Engineering Scholars + Tift + Tech Com = Go Baby Go

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Abstract

The Engineering Scholars Track (EgrST) of the Mercer University Honors Program is an eight-semester sequence of 1-credit SU courses. Two of the major challenges in the program curriculum have been to (i) engaging the freshman in a meaningful engineering project activity and (ii) developing connections between the lower- and upper-level students. Go Baby Go is an adaptive toy program conceived by Dr. Cole Galloway at the University of Delaware that aims to enhance the social development of disabled children by providing them with a mobility solution through the modification of children's powered ride-on vehicles. Go Baby Go vehicle build events were incorporated into the EgrST in the 2016/2017 academic year. This paper describes how the EgrST, Tift College of Education, and Department of Technical Communication collaborate to make these build events happen.

Keywords

Honors education communication adaptive toy

Introduction

The Engineering Scholars Track (EgrST) of the Mercer University Honors Program is an eight-semester sequence of 1-credit SU courses. Completion of the six upper-level courses is required for graduation with recognition from the EgrST. Incoming freshman are invited to join the EgrST based on their high-school GPA and ACT/SAT score. Outstanding rising sophomores are also invited to join the EgrST. The primary deliverable for the EgrST is a project that is developed in the fall semester of the sophomore year and then implemented and documented over the spring semester of the sophomore year, junior year, and senior year. The Engineering Scholars present yearly project updates at the Mercer Engineering Expo and as juniors present a poster at the Southern Regional Honor Council Conference. The freshman year consists of experiential-learning activities and faculty led lab experiences. Two of the major challenges in the program curriculum have been to (i) engaging the freshman in a meaningful engineering project activity and (ii) developing connections between the lower- and upper-level students.

Go Baby Go?

Go Baby Go[1] is an international, community-based research, design and outreach program initiated in 2012 at the University of Delaware by Dr. Cole Galloway, a Professor in the Department of Physical Therapy. The goal of the Go Baby Go program is to aid the social development of disabled children by providing them with a mobility solution that allows them to explore their environment and expands interactions with their peers. Build events bring together families, clinicians, technicians, and engineers that work together to provide modifications to a

factory powered ride-on vehicle that meet the individual child's needs. The majority of the builds are for children with a lower–body disability. The general build procedure is as follows:

1. Identify the appropriate vehicle size and configuration for the child to be served.
2. Modify the electrical system so that the vehicle can be turned on/off by pressing a large button secured to the steering wheel and only operates in the forward direction.
3. Customizing the support system to the child's needs. Children with a lower-body disability will not be able to use their legs to keep themselves positioned in their seat. Therefore a five-point harness system is a fundamental requirement for all vehicles.
4. Test drives and final adjustment.

Mercer Go Baby Go Build Events

Go Baby Go was discovered by the Director of the EgrST in the Spring of 2016 and proposed as an activity that could be incorporated into the EgrST. The Director subsequently participated in a build event held at the Marianjoy Rehabilitation Hospital in Wheaton, Illinois. This experience made it clear that while Go Baby Go was well within the technical skill set of the EgrST, collaboration with a colleague connected to special education programs or pediatric physical therapists was critical. In addition, a funding source for tools, supplies, and materials for the first build event was required. Go Baby Go was then proposed as a collaboration to Dr. Keesbury, a special education specialist in Tift, and a joint proposal from the EgrST and Tift was submitted to and funded by Mercer's Office of Research That Reaches Out. The Research That Reaches Out initiative was developed as the Quality Enhancement Plan under Mercer University's SACSCOC 2012 accreditation review.

The first technical step in preparing for this build event was a review of locally available powered children's ride on vehicles. A variety of vehicles that appeared to meet the needs for a base Go Baby Go vehicle that would meet the needs of children ages 1.5 to 3 and 3 to 7 years were procured from a local Toys-R-Us. A vehicle review event was held with the senior Engineering Scholars and a number of engineering faculty. The teams partially assembled their vehicles and followed Go Baby Go build instructions from other institutions where available. The key findings from this event were that an ideal vehicle has:

- Single-seating. The steering is centered and there is typically sufficient leg room.
- Standard opening (horizontally hinged) doors or no doors at all. This allows for a variety of access options to the vehicle.
- A low-speed by default or a low-speed option that can be locked in. High-speed settings often approach 6 mph (10 min/mile) which exceeds a casual walking pace and could quickly distance the child from their guardians.
- A smart charging system which provide an easily accessible port that when connected to a charger prevents activation of the vehicle drive system. Many vehicles require that the battery be physically disconnected from the drive system in order for the charger to be connected. Most vehicles have the battery located underneath the seat. Once the five-point harness and supplemental support system are installed, removal of the seat to access the battery may be impractical and possibly impossible.

