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Article 3

Project- and Problem-Based STEM Education

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PROJECT- AND PROBLEM-BASED STEM EDUCATION

How do we best equip science, technology, engineering, and mathematics (STEM) teachers for the schools they are going to serve in?

Dr. David Mulder ('98), professor of education, ponders this question every time he teaches Methods of Teaching STEM in K-12 Schools. The course is designed to meet the needs of STEM teaching majors such as engineering education, physics education, and industrial technology. Chemistry, biology, and mathematics majors also choose to take the course, which allows them to explore creative, fun ways to apply STEM concepts in the classroom.

"In STEM education today, there is a big push toward project-based learning and problem-based learning," explains Mulder. "With project-based learning, teachers devise projects where students can practice different skills. They learn science while doing science, or they learn engineering while doing engineering. With problem-based learning, teachers assign authentic problems where students must do realistic work to engage in real problem solving."

This spring, to prompt project and problem-based learning, Mulder gave his students a bag of materials—popsicle sticks, a wooden spoon, and a glue gun—and told them to build a catapult that could launch a marshmallow at least 25 feet. In another activity, he asked students to build a bridge out of one sheet of 8.5 x 11-inch paper that could withstand the weight of at least 100 pennies.

Later, his students worked on more complex problems.

"Let's say your administrator received a STEM grant and ordered you this roller coaster kit," says Mulder. "How can we use this kit? Where should this be placed in the curriculum? What could we actually teach with it? I have my students step into the role of teacher, because these scenarios are real possibilities that happen all the time in K-12 education. I have this great resource, but where does it fit in my curriculum?"

He also gave a similar scenario with Lego robot kits, where his students explored how the Lego robots work and then figured out how the kits might fit into the curriculum.

Mulder and his students also read through a book titled *Teaching and Learning STEM: A Practical Guide*.

"Every time I assign a reading, I frame our class discussion around three questions," says Mulder. "What was new for you? What was affirmed for you in this chapter? And now what—what questions do you still have? We can talk for the entire 50-minute class period about these three questions, because these students know that they are going to be student teaching next year, and they want to do their best as student teachers."

Joseph Wanninger, a senior double majoring in engineering and secondary education, says that this is the most applicable methods class he has taken. He plans to teach engineering in a high-needs school after he graduates, so he appreciates the STEM-centered approach.

"Professor Mulder has taught in the STEM fields and knows them well," says Wanninger. "He's really passionate about his work, and he is willing to answer any questions we have. It's nice to share our thoughts in class and to get his ideas, critiques, and comments."

STEM educators are in short supply nationwide, and Dordt's education department is committed to increasing the number of STEM education majors that they teach and send out into the world. Teaching a course like Methods of Teaching STEM in K-12 Schools is one way of doing that.

"Every time our class gets together, we have really rich conversations," says Mulder. "It's a lot of fun."

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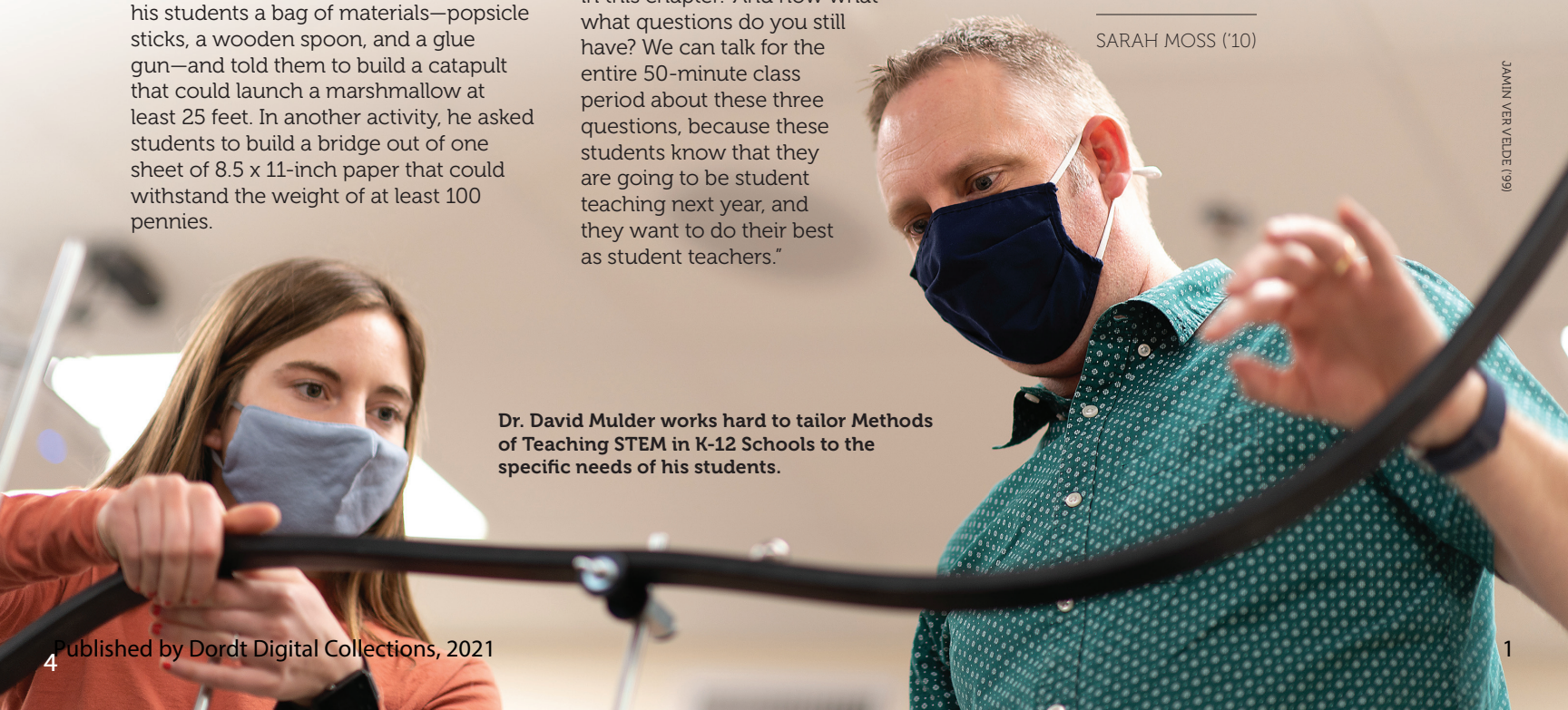

JAMIN VER VELDE ('99)

Dr. David Mulder works hard to tailor Methods of Teaching STEM in K-12 Schools to the specific needs of his students.