
AC 2012-3640: SUMMER BRIDGE TO COMMUNITY COLLEGE PROGRAMS EMPHASIZING ENGINEERING AND TECHNOLOGY

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Summer Bridge Programs Emphasizing Engineering and Technology at a Community College

Abstract:

In an attempt to ease the transition to Science, Technology, Engineering and Mathematics (STEM) programs at the NECC and “bridge” a perceived gap between pre-college and college, a short, intense four-day program called a summer bridge program was instituted at a NECC. Four such programs were held at Northern Essex Community College (NECC) in August of 2008, 2009, 2010 and 2011. All four days of each summer bridge program were organized around the theme of the generation of electricity from renewable sources and provided an introduction to engineering design and green technology while emphasizing the centrality of applied mathematics. Participants explored the technology and engineering of alternative energy systems with hands-on activities that concentrated on Wind and Solar Power design projects. Also, energy conservation and efficiency and carbon footprints were covered.

Students in these bridge programs were selected from new applicants to NECC or students already enrolled at NECC that had accumulated fewer than 15 credits and were enrolled in developmental mathematics courses.

Pre and post-surveys of student attitudes toward engineering were administered in 2009, 2010 and 2010 and an independent evaluator was employed to analyze and report on the results. A summary of the reports from the independent evaluator is included in the paper.

An extensive tracking of the participants in all four summer bridge programs was conducted internally by NECC and comparisons as to choice of major and subsequent success in mathematics courses were made to similar students at NECC who did not participate in the summer bridge programs. These findings are also reported in the paper.

The paper concludes with modifications to the summer bridge program planned for 2012 in response to the results of the first four years.

Summer Bridge Program- Introduction

This paper describes the Summer Bridge Programs (SBP) designed to ease the transition to the programs in various Science, Technology, Engineering and Mathematics (STEM) fields at NECC. The four-day SBPs were held in August of 2008, 2009, 2010 and 2011. All four SBPs were funded by the National Science Foundation through a grant to Northeastern University in partnership with NECC. The SBP was meant to encourage new STEM students to embrace STEM careers as well as to improve retention at NECC. The hands-on activities allowed participants to apply mathematics to technical problems and to experience how engineering and mathematical skills are used within STEM majors. "Hands-on and learning by experience are powerful ideas, and we know that engaging students actively and thoughtfully in their studies pays off in better learning."¹ Participants explored alternative energy systems with hands-on activities that concentrated on wind and solar power design projects.

Instructional Team

The Program Director was a former full-time faculty member at NECC with BSEE and MSEE degrees who had taught computer and electronic engineering as well as mathematics through Calculus II.

Two full-time engineering faculty members taught the four SBPs. Both NECC faculty members were electrical engineers experienced in teaching electronic technology and electrical engineering courses as well as college-level mathematics courses. One had earned a BS and an MSEE; the other, a woman, had earned a BSEE and an MS in Applied Mathematics.

In all SBPs, peer mentors engaged with the program participants and supported the engineering faculty in the classroom and lead engineering lab activities. The peer mentors in all four SBPs were provided with stipends for their assistance. The peer mentors provided feedback and support in specific projects and provided insight about what they had learned in these lab activities. The participants found the answers they needed to many of their questions or concerns from the mentors. Peer mentors discussed work experiences and/or projects with which they had been involved and shared how this had impacted their career goals.

Summer Bridge Description

All four days of each SBP were organized around the theme of the generation of electricity from renewable sources and provided an introduction to engineering design and green technology while emphasizing the centrality of applied mathematics. Energy conservation, efficiency and carbon footprints were also covered. Participants explored how simple lifestyle changes could reduce their monthly and annual household output of CO₂. Participants learned how to calculate CO₂ footprints with a carbon calculator and they also learned how carbon offsets, like using a renewable energy source, can reduce the carbon footprint.

All four SBPs were organized and delivered using Blackboard, the NECC's distance learning system. All lecture notes, assignments, and required readings were provided on-line. Participants submitted assignments on-line and completed pre- and post-surveys on-line as well.

