Conference Workshops At-A-Glance

All workshops on Sunday will be held in Prescott Hall and Oakley-STEM Center on the TTU campus.

#	Title	Lead Author	Time	Loc	Fee
1	**Screen Engineering**	Chris ORiordan-Adjah	10-12	SC 137	Free
	Screen Engineering – Bridging the gap between in class concepts and real life application in an entertaining way to improve theory effectiveness.				
2	**Introduction to Arduino**	Timothy Wilson	1-4	PH 215	Free
	This workshop presents the Arduino computing platform as a tool for instructional use across a number of engineering domains * Limit 10				
3	**A Framework to Predict Dissemination Success of STEM Educational Innovations**	Chetan Sankar	10:30 – 12	SC 139	Free
	Participants will be shown a framework leading to the successful implementation of engineering educational innovations and will be involved in discussion on this topic.				
4	**Screen Engineering Showcase**	Chris ORiordan-Adjah	1 - 5	SC Lobby	Free
	Posters will be on display that Showcase Screen Engineering				
5	**Engineering EFFECTs: Environments for Fostering Effective Critical Thinking.**	Charles E. Pierce	1-5	PH 304	Free
	Participants in the EFFECTs Workshop will explore teaching and learning methods that engage engineering students in critical thinking about real engineering problems, and the workshop will provide examples and tools that are used in the EFFECTs pedagogical framework to stimulate, document, and assess critical thinking.				
6	**K-12 Engineering Outreach Workshop**	Sally Pardue	1:30 - 4:30	SC 131,135, 137,139	Free
	K-12 Engineering Outreach Workshop – The workshop is a 3-hour showcase of ten to twelve engineering activities and programs aligned with education standards and designed for use with K – 12 teachers and students in formal and informal learning environments.				
7	**Creating Hands-on Programming Experiences for Engineering Students**	Sheikh Ghafoor	1:00-5:00	PH 222	Free
	The workshop will present a method and tools to introduce programming to engineering students using microcontrollers. The method will allow freshman engineering students to learn programming while engaging with engineering hardware. The method can also be implemented into other engineering courses.				
8	**Developing the NAE 2020 Engineer**	Pedro Arce	1:00 – 5:30	PH 205	Free
	Workshop will train educators in approaches useful to develop the new NAE 2020 Model: One helpful prototype is the recent Renaissance Engineering Model adopted at TTU.				

SC = The Millard Oakley STEM Center and PH= Prescott Hal

Workshop 1

Screen Engineering

Chris ORiordan-Adjah

Sunday, March 10, 10:00 am – 12:00 pm, Stem Center, TTU campus

"Screen Engineering" which started three years ago with my Engineering Analysis (Statics) class as an extra credit project has recently caught the attention of many engineering educators. In response to the article in September's issue of the Prism entitled "Lights, Camera, Engineering", a brief article (my response) was featured in the November issue entitled "Movies and Statics". I received emails from engineering educators who saw the article and started asking questions from "How I turned a dry and boring course to one that is entertaining and engaging" to "How effective and efficient is Screen Engineering".

The goal of this workshop is to answer these questions as well as give a detailed description of how "Screen Engineering" can be incorporated in any engineering course but specifically Engineering Analysis (Statics) to make it more effective and efficient. These goals will be illustrated using;

- Statistical Analysis & Results of student participants in "Screen Engineering".
- Detailed description of "Screen Engineering" including proposals, reports and presentations.
- Student testimonials.

Last but not least, it is not coincidence that the December issue of the Prism featured an article entitled "Wow the Audience" in which it stated that "many engineering students lack the communications skills they will need to succeed professionally. In "Screening Engineering" much emphasis is laid on presentation and it is a huge percentage of the project aimed at improving "communications skills". I have first handedly witnessed this "lack" coming from a professional background where it is almost an everyday activity ranging from in-house project meetings, proposal rehearsal to bid project meetings. This is why I have incorporated strict presentation rules in "Screen Engineering".

Workshop 2

Introduction to Arduino

Tim Wilson

Sunday, March 10, 1:00 pm – 4:00 pm, Prescott Hall, TTU campus

This workshop presents the Arduino computing platform as a tool for instructional use across a number of engineering domains. Arduino is a cheap, readily available, open-source microcontroller platform that interfaces easily with a variety of sensors and actuators. Its software development environment is easy to use, facilitating rapid development and prototyping of real-time systems. Arudino has been widely adopted by "makers"—from artists to engineers—around the world. Students increasingly use Arduino as the computing platform of choice in student projects.

This workshop is a hands-on introduction to Arduino for engineering faculty, with examples of its application in a variety of disciplines, not just electrical engineering and computer engineering. In the workshop, participants will learn how to:

- Use Arduino to actuate: turn on LEDs, make sounds, run motors, etc.; and
- Use Arduino to sense: get input from switches, potentiometers, strain gauges, ultrasonic sensors, etc.