An Avigo Maserati Gran Turismo MC Centennial 6 Volt Powered Ride On, Figure 1, was selected as the base vehicle for the Fall 2016 build event. This vehicle met the needs of children from 3 to 7 years of age, had a max speed and occupant weight of 2.5 mph (24 min/mile) and 75 lbs, respectively.

Figure 1. Avigo Maserati Gran Turismo MC Centennial 6 Volt Powered Ride On[2].

The next steps in preparing for the build event were identification of children that would be served by the Avigo Maserati and determining what electrical modification were required and how they should be made. Local pediatric physical therapists were contacted by Tift to identify up to ten children for this event. The electrical configuration of the Avigo Maserati made it fairly straight forward to convert to push button operation for forward motion while maintaining functionality of the dash board sounds and audio system, driving lights, and most importantly charging. A 'Big Dome Push Button' available from Amazon mounted at the center of the steering wheel was used to provide on/off control as well as steering for the vehicle. A toggle-switch installed in series with the 'Big Dome Push Button' and mounted at the rear of the vehicle allows for a guardian to have ultimate control over vehicle operation. Electrical connections were made using crimp connectors where spade terminals were required. All other connections utilized Posi-Products® connectors.

Mercer's first Go Baby Go build event was held in December 2016. Nine Kid Trax Maserati's were modified at this event. The sophomore and senior Engineering Scholars were the primary group of students supporting this event. Eight of the vehicles were standard lower-body disability vehicles while the ninth was modified to be entirely foot-operated, on/off and steering, for a girl with only partial digits for her upper-body extremities. The build event was held on a Friday in the late afternoon (3 to 6 PM) and Saturday (10 AM – 5 PM). The Friday session was focused on pre-building and electrical modifications. The step-by-step building of a single vehicle was captured with a document camera and projected onto large format screens. The teams of engineering faculty and sophomore and senior engineering scholars followed along modifying their vehicles in concert with the demonstration vehicle. This was a tedious process and Dr. Watson, a Tech Com faculty member participating in the build, proposed that the Tech Com Student Society could support future builds by developing digital instructions that builders could access via laptops, tablets, or phones. The Saturday vehicle fitting was held in a large classroom in the School of Engineering and ran from 10 AM to 5 PM. Images from the fall 2016 build event are presented in Figure 2.

The second Go Baby Go build event was held in March of 2017 and modified vehicles for twelve children. The Avigo Maseratis were again used as the base vehicle. Freshman and senior Engineering Scholars were the primary builders at this event. The major improvements incorporated into this event were digital instruction sets and a change in venue to an intramural basketball court in the University Center. Dr. Watson organized a group of engineering and Tech

Figure 2. Images from the fall 2016 Go Baby Go build event at Mercer University.

Com majors to work on the development of digital instructions based on the procedures used in the fall 2016 build. These instruction sets were provided at the spring 2017 build via a dedicated WIFI server which allowed the builders to link directly to the instructions rather than routing through the university's network or mobile WIFI. Each group was able to work at its own pace and the faculty supporting the event were able to wander through the pre-build and interact with multiple student groups. The freshman Engineering Scholars were required to document this event by developing a poster for the vehicle build they participated in and presenting it at the 2017 Mercer Engineering Expo. Example posters are presented in Figure 3.

Impact on Tift College of Education

Tift College of Education prepares our Holistic Child majors to be preschool – fifth grade teachers who are dual certified in regular education and special education general curriculum. The Go Baby Go events, allow for students to interact with children with special needs along with their families. Being able to spend time with the children and families who come to Go Baby Go prepares the students to communicate effectively with parents of a child with special

Figure 3. Fall 2017 Go Baby Go posters prepared by freshman Engineering Scholars.

needs. Go Baby Go gives the education students exposure to a variety of populations of students with disabilities. Through this exposure they are made more aware of the array of needs that these types of students may need as accommodations in the classroom.

Tift College of Education students are assisting in follow-up research on how the cars impact the lives of the children and the families, specifically focusing on how the children use the cars, how often and in what context. Students will follow up with children and families twice in the calendar year after receiving the car to determine how the use of the vehicle is increasing their social interactions with their siblings and peers.