The SBP met from 9AM – 3PM each day for four days. Each participant received access to all resources provided in Blackboard, including online PowerPoints, green technology materials, web links, and many other online resources. Participants also received a book on carbon footprints called “Low Carbon Diet, A 30 Day Program to Lose 5000 Pounds.”² This book provides global awareness and concepts for all who aspire to a greener society.

Enrollment was limited to 20 participants and preference was given to new and returning NECC engineering and technology students with fewer than 15 earned credits. Each participant received a \$25 per day stipend during the SBP of 2008 and 2009 (\$100 total for attending all four days) and during the SBP of 2010 and 2011 stipends increased to \$40 per day (\$160 total for attending all four days) in hopes of attracting more participants. Participants also enjoyed a complimentary lunch on all four days of the SBP activities. Descriptions of the four days' activities of each of the Summer Bridge programs may be found in the Appendix.

Synopsis Summer Bridge Coursework and Activities

From an ancient Chinese proverb: “I hear and I forget, I see and I remember, I do and I understand.”

On the first day of the four-day program, the instructors welcomed participants and introduced some hands-on critical thinking puzzles. The puzzles required group interaction which serves to quickly break the ice for students. After the group activity was completed, an overview of the program was presented using Blackboard. A hands-on tutorial on navigating Blackboard was conducted. A pre-test was administered to provide a baseline of participant knowledge of topics that would be covered in the SBP. After the pre-test, the engineering design process was introduced and discussed. The participants' first activity was to create a basic type of DC circuit that included a small light bulb. Following the Ohm's Law and Watt's Law activity, the participants built both series and parallel DC electric circuits using batteries and electrical loads mounted on bases which snapped together. The students were asked to put the experimental data into tables and provide graphs of voltage vs. current. Once all the electric circuit activities were finished, time was dedicated to reflecting on material learned and discussing the engineering connection to the activities.

On the second day, a design project to follow-up the energy and power activity, the students, working in pairs, calculated the carbon footprint of a modern kitchen. Students designed their kitchen by choosing the electric appliances they wanted and the kitchen's lighting scheme. After the cost of electricity was calculated, students calculated the amount of CO₂ emitted into the atmosphere due to the energy consumption of the kitchen. Students could research, by their zip code, the amount of carbon released per kilowatt-hour of energy consumed. Students were asked to postulate alternate energy resources to offset the CO₂ emitted. The students dedicated some time to reflecting upon and discussing feelings (negative and positive) that people may have about conserving electrical energy.

On the third day, once energy costs, consumption, storage, distribution and the carbon footprint relationship were covered, the course shifted to the possibilities of using alternate energy sources. To explore wind power, the students constructed a basic vertical axis wind generator based upon the Savonius design by mounting two half cylinders on a vertical shaft. It was simple to build and could accept wind from any direction. This was a simple and efficient way to generate electricity. Also, this was the same basic principle used in almost all turbines, even large-scale commercial ones. The hands-on activity followed, and a discussion around how to make practical use of the electricity created by wind turbines ensued.

On the last day, students devoted their time to solar energy. Photovoltaic cells were introduced to the class with a discussion on how the cells converted solar energy into useable electricity. Terms such as solar PV cells, modules, panels and arrays were also discussed. The participants conducted hands-on activities with photovoltaic cells. Outside, they measured and calculated voltage, current and power of circuits with cells in parallel and/or series combinations. With the data they gathered from their outside solar experiments, the students designed a photovoltaic system using the lab PV cells that produced enough DC electricity to run a DC refrigerator. The refrigerator's power and voltage specifications were provided or could be researched on the

internet. The design had to take into consideration the combination of parallel and series source circuits. In addition, the numbers of PV cells and total surface area had to be calculated.

As the program neared completion, the students, working in groups of three or four, developed a plan for a low carbon emission diet. Students simulated that they were living in one house under one roof, or they could simulate living in their own house with the group members as neighbors. Students calculated the carbon footprint for their simulated homes by taking a room-by-room inventory of all items that consumed electricity. Students drew from their real-life situations to help with this exercise. They looked at their driving patterns, the heating of their homes and examined their basic life style. Once students had an understanding of their yearly carbon footprint, they developed a strategy to reduce their carbon emission. This reduction could be achieved through efficiency, introduction of alternate energy sources, procuring carbon credits, etc. The course ended with students presenting their low carbon emission diet plan.

