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SIUE's Onal studies effectiveness of active learning pedagogies in manufacturing curriculum through industry partnerships

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EDWARDSVILLE - Seeing, hearing and reading how to do something is, of course, imperative for generating new knowledge, but research has shown that working hands-on through active learning techniques is especially effective for the retention of information.

Knowing this, and to ensure innovative leadership in teaching and learning, Sinan Onal, PhD, assistant professor in the Southern Illinois University Edwardsville School of Engineering, is researching how the implementation of project-based learning in engineering curriculum will enhance student engagement in the learning process and provide better understanding and retention in manufacturing fundamentals.

“U.S. institutions must identify industry workforce needs and then provide students with academic experiences that will enable graduates to successfully enter the job market and make meaningful contributions to both the regional and national economies,” said Onal, who teaches in the Department of Mechanical and Industrial Engineering.

“The project aims to enhance creativity as well as problem-solving and teamwork skills by implementing the design and production of real-world medical device projects in collaboration with local partners in the medical device industry and academia, namely the SIU Schools of Medicine and Dental Medicine.”

His research is being conducted through a 2017-18 faculty fellowship with the SIUE Center for Science, Technology, Engineering and Mathematics (STEM) Research, Education and Outreach. The fellowship allows SIUE faculty to engage in STEM education projects which focus on design, development and research on teaching and learning at the undergraduate level.

“We are excited to partner with Dr. Onal and the School of Engineering to support innovative STEM teaching,” said SIUE STEM Center Director Sharon Locke, PhD. “Dr. Onal’s project exemplifies high-impact educational practice and SIUE’s commitment to providing an excellent undergraduate education. Students are applying science and engineering concepts taught in the classroom to solve real-world problems. They are learning how STEM can contribute to human well-being.”

In Fall 2017, juniors participated in a modified manufacturing course which incorporated in-class, short, team exercises using active learning approaches, and assigned a course project identified in collaboration with local medical device industry partners.

Students used the Department of Mechanical and Industrial Engineering’s Design Station, which consisted of 15 workstations where small groups used computer-aided design and manufacturing, as well as equipment-related software.

The Design Station exposed students to the design of medical device products through firsthand experiences using manufacturing equipment to make medical device prototypes. The stations featured computer numerical control milling and lathe machines, as well as 3D printers.

“The medical device industry is important to both the greater St. Louis region and the United States as a whole,” Onal said. “The industry has strong economic and social impacts, has been growing gradually and is essential to the global competitiveness of the U.S. which currently leads the market. The integration of the active learning project into the manufacturing processes course increased students’ awareness of problems currently challenging the medical industry.”

This spring, Onal will analyze the collected data to evaluate the effect of the active learning environment on student learning outcomes. He expects his results to be transferable to other industries in the region as well.

The STEM Center Faculty Fellowship provides funds that free up a portion of faculty time for testing classroom innovations, and gives access to the Center’s educational researchers to help assess student outcomes. Applications for the 2018-19 STEM Faculty Fellowship will be accepted beginning February 2018.

The Southern Illinois University Edwardsville Center for STEM Research, Education and Outreach comprises an independent group of researchers and educators, innovating ways to engage students and the public in science, technology, engineering and math (STEM). Within the SIUE Graduate School, the Center brings together research faculty, graduate students and practitioners to conduct education research. The Center contributes educational expertise to SIUE undergraduate classes and provides professional development for K-12 teachers. The Center boasts a significant library of equipment and resources, which are available for loan at no cost to campus and regional instructors. For more information, visit https://www.siue.edu/stem/about.shtml or contact STEM Center Director Sharon Locke at (618) 650-3065 or stemcenter@siue.edu.

The SIUE School of Engineering offers one of the most comprehensive and affordable engineering programs in the St. Louis region with eight undergraduate degrees, five master’s degrees and two cooperative doctoral programs, all housed in a state-of-the-art facility. Students learn from expert faculty, perform cutting-edge research, and participate in intercollegiate design competitions. Companies in the metropolitan St. Louis area provide students challenging internships and co-op opportunities, which often turn into permanent employment. All undergraduate programs are accredited by their respective accreditation agencies.