Impact on Department of Technical Communication

From the beginning, the Go Baby Go project recognized the importance of documentation to support the people who adapt the cars. The Mercer University Tech Com department reviewed printed documentation developed and used by other institutions. The effort and cost associated with printing this limited number of documents made it clear that digital documentation was critical. This approach would enable distributed support and maintenance of the documentation

as well as maximizing both the utility of the documentation and the opportunities for Tech Com student contributions.

The document and audience requirements for the documentation were developed after observing students assemble cars during Mercer's first Go Baby Go build event in December 2016. Using the observations from that event, several Tech Com students wrote the procedures and photographed the key steps by assembling one car over the course of several days. Critical elements of the documentation were tested in advance of the spring build, but the first real field-test of the documentation took place during the Go Baby Go build event held in March of 2017. During and after that event, the engineering students were interviewed to identify areas in which the documentation could be improved and several Tech Com students incorporated their feedback into the documentation for the subsequent build.

The iterative and collaborative nature of developing and maintaining the documentation has made an excellent, real-world example of a documentation project that has provided our Tech Com students an ongoing opportunity to develop their skills while supporting the Go Baby Go project.

Impact on Engineering Scholars Program

The Go Baby Go program has been successful as an event that requires the senior Engineering Scholars to collaborate with the freshman and sophomore Engineering Scholars. The long term impact of this collaboration will need to be evaluated via surveys administered to subsequent sections of the sophomore, junior, and senior Engineering Scholars courses. It was also effective in introducing the freshman Engineering Scholars to engineering projects. It incorporated basic electronic tools and concepts, simple manual fabrication techniques, modeled client interactions, demonstrated the service to community nature of the engineering profession, and provided a structured poster and presentation for them to deliver. In addition, the Go Baby Go event is clearly popular with the Engineering Scholars. Scholars that were not required to attend the spring 2017 build requested that they be allowed to participate. It has also generated several EgrST projects, a joystick controlled vehicle and a foot-operated vehicle that employs a floor mounted steering mechanism rather than a bracket attached to the original steering wheel.

Future Endeavors

The EgrST, Tift, and Tech Com plan to continue to collaborate to perform fall and spring build events and ultimately reach a build capacity of approximately twenty vehicles per semester. Fifteen of these builds would be traditional mobility builds for children with a lower body disability while the remaining five would be alternative designs such as foot operation, physical therapy, or joystick control. In addition, expansion of the collaborating entities is being pursued. The Department of Physical Therapy in particular would be a natural fit for the build events

Future Endeavors

Mercer's Office of Research That Reaches Out and Lockheed-Martin provided financial support that made these build events possible. The Warner Robbins Post of the Society of Military Engineers provided financial support for two vehicle builds and their members participated in these build events.

References

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Philip T. McCreanor

Dr. McCreanor is a Professor of Environmental Engineering and Director of the Engineering Scholars Track of the University Honors Program at Mercer University. He holds a B.S. in Mechanical Engineering from the University of Miami as well as a M.S. in Environmental Science and Ph.D. in Environmental Engineering from the University of Central Florida. He is a member of the Tau Beta Pi, Sigma Xi, and Phi Kappa Phi Honor Societies. He was inducted as a Georgia Governor's Teaching Fellow in 2008 and received ASEE-SE Section's Outstanding Mid-Career Teaching Award in 2012. His professional interests include bioreactor municipal solid waste landfills, treatment of gray water for landscape irrigation, and adaptive toy projects.

Sybil Keesbury

Dr. Keesbury is an associate professor in the Tift College of Education and has been teaching at Mercer University for seven years. She has her Ed.D in curriculum and instruction from Gardner-Webb University, M.S. in Special Education from University of Minnesota Mankato, and a BA from Gustavus Adolphus College. Her area of specialty is special education, with a focus on Autism Spectrum Disorders and Behavioral Disorders. She is the coordinator of the Holistic Child Program and is the university liaison for the Professional Development School for the partnership at Ingram Pye Elementary School. Dr. Keesbury is the recipient of the 2015 Tift College of Education Cathryn Futral Excellence in teaching award.

Robert Watson

Dr. Watson is in his second year as an Assistant Professor of Tech Com in the Mercer University School of Engineering. His research areas include testing and measuring the effectiveness and value of documentation and applying Tech Com principles to solve information challenges in the developing world. After a 30-year career in industry, working as a software engineer for 15 years and then as technical writer for another 15 years, Dr. Watson graduated from the University of Washington in Seattle with a Ph.D. in Human Centered Design & Engineering, adding to his Master of Science in Human Centered Design & Engineering and Bachelor of Arts in Business Administration.