Brief description of topics to be covered:

- Downloading the Arduino development environment;
- Connecting an Arduino board to the computer for the first time (installing drivers);
- What's on the Arduino board;
- "Hello, World" for Arduino;
- Getting data from sensors;
- Pulse-width modulation control of actuators;
- Voltage control of actuators;
- Using "shields" (special-purpose daughter boards); and
- Arduinos on the network.

Workshop 3

A Framework to Predict Dissemination Success of STEM Educational Innovations

Chetan Sankar

Sunday, March 10, 10:30 am – 12:00 pm, Stem Center, TTU campus

Workshop goals:

We have conducted a literature review and obtained experts' opinion on the important factors leading to the successful dissemination of educational innovations. We will discuss the results of this research and the framework that we have formulated to address this issue. Through this process, we expect participants to be better prepared to be either effective innovators or implementers of educational innovations.

Brief description of topics to be covered:

Over the past decade, organizations like the National Academy of Education (2009), National Academy of Engineering (2004, 2005), and National Science Board (2007) have recommended improvements in science, technology, engineering, and mathematics (STEM) undergraduate education. These recommendations have not resulted in the major systematic changes within engineering education that were originally expected (Eiseman & Fairweather, 1996; Fairweather & Beach, 2002; National Science Foundation, 2008). Feser et al., (2011) and Eiseman and Fairweather (1996) found in an evaluation of National Science Foundation CCLI and TUES projects that dissemination warranted a co-equal role to the development of new instructional materials. This evaluation asserted that academicians would benefit from a more detailed and empirically based set of information regarding which factors lead to the successful acceptance of innovations and the types of barriers that hinder the adoption of innovations. Catalyzing widespread adoption of empirically validated teaching practices is a key recommendation in the report Engage to Excel by the President's Council of Advisors on Science and Technology.

Based on a recent article by Olds et al., (2012), this workshop proposes to address the following questions:

- What are the barriers to implementation of educational innovations at student, faculty and administration levels, and how can those barriers be addressed?
- What are the important factors leading to the successful implementation of these innovations at student, faculty, and administration levels?
- Can a framework be developed to help faculty develop new innovations and others who wish to adopt new innovations?

We propose a framework to address this problem and will discuss the details of this framework and the results of our past research. We expect the participants of the workshop to benefit from this discussion and expect valuable comments from them that will refine the framework further.

Workshop 4

Screen Engineering – Poster Displays

Chris ORiordan-Adjah

Sunday, March 10, 1:00 pm – 5:00 pm, Stem Center, TTU campus

Posters will be on display that Showcase Screen Engineering

Workshop 5

Engineering EFFECTs: Environments for Fostering Effective Critical Thinking.

Charles E. Pierce

Sunday, March 10, 1:00 pm – 5:00 pm, Prescott Hall, TTU campus

The goals of the proposed workshop are as follows:

1) Explain the pedagogical framework for the Environments for Fostering Effective Critical Thinking (EFFECTs);
2) Demonstrate tools that facilitate the development, deployment, and assessment of EFFECTs;
3) Illustrate examples of decision worksheets and active learning exercises that have been used with EFFECTs;
4) Share faculty experiences with EFFECTs across all academic levels of engineering courses;
5) Guide participants through the design process of an EFFECT, leading each individual to draft a decision worksheet and at least one active learning exercise; and
6) Invite participants to join the Community of Practice, which will offer opportunities for continued support to further develop the drafted EFFECTs.

Brief Description of Topics:

The proposed workshop will be divided into the following chronological sessions:

1) EFFECTs Project – Introduction and Background
2) Pedagogical Framework
    a. Setting the Stage – Driving Questions and Decision Worksheets
    b. Engaging Students – Active Learning Modules
    c. How Do We Know That Students Are Learning? – Journals and Other Reflection Exercises
    d. Closing the Loop – The Final Product
3) Assessment of EFFECTs on Student Performance
4) Developmental Framework – How to Build Your Own EFFECT

Workshop 6

K-12 Engineering Outreach Workshop

Sally Pardue and Stacy Gardner

Sunday, March 10, 1:30 pm – 4:30 pm, Stem Center, TTU campus

K-12 Engineering Outreach Workshop – The workshop is a 3-hour showcase of ten to twelve engineering activities and programs aligned with education standards and designed for use with K – 12 teachers and students in formal and informal learning environments. Organizers will invite PIs and/or directors of SE regional K-12 outreach programs to showcase one of their activities – tried and "proven" with K-12 students

