Engaging and Teaching through Service Learning

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Central Connecticut State University
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History

• Launched in 2013 as a service-learning project for students in an Introduction to Engineering course.

• Students refurbished used wheelchairs for donation to Chariots of Hope, a local non-profit whose mission is to provide mobility to confined individuals at no cost.
The “Puzzle Pieces”

- ITBD
- IMRP
- School of Engineering, Science & Technology
- Office of Community Engagement
- Student Government
- Alumni Foundation

CHARIOTS of HOPE

NEAT
An Oak Hill Center

ccsu C.A.R.E.S.
Collaboration for Assistive Resources, Equipment and Services
Achievements

• Over the past four years, more than 100 students from a wide range of majors have helped refurbish wheelchairs.

• Approximately 10 wheelchairs have been refurbished per academic year.

• The student government donated 20 new wheelchairs to the project.
Highlights
Highlights
“His name is Renaud Joseph, 23 years old. He became paraplegic after a bad moto accident, which happens very often here. A week later (had to wait for visiting team to arrive, neurosurgery isn’t available in Haiti), his spine was surgically stabilized and he was later transferred to the rehab ward. After 3 months, he has bulked up and is now independent with his functional mobility and his bowel/bladder care (after spinal cord injury you lose control of these functions). We’re so happy that he’ll be going home at the end of the week and be reunited with his extended family and his wife and 4-year-old daughter.

In the picture is Jude Colas, one of our team’s rehab educators. The wheelchair will really allow Renaud to be more independent, mobile, and have a sense of dignity as he reintegrates into his community. I asked him if it was okay if we took a picture and the reason behind it. He happily said ‘no problem,’ smiled and told me to tell the person who gave the chair, ‘thank you!’”
Students Solving Real-World Problems

• For some children with special needs, independent mobility can only be achieved when assistive technologies, such as a power wheelchair, are available, which is rarely the case before the age of three (Guerette, Tefft., & Furumasu, 2005).

• This immobility takes a tremendous toll, not only in terms of motor skills but on a child’s intellectual, social, and emotional development.
Go Baby Go!

- To reduce the number of children negatively impacted by immobility, researchers at the University of Delaware founded “Go Baby Go!,” a program designed to allow children with special needs to move independently by modifying toy ride-on cars that are both affordable and readily available.
Go Baby Go!

• In April 2015, CCSU C.A.R.E.S. expanded its offerings by launching “Go Baby Go!”

• This new venture brought faculty and students from across campus together for a hands-on workshop during which they adapted toy ride-on cars for children with special needs.
The Power to Move

- Most recently, Go Baby Go! was incorporated into a weeklong summer program for middle and high school students called “The Power to Move”
- Developed collaboratively by faculty members from technology and engineering education, and physical education and human performance.
- Students:
  - Engaged in hands-on projects to help children with special needs
  - Participated in disability awareness activities and games
  - Gained exposure to possible careers in assistive technology and biomedical engineering
# Program Schedule

<table>
<thead>
<tr>
<th></th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
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<tbody>
<tr>
<td><strong>Morning Activities</strong></td>
<td>Check-in</td>
<td></td>
<td></td>
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<td>Go Baby Go!: Part I</td>
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<td></td>
<td>Introductions</td>
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<td></td>
<td>Go Baby Go!: Part II</td>
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<td></td>
<td>Pre-surveys</td>
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<td></td>
<td>Overview of program</td>
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<tr>
<td></td>
<td>Overview of biomedical engineering/assistive technology</td>
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<tr>
<td></td>
<td>Intro to i-Pads and i-Movie project</td>
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<td></td>
<td>Leveling the Playing Field (Disability Awareness Activity)</td>
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<tr>
<td></td>
<td>Intro to soldering/soldering practice</td>
<td></td>
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<tr>
<td><strong>Lunch</strong></td>
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<td></td>
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<tr>
<td><strong>Afternoon Activities</strong></td>
<td>Toy hacking</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Intro to biomechanics/fitness skill analysis</td>
<td></td>
<td></td>
<td>Guest speakers from industry</td>
<td></td>
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</tbody>
</table>
Disability Awareness: Leveling the Playing Field

• The goal of participating in these activities was to help students empathize with people who have special needs and to improve their understanding and attitudes towards these individuals.

