

## **GIFTS - First Year Foundations Learning Community**

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Dr. Bednarz was a Senior Mechanical Engineer for 12 years for the U.S. Army before becoming a full-time professor at Wilkes University in 2013. He has a passion for teaching and working with students and enjoys working on a variety of research projects with his undergraduate and graduate students. Dr. Bednarz has presented at a number of conferences, is published in several academic journals and has been awarded several US Patents. He enjoys introducing engineering to students and encouraging them to become inventors.

**First Year Foundations Learning Community**  
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The first semester of college is challenging for engineering students. The goal of the First Year Foundations (FYF) at Wilkes University is to help students transition from high school to college. General student learning outcomes of the FYF course is to provide students with communication skills (both written and oral), quantitative reasoning, diversity awareness, critical thinking, and computer literacy. Through the group design project shown here, students will gain experience with all of the above learning outcomes, while also getting introduced to engineering.

Engineering students need to enroll in fundamental classes such as calculus, physics, and chemistry. However, new students may not see where these courses fit into engineering as a profession. In an effort to connect fundamental classes to real world engineering, a learning community was created with a common design project between the introductory Computer Aided Drafting and Design (CADD) course and the FYF Engineering Design course. This affords students a fun experience and an opportunity to learn about engineering, teamwork, technology, and testing. They work with the same group across two different courses on the same exact design project. The project involves designing a bridge with certain constraints broken into three phases: 3D CADD model, Bridge Designer software, and the physical build.

Students use an open access Bridge Designer software to optimize their design for the lowest cost (<https://bridgedesigner.org/download/>). They learn about the basics of what it means to “design”, i.e. limited budget, time and resources. They employ trial and error methods to explore trusses, arches, different materials, and cross sections. The span of the bridge must be 44 meters without any supports in the middle. The bridge must support a vehicle crossing it with a 480 kN load.

The next phase of the project is to model their design in 3D CADD using SolidWorks. Students get to see how the different members form an assembly. It is the culminating project for the CADD course in that they utilize all the different skills they have learned throughout.

Finally, students physically build their bridge out of 100 popsicle sticks or less using a 22 inch gap without any supports in the middle. As a class, each bridge is tested to failure with a machine that can measure force versus deflection.

It is also a fun competition to see which design is the cheapest in the theoretical Bridge Designer software and holds the most weight in the small scale real world test. This project has been run successfully for three straight years with plans to continue running in the future. The record for the cheapest bridge is \$164,000 and the record for the most physical load held before failure is 141.5 pounds. The in-class presentations are exciting because students get to reveal their final cost. The in-class testing is even more exciting because the students in each group get hands on experience to test their own bridge to failure.

Overall, the bridge design project, through the learning community, has been very successful in engaging engineering students early on in their curriculum. It gives them experience in designing an optimal product under constraints in a team environment and connects engineering to fundamental courses. Student feedback at the end of each semester has shown an overall positive experience.