- #1 objective: engage the participants with demonstration of hands-on, standards aligned activity for a specific grade band of students
- #2 objective: curate a collection of the "best" activities in the SE – the activities will be collected into a single on-line location for participants to access afterwards
- Presenters can offer overview literature of full programming but primary intent to meet #1 objective
- Each presentation space will have xx tables and xx square footage to work with ~8 to 10 participants at a time for a 20 to 30 minute window of time

Workshop 7

Creating Hands-On Programming Experiences for Engineering Students

Sheikh Ghafoor

Sunday, March 10, 1:00 pm – 5:00 pm, Prescott Hall, TTU campus

Programming is an essential skill for engineering students, particularly in areas of mechanisms and robotics, mechatronics and design. Students receive formal programming training early on in the typical engineering curriculum, but generally demonstrate difficulty in implementing programming skills to solve engineering problems in later courses. This is due to a number of factors including a lack of cohesion in programming practice in the curriculum and improper context for introducing programing to engineering students. This workshop will introduce a hands-on programming toolkit to allow engineers to learn programming based on Microcontroller and associated hardware (sensors, motors, output devices) using either the Matlab or C programming environment. This toolkit is applicable to all levels of students, from freshman in their introductory programming course through senior and graduate students. This toolkit will be demonstrated for use in in freshman through senior year courses with specific examples in dynamics of machinery, robotics, mechatronics and controls.

In this hands-on toolkit, the MCU becomes the target for the program. Once programmed, the hardware runs independently and can readily implement outside of class or the lab. The primary method of programming an MCU is with C or C++. The toolkit supports C programming or Matlab programming using standard Matlab scripting language. One of the unique offerings of this toolkit is that it provides a way to program an MCU directly using Matlab.

The premise is that adding an MCU as a programming target, rather than simply a PC, may provide a more appropriate context for engineers to learn programming. In addition, the MCU target will offer a greater number of options for incorporating programming into the engineering curriculum.

This workshop will offer hands-on practice in the following areas to its participants:

Introduction to Hands-on programming toolkit

Programming a Microcontroller using Matlab script.

Demonstrated applications in engineering courses (dynamics of machinery, design, controls, mechatronics

Demonstrated applications in an introductory programming class

Demonstrated applications in dynamics of machinery, robotics, mechatronics and controls courses

Workshop 8

Developing the NAE 2020 Engineer

J.R. Sanders and Pedro Arce

Sunday, March 10, 1:00 pm – 5:00 pm, Prescott Hall, TTU campus

The USA-National Academy of Engineer has called for a different type of engineer that will be very effective in bringing the much needed solutions to the Grand Challenges identified by the Academy[1]. This style of engineer is a considerable departure of the current and traditional model more focused on repetition, maintenance, and routine types of operations and applications. While the strong analytical skills, high ethical standards, and practical ingenuity are 'invariants' attributed to the engineers, the NAE-2020 Model is also focused on innovation, creativity and entrepreneurship.

The NAE-2020 Model requires a new paradigm in engineering education; this paradigm needs to *develop* actively and collaboratively the fundamental knowledge in the students and, then, be able to bring a strong opportunity for them to *transfer* that knowledge in order to produce innovations. In short, the engineer in the making needs to learn and be trained on the process of creativity and innovation where a very effective transfer of knowledge towards the 'composer' rather than the 'conductor' style of professional that for years the engineering schools have been producing. [2]

The workshop will introduce and train participants with key elements of the new paradigm including: Cycles of Learning, in particular the "*Legacy Cycle*", extensively tested by the VANTH-ERC at Vanderbilt University[3], will be introduced and examples of its use in chemical engineering courses will be given. In addition, the "*Documentation Cycle*"[4] will be highlighted as part of a very effective student-centered approach to document concepts and monitor student learning. Participants will be introduced to the role of collaborative learning and the powerful principle of "*Group Genius*" as well the role of the student team within this environment.[5] "*Linear Engineering Sequences*" [6] (LES) as an effective and productive environment for creativity and innovation will be described and illustrative examples from two courses, i.e. biotransport and fluid-mechanics will be shared with the audience, describing the role of the instructor and finally, assessing tools use in the various courses will be offered.

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[1] "The Engineer of 2020: Visions of Engineering the in the New Century", NAP 2005

[2] Pedro E. Arce, "New Paradigm of Engineering Education: The Composer vs. the Conductor Engineer", National Science Foundation (NSF) –Engineering Research Centers (ERC) Annual Meeting, Keynote Presentation, Washington DC, December 2009.

[3] https://repo.vanth.org/portal/public-content/star-legacy-cycle/star-legacy-cycle

[4] P. Arce-Trigatti et al, "The Documentation Cycle", ASEE-SE Annual Meeting, The Citadel, SC, 2010.

[5] See "The Group Genius" by Keith Sawyer (2007).

[6] Pedro E. Arce and Loren Schreiber, "Hi-PeLE, Journal of Chemical Engineering Education, Summer 2004.

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