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TTU Students Develop Specialized Rowing Bike for Cookeville High School Special Education Program

by Jerry Renshaw

December 17, 2014

Five students from Tennessee Tech University's mechanical engineering program have built a rowing bike for the special education program at Cookeville High School. The bike is designed for students who don't have full use of their lower extremities, but still want to maintain physical fitness and have fun in the process.

Of the two bikes that the high school currently has, one can only be powered by a backward pull motion, and the other takes considerable effort to operate; neither bike has foot rests or fittings.

The team consisted of TTU seniors Matthew Powelson, of Fayetteville, Tennessee; William Schenk, of Knoxville; Derrick Davis, of Bell Buckle, Tennessee; Riley Collins, of Kingston, Tennessee; and Chimezirim Ibe-Ekeocha, of Lagos, Nigeria. Together, they were able to repurpose and modify an existing bike for the project.

"Our biggest challenge was a drivetrain," said Powelson. "We totally scrapped the old bike's drivetrain, took it all the way out, and had to redesign and install something completely different. It involved chopping up the old frame and widening it to accommodate our design, so much of it was a redesign from the ground up. We were able to salvage the old bike's steering, seat and wheels, but not a whole lot else."

The redesigned bike is 20 pounds lighter and features a more comfortable riding position, with footrests and an adjustable seat that slides on a track to accommodate different-sized riders. Steering is achieved via a steering wheel and cable-pull setup, a carryover from the old bike's design. The drivetrain can now provide power on both the push and pull strokes, via a chain that reverses direction simply by being configured in a figure-8.

As part of the design, the team had to devise the proper gear ratios for a potential rider and a steering and braking system integrated into the rowing handle. During the final fabrication steps, the team installed clear Plexiglas chain guards and completed the bike's cosmetics, all of which involved considerable trial and error.

"As far as cost considerations, we actually got lucky," said Powelson. "We were able to reuse a number of parts that were really just lying around in the machine shop in the basement of Brown Hall."

TTU's College of Engineering is centered around the concept of 21st Century Renaissance Engineers, with the mission of graduating engineers who solve technological challenges to meet society's needs. In light of that, mechanical engineering professor Stephen Canfield equires every student taking his junior-level dynamics of machinery course to take part in a project to design and deliver a machine that can make a child's life better and more productive.

"My students took on this design project as part of the emerging Early Intervention and Mechanical Engineering (EIME) program," said Canfield. "The EIME program teams engineering students to develop specialized assistive devices (machines) for children with special needs. The student teams are supported by educational, service and medical professionals located in the region along with the child's family. The larger group supports the student team to provide



7/9/2018

TTU Students Develop Specialized Rowing Bike for Cookeville High School Special Education Program -:- Tennessee Tech

necessary input in defining and addressing the need while the student team carries out the project design from early stage conceptual design through overseeing fabrication, testing and implementation. I have four primary educational objectives for the EIME project: 1) To engage students in a real-world application of mechanism design, 2) to provide a compelling and immediate purpose for learning engineering theory, 3) to provide students experience in working with customers (and other team members) that are not engineers and 4) to create an opportunity for students to see their design in practice and learn from this experience."

*Last edited **2015.03.17** by **Davis, Cynthia**.*