Outside Evaluator's Report on the Summer Bridge Program

An outside evaluator conducted an attitudinal survey of the participants in the SBP for the years 2009-2011 using a survey instrument that had been developed and pilot-tested at a major university. The survey had been administered to various groups of students of college and pre-college age over a number of years and tested for reliability and validity by both the university and the outside evaluator.

The following table summarizes the number of SBP participants in the survey.

Table 1: Number of Participants by Cohort

Year	Frequency	Percent	Cumulative Percent
2009	14	40.0	40.0
2010	8	22.9	62.9
2011	13	37.1	100
Total	35	100	

The following table shows the 20 items on the attitudinal survey.

Table 2: Pre-Post by Item

Item	Pre	Post
1. I do my college work as well as my classmates.		
2. I am good at solving problems in mathematics.		
3. I am good at solving problems in science.		
4. I use computers as well as my classmates.		

5. I am good at working with others in small groups.		
6. I like being a student at my college.		
7. Being a student at my college is important to me.		
8. I make friends easily at my college.		
9. The professors at my college want me to do well in my college work.		
10. Engineers solve problems that help people.		
11. Engineers work in teams.		
12. Engineers design everything around us.		
13. There is more than one type of engineer.		
14. Engineers use mathematics.		
15. Engineers use science		
16. Engineers are creative.		
17. When I graduate I want to be an engineer.		
18. When I graduate I want to solve problems that help people.		
19. When I graduate I want to design different things.		
20. When I graduate I want to work on a team with engineers.		

Scale: 1=I strongly disagree; 2=I disagree; 3=I agree; 4=I strongly agree

Items 1-5 of the survey instrument measured changes in student attitudes toward academics; questions 6-9 measured changes in attitude toward college; items 10-16 measured student attitudes toward the occupation of engineering, and items 17-20 measured the aspirations of respondents to pursue a career in engineering.

Table 3: Summarized Pre-Post Change for 2009-2011³

	Mean	Std. Deviation	Effect Size
Pre Academics	16.27	2.72	0.18
Post Academics*	17.24	3.17	
Pre College	13.18	2.53	0.15
Post College*	14.00	2.45	
Pre Occupation of Engineering	24.06	5.03	0.15
Post_ Occupation of Engineering *	25.44	4.41	
Pre Aspirations to Career in Engineering	12.64	3.01	0.03
Post Aspirations to Career in Engineering	12.97	3.08	
Pre Total	67.69	10.44	0.12
Post Total*	69.75	12.07	

*Significant at $p < .05$ (paired samples t test)

When the evaluator focused on the pattern of pre-post gains, the evaluator “found no significant ... differences between the three years of the program,” and observed “that no matter what the incoming attitudes of the students were, the program was able to engender attitudinal improvements, and while the improvements were of a modest magnitude, they were commensurate with the duration of the treatment [SBP].”⁴

In looking at Table 3, it is apparent that the greatest gains were in student attitudes toward academics, college and the occupation of engineer, and the smallest gain was in aspirations to become an engineer. Although the size of the gains was judged to be modest by the evaluator (based on eta-squared values), the evaluator noted that “this is probably a reasonably good outcome given the very short duration of the period between the pre- and post-test.”⁵

Tracking of Participants

Tracking the participants in the 2008 – 2010 SBP was an arduous task; however the data below supports the reality: a lack of female participants in the SBP. Five female participants only represented 19% of the total population. On the other hand, eighteen white males represented 67%, while the nine male minority population represented only about 33% (about half of the white males). The average age was approximately 29 years, with the overall range being 18 – 55 years. The average earned hours worked out to be 26; transfer credit included, and the average GPA was 2.919.

