



# Making Coursework Relevant

CREST ENGINEERING PROGRAM EMPHASIZES PRECISION DESIGN SKILLS

*“The Dimension 3D Printer gives them a chance to touch and feel the designs they’ve created. Not only do students possess a better understanding of the entire process, but they also enjoy an immense sense of pride in their accomplishments.”*

*– Phil Howardell, Paradise Valley High School*

## CASE STUDY



Engineering teacher Phil Howardell discusses student Zach Nelson's 3D model at Paradise Valley High School.

Phil Howardell loves to watch his young engineers solve problems. As the lead instructor in charge of Paradise Valley High School's Center for Research in Engineering, Science and Technology (CREST), Howardell takes pride in giving kids a solid foundation for careers in engineering. For many CREST students, Howardell's Introduction to Engineering Design course is their first exposure to basic engineering principals and practices. It's easy for him to visualize the wheels turning inside his students' heads...and occasionally grinding to a halt.

“Our coursework is rigorous and challenging, even for students who have a good understanding of math and science,” said Howardell. “Physical modeling is a huge part of bringing relevance to our curriculum and helping students analyze the work they’re doing on the computer.”

One of the students' first projects is to design and build a toy train, following precisely engineered plans. The lesson is designed to teach the importance of precision measurement; ideally, every train will be modeled identically according to the plan, but that is rarely the case. The students learn a valuable lesson about engineering: every detail matters.

The next project is more complicated – designing and building a model of an arbor press, one of engineering's most basic tools for machining parts. For both projects, Howardell uses a Dimension 3D Printer as a critical part of the lesson, helping students troubleshoot design problems based on actual, physical results.

“Most students, when they first tackle the projects, will simply design and print non-working parts, so they can see how the process works,” Howardell said. “As we get more advanced, we talk about things like clearance for moving parts, and they work through design revisions using the Dimension 3D Printer, in much the same way real engineers would use prototypes.”

Howardell says one of the biggest benefits of the Dimension 3D Printer is that its use is scalable based on individual student abilities. If a student wants to explore design principals in greater detail, they can produce scale models without needing carpentry or machine tool experience. Likewise, if a student is struggling to master engineering concepts, a 3D prototype will help them see, touch and feel their designs which helps them to better understand the design process.

### Why Dimension?

Schools have many options when it comes to choosing a 3D printer, so Howardell conducted due diligence when determining the best option for his classroom.

“The ABS modeling material is a key component for us, since we do a lot of post-forming with drills and lathes,” Howardell said. “With other 3D printers, you can paint your models, but they crack and splinter when you try to mill them. With the Dimension 3D Printer, I've made custom motorcycle parts that are durable enough to last for years.”

Howardell believes his Dimension 3D Printer is one of the reasons why his engineering courses continue to grow in popularity, inspiring younger students to enter the CREST program. Whenever the school hosts an open house or recruitment event, Howardell makes sure he has something printing on the Dimension 3D Printer to capture the attention of prospective students and their parents.

“What I love about this printer is that my students can be as creative as they want,” Howardell continued. “I've even had kids design stuff at home for extra credit, then bring it in and print it at school. Our entire program is fueled by student interest and creativity, and the Dimension 3D Printer keeps them experimenting. That's perhaps the most rewarding part of my job – seeing young people become truly inspired by engineering.”



The Dimension 3D Printer allows instructors to teach hands-on engineering to students at Paradise Valley High School.

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