage.

Of note, the coordinators were not responsible for accepting applications and selecting camp participants; this was administered by the Heartland Consortium. This is an obvious time commitment that must be considered from advertising the camp to structuring how applications will be submitted and reviewed.

Summary and Conclusions

The Engineering Extravaganza Summer Camp at FGCU engaged forty high school students in numerous engineering design activities over the course of a week and included both discipline specific as well as broader general engineering design activities. Participants worked in both small (teams of 4) as well as larger (teams of 10) groups with students from different high schools and assisted by undergraduate engineering majors from FGCU. Daily activities balanced speed designs with time for colossal challenge work, discipline specific activities, and informational sessions orchestrated to keep students active and engaged. Survey results suggest an overall positive response from participants, and anecdotal evidence from discussions with teachers, parents, and individuals from the Heartland Consortium support the positive nature of the event. Future plans are to refine the camp offering, develop a reasonable registration process (applications, fee structure, etc.) and open it to all high school students. Efforts will be made to obtain external funding to either partially support activities or provide scholarships to select student participants. On a more long term basis, the impact on camp attendance and enrollment in STEM (particularly engineering) majors in college as well as enrollment at FGCU will be investigated.

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Kristine R. Csavina

At the time of this summer camp and the initiation of this paper, Dr. Kristine Csavina was an Assistant Professor of Bioengineering in the U. A. Whitaker College of Engineering at Florida Gulf Coast University. Dr. Csavina received a Bachelor’s of Mechanical Engineering from University of Dayton and her Ph.D. in Bioengineering from Arizona State University. Her research interests range from motion analysis of human motion in movement disorders, orthopedics and sports to engineering education research in student learning, pedagogical approach, and K-12 outreach initiatives. Dr. Csavina recently joined the faculty of the Department of Engineering at Arizona State University Polytechnic campus, where she is the Associate Director for Engineering Program Innovation.

Lisa Zidek

Lisa A. Zidek is an Associate Professor in Bioengineering and the Academic Program Director at Florida Gulf Coast University. She received her Ph.D. in Industrial Engineering Health Care Management from the University of Wisconsin Her research interests are in engineering education, with particular emphasis on engineering entrepreneurship and K-12 STEM outreach initiatives.