Table 4: Participants in the 2008-2010 Summer Bridge Programs

Age	Gender	Race	Major Designation	Admit Term	GPA	Earned Hrs
51	M	WHT	Computer Forensics Basic Certificate	200909	3.609	78
51	M	WHT	Computer Information Science: Information Technology (CIS: IT)	201001	3	76
37	F	WHT	Business Mgt: Computer Applications	201001	3.2	70
20	M	WHT	Electronic Technology	201009	3.746	26
38	M	HSP	Laboratory Science	201009	1.628	27
55	F	WHT	Liberal Arts: Writing	201009	3.445	29
23	M	HSP	Electronic Technology	201005	3.546	57
21	M	HSP	Electronic Technology	200809	2.057	19
22	M	WHT	Electronic Technology	200909	2.607	37
23	M	WHT	Engineering Science	201009	2.496	24
44	M	WHT	Computer Forensics Basic Certificate	201001	3.063	16
22	M	UNK	Electronic Technology	200801	2.131	64
22	F	HSP	Engineering Science	200901	2.7	30
33	F	WHT	Liberal Arts	200809	4	35
23	M	HAW	Engineering Science	201009	4	7
19	M	WHT	CIS: IT	200909	2.487	36
19	M	HSP	Liberal Arts: Biology	201009	3.396	27
18	M	WHT	Engineering Science	201009	3.665	20
46	M	WHT	Electronic Equipment Tech Cert	201001	2.138	13
44	F	WHT	Engineering Science	SBP 2008	3.94	87
25	M	WHT	Engineering Science & CIS: IT	SBP 2008	3.6	26
21	M	HSP	Engineering Science & CIS: IT	SBP 2008	2.66	71
20	M	BLK	CIS: IT	SBP 2008	2.58	35
19	M	WHT	Engineering Science & CIS: IT, switched to Criminal Justice	SBP 2008	4	3
18	M	WHT	Engineering Science & CIS: IT	SBP 2008	2.45	7
20	M	WHT	Engineering Science & CIS: IT	SBP 2008	2.93	15

Only two female participants out of five declared STEM majors, while twenty males out of twenty-two did so. This research also exposes the harsh reality of the lack of female STEM majors, especially in engineering. Hopefully, with the continuation and support of the SBP and through enhanced recruitment, these numbers will move upward. In Donna Milgram's report on "Gender Differences in Learning Style Specific to Science, Technology, Engineering and Math (STEM)," Tech Equity Project of California State University, Channel Islands⁶, there is strong evidence of the differences in female and male learning styles and she provides suggestions for appealing to female interests which are discussed in the conclusion of the paper.

Table 5: STEM Majors from SBP

NECC	SBP participants- 2008 - 2010	STEM Majors- 2008 - 2010	Percentage of STEM Majors -2008 - 2010
Total	27	22	81.5%
Female	5	2	40%
Male	22	20	90.9%

In the 2011 SBP, the female participant population increased; however, none of the 2011 participants were STEM majors. There were five female participants in the 2011 SBP, while in the past there was only one in the 2008 SBP, three in the 2009, and one in the 2010 SBP. The promotion of green technology is increasing throughout the campus. NECC has taken initiatives to become a greener campus and it is reflected in the increase of participants in the SBP as well as female participants who are not majoring in STEM.

Success Stories

The SBP has had significant success stories, including a female engineering student named Donna. Donna was a participant in the 2008 SBP. She was featured in the local paper as a successful engineering student. Since then Donna completed her Engineering Science degree at NECC in the summer of 2009, and has been accepted to a four-year university as a Chemical/Nuclear Engineering student. She plans to graduate in 2012. She still spends much of her free time at the college resource center helping STEM students in math (especially Calculus through Differential Equations), chemistry, biology, and engineering. She is one of several success stories of the SBP.

Donna started in a Basic Algebra II class in her first semester, and can be considered a success from several perspectives. She proved to be a very quick study in learning the concepts of algebra, her critical thinking skills were superb, and she received excellent marks on all of her assignments. Donna immersed herself into her assigned projects wholeheartedly, and showed

every sign of having real talent in a STEM career, especially engineering. At this time, a female engineering/math professor noticed her natural ability and outstanding aptitude in mathematics and encouraged Donna to use her mathematical skills in a different major. After having an in-depth conversation with her professor, Donna decided to change her major from psychology to engineering science.