• Students found the activities challenging and eye-opening, mentioning that they had never previously participated in activities which simulate a disability.

• They expressed having a greater appreciation of the challenges that individuals with special needs face on a daily basis.
Toy Hacking

• To hack their toys, students first disassembled their RC toys and examined the circuitry and determined which connections were responsible for the two functions of the vehicle (moving forward and turning in reverse).

• They next soldered wires to the appropriate locations on the PCB and soldered the other ends to a mono audio jack.
Field Trip to Chapter 126
Go Baby Go! Part I
Guest Speakers from Industry

One-handed operation
- Can be articulated, rotated, and fired with one hand

Enhanced system-wide compression
- Compression before firing and alignment during firing delivers consistent, properly formed staples for hemostasis across the entire length of the staple line

Medtronic
Go Baby Go! Part II
Research Methods

• The National Science Foundation-funded AWE pre-college outreach surveys, “Pre- and Post-Activity Survey for High School-Aged Participants – Engineering” were used.

• These pre- and post-activity questionnaires are designed to measure the degree to which specific activities aimed at increasing interest in STEM-related careers have achieved their stated objectives.

• Focus group interviews were also conducted with the students immediately after the post-survey was administered.
Both females and African Americans appeared less confident overall in their ability to “build something mechanical that works”
• Females also seemed less confident about using their knowledge to design solutions.
Both of underrepresented groups gained the most confidence in their ability to lead a team to design and build a hands-on project.
• The African American students reported the greatest gain in their interest in belonging to a science or technology club.
All groups felt that the activities increased their interest in STEM.
• However, females were less inclined than males to believe their ideas were valued by their teammates.
Both females and African Americans were less likely to think their involvement was critical for the project to succeed.
Focus Group Findings

• Overall, feedback about the program was very positive and their interest in attending a similar program in the future was high.

• They especially liked the hands-on nature of the activities and the insights they gained into the challenges faced by people with special needs.
Focus Group Findings

• Some suggestions for improvement included more field trips and guest speakers, and more time spent on the Go Baby Go! portion of the program. One student suggested that a two-week program might be preferable.
Recruiting Diverse Students to Engineering and Related Fields

• Engineering is an unpopular college and career choice for many women. For instance, only 18% of bachelor's degrees in engineering were earned by women (National Center for Education Statistics, 2013) and while 9% of male freshmen chose engineering as their major in 2011-2012, only 1% of their female counterparts made the same selection.

• Comparable disparities emerge when analyzing the data by race.

• The majors where female and African-American students are highly represented, however, are often associated with serving the community.
Recruiting Diverse Students to Engineering and Related Fields

• While a career in engineering can provide countless opportunities to help others, jobs in this field are often perceived as involving little human contact, and many students find it difficult to connect engineering with helping people (National Academies of Sciences, Engineering, & Medicine, 2008).

• Most people value working with and helping others, but having a career which affords ample opportunities to do so may be especially important to members of groups that are underrepresented in engineering, including African Americans and females (Carnevale, Fasules, Porter, & Landis-Santos, 2016; Eccles & Williams, 2007).

• A report from the American Association of University Women recently advised, “The more that engineering and computing educators and employers can incorporate communal goals into their environment, the more open the doors of these fields will be” (Corbett & Hill, 2015, p. 74).
# Summer Program Demographics

