STEM TEACHER PROFESSIONAL DEVELOPMENT WORKSHOPS FOR TRANSPORTATION

OVERVIEW: Researchers at the Texas Tech T-STEM Center in the Edward E. Whitacre Jr. College of Engineering in collaboration with the Department of Civil, Environmental and Construction Engineering conducted two Teacher Professional Development Workshops focusing on Transportation in July 2014 and July 2015 (Figure 1). These workshops were sponsored by the Southern Plains Transportation Center (SPTC) through the project entitled “STEM Teacher Professional Development – Transportation Series/Student Outreach and Education.” In these workshops, K-12 science and math teachers were provided professional development training directly related to transportation industry applications. Texas Tech faculty, researchers and graduate assistants developed and conducted several teaching modules related to transportation that were customized to middle school and high school science and math classes. The workshop was facilitated by a Texas-certified science teacher with more than thirteen years teaching experience in rural and urban schools, and who frequently presents at state and national science conferences. Students and teachers in Region 6 will benefit from the implementation of these workshops.

During these workshops, teachers received instruction and products related to various topic areas. Demonstrations were provided on cutting-edge transportation research in formats applicable to instructional techniques for use in science and math classrooms. Teachers also gained a deeper understanding of how transportation infrastructure is designed and built; a sneak-peek at the future of transportation infrastructure landscape; instructional content on highway design and performance, driver behavior, traffic safety and future of surface transportation; project-based learning exercises related to sight distance, space between successive vehicles, horizontal and vertical curves, traffic safety, pavement design and material selection, earth-retaining structures and the future of surface transportation; materials in transportation infrastructure for math, physics, chemistry, technology and ecology lessons, and “hands-on” projects that can be differentiated for the classroom (Figures 2 & 3).

IMPACT: In the first workshop, eight high school, middle school and elementary math and science teachers from Lubbock and the surrounding areas participated. Teachers traveled from Olton, Texas, one hour north of Lubbock, to as far away as Presidio, Texas – in the Rio Grande, located on the Texas/Mexico border – about six hours south of Lubbock. The participating teachers serve elementary, middle, and high schools in math and science classes plus Pre-calculus, Geometry, Algebra 1, Algebra 2, Physics, IPC, Dual Credit Algebra, Trigonometry, SAT Prep, Social Studies, Robotics, and Math Models. Data collected by the Texas Tech T-STEM Center shows that a total of 743 students are reached by these eight teachers. A demographic breakdown of 53.3% Hispanic, 39.7% White, 3.6% African American, 1.3% Asian and 1.5% from two or more races, with 51.5% of all students classified as economically disadvantaged.
In the second workshop, eleven teachers participated in the two-day workshop, representing seven high schools and four middle schools in the seventeen-county Lubbock region. Subjects regularly taught by the participating teachers include: Middle School Math, Algebra I, Algebra II, Geometry, Calculus, Computer Applications, Biology, Anatomy & Physiology, Chemistry, Physics, Social Studies, IPC and Engineering. Data collected by the Texas Tech T-STEM Center shows that a total of 898 students are learning from these eleven teachers with the student demographic breakdown indicating 56.5% Hispanic, 38% White, 2.9% African American, 0.7% Native American, and 0.4% two or more races. It is also important to note that 48.1% of these students are classified as economically disadvantaged as well.

In addition, the Teacher Professional Development Workshops pre- and post-tests were designed to be content-specific based on learning objectives for each workshop. Data showed that the transportation workshop participants achieved an 81.8% significant gain in learning. In all Teacher Professor Development Workshops conducted by the Texas Tech T-STEM Center in the 2014-15 year, a total of 516 teachers completed various workshops, 491 teachers achieved significant gains in knowledge illustrated by a 95.2% aggregate significant gain indicator.

Course and instructor evaluations provided by the trainees (teachers) provided valuable insights on the effectiveness of the second workshop. Overall, the evaluations were very positive with particularly overwhelming positive feedback for the faculty who conducted the training.

About the Researchers, Workshop Designers and Instructors
Ms. Cathy H. Allen, Senior Director of Texas Tech T-STEM Center is the principal investigator of the project. The Co-PIs are Drs. Hongchao Liu, Priyantha Jayawickrama and Sanjaya Senadheera. The workshops were supported by all faculty members in the Department of Civil, Environmental and Construction Engineering. The workshops were conducted by Ms. Cathy H. Allen of the Texas Tech T-STEM Center along with Dr. Wesley Kumfer (postdoctoral research fellow and winner of the 2015 SPTC Student of the Year award), Dr. Sangwook Bae (Assistant Professor), Dr. Hoyoung Seo (Assistant Professor), Dr. Sanjaya Senadheera (Associate Professor), and PhD students Tharanga Dissanayake and Manil Hettiwatte, all from the Department of Civil, Environmental and Construction Engineering.