Donna spent most of her time learning, studying and tutoring while at NECC. She also dedicated her time to extracurricular activities where she became a well - rounded individual. Examples include Finally Friday's, Women's Resource Network Book Group, and the Women Returning to School Information Fair, for which she was a student speaker. She worked tirelessly in the Leadership Development Program which included seminars on how to become an independent and professional engineer. Donna spent over 30 hours a week in a difficult engineering program. This effort required dedication and determination. She carried a full course load, and volunteered time in the Math Lab where she was asked to become a Supplemental Instruction Leader (SI). (SI provides peer-facilitated study sessions led by competent undergraduate SI leaders who attend classes with students and encourage students to practice and discuss course material concepts in a series of review sessions. Sessions are open to all students who are enrolled in the course and want to improve their understanding of the material, as well as improve their grades.) Unlike many students who are not sure which field to pursue, Donna has made clear to all of us that her goal is to become an engineer.

Justin I. started at NECC in the fall of 2007. After graduating from a local technical high school, he was very interested in electronics and wanted to pursue a career in this field. Despite his great enthusiasm for electronics and circuit analysis, Justin struggled with the college course work and did not do well during his first semester. Justin took four courses and received letter grades of below "C", including an "F" in mathematics. Justin decided not to enroll in courses for the spring of 2008; however, he kept in contact with one of the authors of this paper and visited the instructor's classroom during the spring semester.

During the semester conversations with Justin, the instructor invited him to participate in the 2008 Summer Bridge Program, (SBP). Justin accepted the invitation, enrolled in the program and excelled throughout the SBP. In fact, he became one of the classroom leaders. Justin's strong performance may have been the result of less rigorous course work during SBP as well as the emphasis on learning through hands-on activities which seems to be a better match for Justin's learning style.

After successfully completing the SBP, Justin found a job with a local solar power company. Enrolling in the SBP helped Justin obtain the position, and he thrived at this company where he also took advantage of opportunities to go to the west coast several times for additional training in solar energy and systems. After two years there, Justin became a victim of the shrinking US economy and entered the ranks of the unemployed.

In the spring of 2010, Justin came back to NECC a very changed student. He received an "A" in the same math class taught by the same instructor which he failed in the fall of 2007. Also, Justin received excellent grades in both his electronics and circuit classes during 2010.

The instructor who invited Justin to participate in SBP in 2008 saw him in the hallways of a large local defense contractor in the fall 2011. Justin had found a job at the manufacturing plant as an assembler of missile parts, and informed the instructor that he was interested in pursuing a test/trouble-shoot position in the company. The instructor, knowing the company's program in detail, informed Justin that the interview exam for the test/trouble shoot position was difficult and that many people had been known to fail and advised Justin to study hard for the interview test. A month later the instructor spoke with Justin and was happy to learn that Justin had passed the exam and was now a tester/troubleshooter for the company. This promotion is a huge accomplishment for anyone, but especially significant when knowing the struggling origins of Justin's educational experience. Justin is now at NECC finishing up his Associate's Degree in Electronic Technology while working full time. With this degree, he will be well-prepared for continued advancement in his chosen career.

Another student, Justin S. was a participant in the 2009 SBP. In the summer of 2010, he graduated from the college with an Associate's degree in Electronic Engineering Technology. Justin is currently finishing his electronic technology education at a four-year university.

Wascar was a participant in the 2009 SBP and is also an outstanding student. He started in an ESL class in 2008 at NECC. Since then he has taken Fundamentals of Digital Logic and Lab, College Algebra and Trigonometry, and Circuit Analysis II with one of the authors of this paper and has earned 57 credits in Electronic Technology with a 3.546 grade point average.

