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## Abdelrahman and Canfield Share 2010 TTU Sissom Award

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Engineering concepts become accessible, understandable and

exciting for students of this year's Tennessee Tech University Leighton E. Sissom Innovation and Creativity Award winners Mohamed Abdelrahman and Stephen Canfield.

The two developed and are implementing an innovative model to improve students' use of programming tools in engineering. This model offers a unique solution to the classic difficulty associated with learning to program: the contrasting demands between knowledge of programming language (syntax) versus programming strategies (problem solving with programs).

The Canfield/Abdelrahman model introduces hardware into the mix of educational tools as a means to bridge the gap and allows students to use intuitive models for problem solving (based on the hardware) while they gain early confidence with programming details.

The model hardware, a programming toolkit, was given free to approximately 100 students in a pilot group. The assessment covered about 20 months of project activity and was conducted using a collection of tools including surveys, direct student performance, focus-group interviews, formative documentation by the authors and on-site reviews by an external assessment team.

Students who engaged in the hands-on, hardware-based programming activities reported a more positive early experience with programming and its relation to the engineering curriculum relative to their comparison-group peers. Students participating in the project also reported improved confidence in their ability to learn and use programming and noted its importance in their engineering studies.

Abdelrahman, an electrical and computer engineering professor who is passionate about outreach activities for popularizing engineering research and education, oversees two NSF-funded sites for research experience for undergraduates and research experience for teachers.

During one of his programs, participants find themselves immersed in the research and development process through hands-on experience and real-world problems that relate to conventional manufacturing processes such as metalcasting, rapid prototyping, nanomaterials, fuel cells and special coating materials, and enabling technologies such as intelligent optimization.

His research focus is on industrial applications of sensing and control, and his research funding exceeds \$5 million. He has published his research results in more than 80 papers in refereed journals and conference proceedings and more than 30 technical reports. He was a keynote speaker in several international conferences and workshops.

Abdelrahman, who joined TTU in 1997, was a recent Fulbright Scholar to the State of Qatar, and he received TTU's 2009 Caplenor Research Award.

Canfield, a mechanical engineering professor, has a strong interest in active student learning and undergraduate student research. He served as a collaborator in developing TTU's Mechatronics and Intelligent Machine Laboratory and in developing EIME, a program that merges early intervention and mechanical engineering to engage engineering students in designing toys and devices for children with special needs.

He has served as adviser of student groups conducting micro gravity experiments as part of the NASA reduced gravity experiments program and currently advises the student chapter of ASME and the Autonomous Robotics Club at Tennessee Tech.

Canfield received his doctorate in mechanical engineering at Virginia Tech University in the field of parallel architecture robotics. His research interests include robot kinematics and dynamics, topological optimization of compliant manipulators and in-space mechanisms. His current research is in robot modeling, control and development with a focus on climbing mobile robots for autonomous welding and NDE inspection in hazardous, unstructured environments.

Canfield's robots are being used by companies including TVA and General Dynamics. He has served as a NASA summer research faculty at the Marshall Space Flight Center, working on the modeling and control of electrodynamic tethers and tethered space structures. He has been principal investigator on grants from NSF, NASA, the Navy and TVA and has more than 40 refereed technical papers in the areas of robotics, dynamics and design.

Canfield's recent teaching awards include the 2008 TBR Academic Excellence award and the 2008 Tennessee Department of Education Project of Excellence Award.

The Sissom award honors Leighton E. Sissom, former dean of TTU's College of Engineering, and recognizes scholarship, methodology, invention, technique and other contributions within TTU's College of Engineering. The recipient of the award can be a faculty member, staff member or student.

Last year, doctoral candidate Justin Stacy became only the second student-recipient of the award.

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