<table>
<thead>
<tr>
<th>Class</th>
<th>Boys</th>
<th>Girls</th>
<th>Grade Level</th>
<th>% Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Programming Fun with Python</td>
<td>16</td>
<td>4</td>
<td>6-12</td>
<td>20%</td>
</tr>
<tr>
<td>Summer ROV/Robotics: Girls Academy</td>
<td>0</td>
<td>17</td>
<td>6-12</td>
<td>100%</td>
</tr>
<tr>
<td>2D &amp; 3D Modeling through 2D Game Design, Minecraft™ &amp; 3D printing</td>
<td>19</td>
<td>1</td>
<td>3-5</td>
<td>5%</td>
</tr>
<tr>
<td>Beginner Level 3D Computer Modeling for Animation and Game Design</td>
<td>16</td>
<td>2</td>
<td>6-8</td>
<td>11%</td>
</tr>
<tr>
<td>Summer Robotics: SeaPerch/VEX IQ</td>
<td>14</td>
<td>3</td>
<td>6-12</td>
<td>18%</td>
</tr>
<tr>
<td>2D &amp; 3D Modeling through 2D Game Design, Minecraft™ &amp; 3D printing!</td>
<td>16</td>
<td>4</td>
<td>6-12</td>
<td>20%</td>
</tr>
<tr>
<td>Summer Robotics: SeaPerch with Field Trip</td>
<td>8</td>
<td>3</td>
<td>6-12</td>
<td>27%</td>
</tr>
<tr>
<td>Beginner Level 3D Computer Modeling for Animation and Game Design</td>
<td>9</td>
<td>3</td>
<td>9-12</td>
<td>25%</td>
</tr>
<tr>
<td><strong>The Power to Move</strong></td>
<td><strong>5</strong></td>
<td><strong>7</strong></td>
<td><strong>6-12</strong></td>
<td><strong>58%</strong></td>
</tr>
<tr>
<td>Summer Robotics: Lego/VEX IQ</td>
<td>11</td>
<td>1</td>
<td>3-5</td>
<td>8%</td>
</tr>
<tr>
<td>Android App and Game Programming Part 1</td>
<td>15</td>
<td>6</td>
<td>6-12</td>
<td>29%</td>
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<tr>
<td>2D &amp; 3D Modeling through 2D Game Design, Minecraft™ &amp; 3D printing!</td>
<td>13</td>
<td>5</td>
<td>3-5</td>
<td>28%</td>
</tr>
<tr>
<td>The Magic of Multimedia</td>
<td>9</td>
<td>0</td>
<td>6-8</td>
<td>0%</td>
</tr>
<tr>
<td>The Magic of Multimedia</td>
<td>6</td>
<td>2</td>
<td>9-12</td>
<td>25%</td>
</tr>
<tr>
<td>2D &amp; 3D Modeling through 2D Game Design, Minecraft™ &amp; 3D printing!</td>
<td>12</td>
<td>3</td>
<td>6-12</td>
<td>20%</td>
</tr>
<tr>
<td>Programming Fun with Python</td>
<td>10</td>
<td>0</td>
<td>3-5</td>
<td>0%</td>
</tr>
</tbody>
</table>
## Standards for Technological Literacy

### Standard 8. Students will develop an understanding of the attributes of design.

<table>
<thead>
<tr>
<th>Grade Level</th>
<th>Benchmarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>6-8</strong></td>
<td>F. Design in an open forum.</td>
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<tr>
<td></td>
<td>G. Brainstorming.</td>
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<tr>
<td></td>
<td>H. Model building.</td>
</tr>
<tr>
<td></td>
<td>I. Establishing design criteria.</td>
</tr>
<tr>
<td><strong>9-12</strong></td>
<td>J. Engineering visualization.</td>
</tr>
<tr>
<td></td>
<td>K. Prototyping.</td>
</tr>
<tr>
<td></td>
<td>L. The process of refinement and improvement.</td>
</tr>
</tbody>
</table>

In order to comprehend engineering design, students should learn that:

- Design involves a set of steps, which can be performed in different sequences and repeated as needed.
- The design process includes defining a problem, brainstorming, researching and generating ideas, identifying criteria and constraints, and specifying requirements. The design needs to be continually checked and critiqued, and the ideas of the design must be redefined and improved.

### Standard 9. Students will develop an understanding of engineering design.

In order to comprehend engineering design, students should learn that:

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### Standard 10. Students will develop an understanding of and be able to select and use medical technologies.

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### Standard 11. Students will develop the abilities to apply the design process.

As part of learning how to apply design processes, students should be able to:

- Apply a design process to solve problems in and beyond the laboratory-classroom.

### Standard 12. Students will develop the abilities to use and maintain technological products and systems

As part of learning how to apply design processes, students should be able to:

- Use information provided in manuals, protocols, or by experienced people to see and understand how things work.
- Use tools, materials, and machines safely to diagnose, adjust, and repair systems.
- Troubleshoot, analyze, and maintain systems to ensure safe and proper function and precision.

### Standard 13. Students will develop an understanding of and be able to select and use medical technologies.

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Conclusions and Future Directions

• CCSU faculty plan to continue offering The Power to Move summer program, incorporating some of the suggestions from the participants and lessons learned from this pilot run.
Thank you!!