Conclusions and Recommendations for Summer Bridge 2012

Female recruiting should be improved in order to enroll more new incoming STEM students, especially females, in the Summer Bridge program. The lack of female STEM majors is an ongoing issue nationwide. Female faculty in engineering can serve as living examples in recruiting women and share their unique science and engineering learning experience. Educating students in technical disciplines through hands-on learning, classroom training, pragmatic work experience and real-world problem-solving are viable strategies to attract female students to the SBP as well as STEM careers. In hopes of attracting more female students, there is also a need to change the perception and confidence level among women.^{6,7}

Working in groups can inspire and generate enthusiasm in engineering students, especially females. This strategy will help provide female students with the opportunity to gain experience with STEM in a supportive setting and increase their level of confidence. The number of engineering students recruited has been low and the number of female engineering students even lower. Best practices for overall recruitment involve faculty visiting local high schools, presenting at career fairs using engaging engineering activities, facilitating engineering and technology workshops, recruiting within STEM programs, and recruiting through college-wide broadcast emails. Future classroom visits to STEM students in related majors are of vital importance as they will build stronger ties and create a welcoming atmosphere between student and faculty. Active recruiting, mentoring, and increasing female faculty role models is central to attracting more female students.

Advertising the summer bridge program to all new incoming college STEM students must be improved. The advising center is the face of the college and handles assessment, placement, and scheduling for all new and returning students. Twenty participants each summer has been the target for the SBP, and 16 – 20 have been accepted each summer. However, on average, only 11 students have been present on the first day of the program. A strong partnership with the Advising Center is crucial for the continued success of the Summer Bridge program. Summer Bridge flyers will be furnished to all the advisors in the Advising Center and will be made more readily available at the traditional and online semester registrations for the spring and summer sessions. The flyers will also be included in faculty advising packets on both campuses and be available in Academic Advising Center.

As supported by the outside evaluator's findings in the 2009, 2010, and 2011 SBP, the hands-on lab activities were valued by participants of the SBP. Many of the typical STEM hands-on lab activities are good; but some typical activities, such as activities that involve weapons, robots and very fast automobiles appeal more to male interests than female interests.⁶ There is a need to improve the effectiveness of lab activities to accommodate the diversity among the students served by the recruitment program. Women show interest in technologies that help people in everyday situations and solve real-life problems. Consequently, the program would be well advised to include the environmental and social objectives of engineering and technology along with the technical ones.⁸ New projects could be proposed and implemented in order to attract and retain more female students, projects that focus on design or communication that are socially relevant,⁷ such as finding solutions to clean up the gulf oil spill in 2011.

With the addition of enhanced hands-on projects and activities, all participants are better able to grasp basic engineering principles. The SBP allows participants to ask questions and discuss issues informally. Participants who are engaged with such labs and activities are empowered in their own learning process. Hands-on learning in the SBP engages participants who are either not as scholastically gifted or have not shown curiosity in this field and stimulates them to engage and ultimately absorb knowledge that they would not get from traditional didactic presentation methods. Hands-on activities are preferred over didactic presentations when relating what engineering is because participants in hands-on activities seem to develop their critical thinking skills as well as learn basic engineering concepts⁹. Many female students, when seeking careers that help other never consider engineering as a career pathway.⁸ The hope of the SBP is that through meaningful hands-on activities, students will acquire knowledge and find a personal connection with STEM that will lead them to become future engineers. This type of inquiry-based discovery stays with students throughout their college experience.

The summer bridge program should be expanded by 25% to increase knowledge and hands-on engineering activities. This suggestion has been proposed every year by faculty and participants; however, the increased funding required is a major stumbling block.

In the SBP surveys, participants who were enrolled in the SBP found a greater connection between applied math and engineering in relation to alternative energy systems and Green Technology, even though aspirations to become an engineer did not vary much after the four-day experience. The students nevertheless seemed to have received real benefits from their participation, both in terms of their own studies and more generally their overall appreciation for

the work of engineers. For all participants the experience proved to be positive because the introduction to engineering professors and other STEM students helped ease the participants' transition to the college. Participants created a positive personal connection to other students and discovered the importance of peer support within the NECC environment.

Creating an engineering club for women would seem to promote retention and higher graduation rates. This club would provide a strong social network for female engineers as well as create mentoring opportunities between first year and higher level engineering students. "They [engineering clubs] provide advocacy for women, meeting places (both literal and figurative) for students seeking contact with one another, and mentors, internships, and social and academic activities and resources for women across the board."¹⁰

Judging from the positive impact the SBP and STEM programs have already produced, including the unanticipated tangential side-effects delineated in this paper, it would certainly be advisable to continue to recruit for, develop and work with these programs and this population and use the knowledge and insight gained from being involved in the program the past four years. By implementing the aforementioned recommendations in 2012, enrollments in the SBP and in engineering, including growing the female involvement, are likely to increase significantly.

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Appendix: Syllabi for the 2008-2011 Summer Bridge Programs

Summer 2008 Bridge to Alternative Energy Engineering

Day 1:

1. Pretest
2. Technology and Engineering
3. Engineering & Scientific notation
4. Light Bulb Experiment
5. DC Circuits, SNAP Circuits and Digital Logic
6. Multisym
7. Review Wind Turbine Projects- Check parts list

Day 2:

1. Photovoltaic Cells
2. Fundamentals of AC electricity
3. Sine wave, Period, Frequency and Amplitude
4. How AC electricity is made
5. Wind Turbine Construction

Day 3:

1. Wind Turbine Construction (cont.)
2. Testing Wind Turbine

Day 4:

1. Carbon Footprint of a Modern Kitchen
2. Post Test

Summer 2009 Bridge to Green Technology Engineering

Day 1:

1. Pretest
2. Technology and Engineering
3. Engineering & Scientific notation
4. Introduction to DC Circuits,
5. SNAP Circuits and Multisym
6. Greenhouse effect and history of burning fossil fuels

Day 2:

1. Energy and power Relationship (Potential vs. Kinetic Energy)
2. Renewable Energy
3. Wind power
4. Solar energy
5. Save by the Sun - DVD Video
6. Mixed Bag - Article Assignment
7. Savonius Wind Turbine Project

Day 3:

1. Testing a Wind Turbine
2. Fundamentals of AC Electricity and Generation
3. Sine Wave, Period, Frequency, and Amplitude
4. Photovoltaic Cells

5. Energy Calculation, Efficiency, and Conservation

Day 4:

1. Carbon Footprint Calculations
2. Post Test

Summer 2010 Bridge to Green Technology Engineering

Day 1

1. Pretest
2. Technology and Engineering
3. Story of Stuff Project – Video
4. Engineering and Scientific Mathematical Notation
5. Introduction to DC Circuits
 - 5.1 Light Bulb Experiment
 - 5.2 Ohm's Law
6. SNAP Circuits and MultiSym
7. Tesla – Master of Light Video
8. Fundamentals of AC Electricity and Generation

Day 2

1. Savonius Wind Turbine Project
2. Wind Energy
3. Solar Energy
4. Photovoltaic/ Solar Cells

Day 3

1. Testing a Wind Turbine
2. Fundamentals of AC Electricity and Generation
3. Sine Wave, Period, Frequency, and Amplitude
4. Photovoltaic Cells
5. Energy Calculation, Efficiency, and Conservation

Day 4

1. Geothermal article
2. Solar Cooker
3. Science of Electricity
4. Electricity in the U.S.
5. How Fuel Cells Work
6. Sustainable Minds
7. Post Test

Summer 2011 Summer Bridge to Green Technology

Day 1

1. Pretest
2. Introduction to DC Circuits
3. SNAP Circuits and Multisym
4. Tesla- Master of Light Video
5. Tesla questions.pdf
6. Fundamentals of AC Electricity and Generation
7. Reverse Engineering Design Analysis

8. Technology and Engineering
9. Story of Stuff Project – Video
10. Engineering and Scientific Mathematical Notation

Day 2

1. Greenhouse effect and History of Burning Fossils
2. What is Energy?
3. Carbon footprint Calculations
4. Carbon Kitchen Calculations
5. Heat: Frontline- PBS Video

Day 3

1. Science of Electricity
2. Electricity in the U.S.
3. Energy in the U.S.
4. Savonius Wind Turbine Project
5. Wind Energy

Day 4

1. Solar Energy Basics
2. Photovoltaic/Solar Cells
3. Geothermal article
4. How Fuel Cells Work
5. Sustainable Minds
6. Post Test