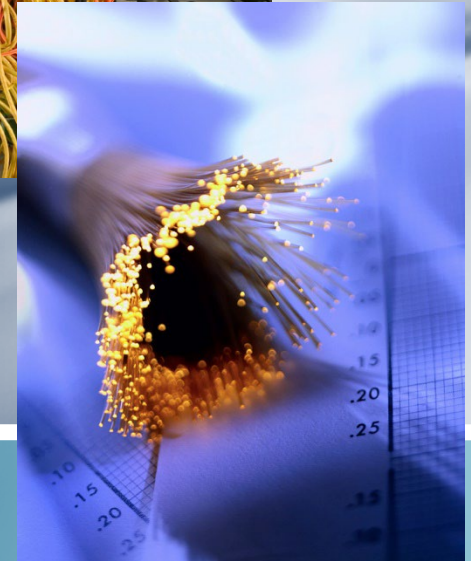
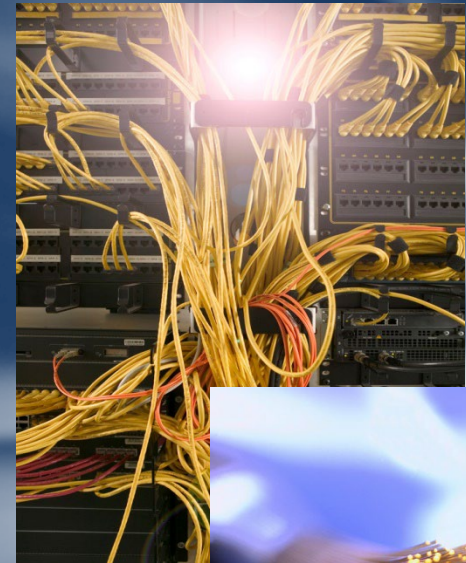


Advancing and Integrating Knowledge of Telecommunication Standards into STEM Education

Project ISTEE



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Presentation Layout

- Background
- Course Description
- Evaluation Plan
- Communication and Dissemination Plan
- Outcomes, Accomplishments, and Lessons Learned

Background

Award Data

- Advancing and Integrating Knowledge of Telecommunication Standards into STEM Education
 - *The acronym **ISTEE** was coined last summer to refer to this project (**Integrating **Standards into **Telecommunication **Engineering **Education******)*****
- Funding Program: Standards Services Curricula Development (SSCD) Program, the National Institute of Standards and Technology (NIST), US Department of Commerce.
 - *Funding Opportunity # 2015-NIST-SSCD-01 (Funding Type: Cooperative Agreement)*
- Project Team
 - *Tarek S. El-Bawab, Jackson State University (PI)*
 - *Frank Effenberger, Huawei USA (Consultant)*
 - *Two students, Jackson State University (RAs)*
- Period of Performance: September 1, 2015- February 28, 2016

Motivation and Rationale

- STEM education is re-examined, in terms of educational objectives, curricula and majors, and instruction methods. Several changes are desirable and anticipated, including:
 - New Majors
 - New instruction strategies
 - Better prepare our workforce for the 21st century's global challenges
 - Among other changes, standards education became necessary
- The Telecommunication Engineering Education (TEE) movement (2008-2014) led the Accreditation Board for Engineering and Technology (ABET) to recognize Telecom Engineering as distinct education discipline
 - Telecom is particularly rich in standardization activities and curricular effort is needed in this regards

This Project ...

- An Academic/Industrial partnership with NIST to advance and integrate knowledge of Telecom standards into STEM in general, and into Telecommunication, Electrical, and Computer Engineering in particular.
- Delivers new university course in *Telecommunication Standards and Standardization Processes*, where innovation is twofold: in course content; and in instruction strategy.
- Focuses on Telecom as a platform, but presents a model that can be adapted by other disciplines and has broader impact on standards education across STEM

Course Description

Telecommunication Standards and Standardization Process

- Designed for senior-undergraduate and graduate students
 - 18 students in Spring 2016
 - 21 students in Fall 2016
- First-of-its-kind syllabus and course material in this field
- Innovative instruction strategy, which blends two distinct methods:
 - Traditional/conventional Instruction (lecture type)
 - Interactive Workshops (two per semester)
 - Involve simulation of SDO meetings, contribution / draft writing, standard-project presentations, and related activities.

Traditional Instruction Topics

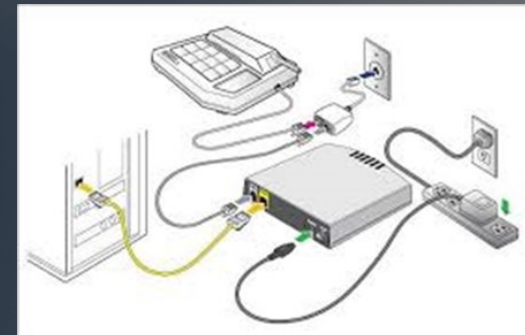
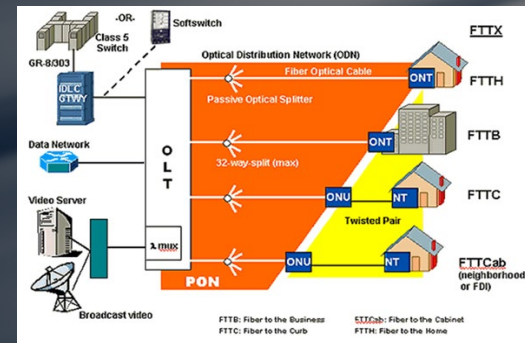
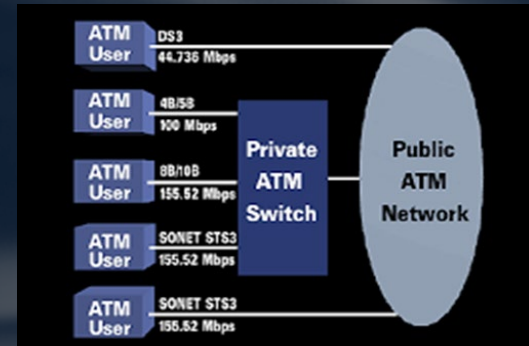
- **Part I**: Introduction to Standards and Standardization: A Telecom perspective
- **Part II**: Telecommunication Standards Development Organizations (SDOs)
- **Part III**: The Standardization Process
- **Part IV**: Standards in Relation to Technology Life Cycle
- **Part V**: Standards and Telecom Market Forces
- **Part VI**: Miscellaneous Topics

Interactive Workshops

- One-hour seminar by invited standards expert (industry).
- Two-hour interactive/simulation session where students take the stage and learn firsthand.
 - Students capitalize on their prior learning in classes, on a 2-weeks prep, and on the seminar to simulate a standards meeting/activity.
- Students experience critical thinking, debating, speaking, and team work within standards' contexts
- Simple technical problems adopted in order to:
 - Strike a balance between keeping it technical , Telecom related; and enabling students to appreciate processes and none-technical issues.
 - Open up course enrolment to diverse majors, if possible
- ITU-T & IEEE-SA based simulations administered
- Workshops are video taped

Samples of Real-Life Drama

- Course involve discussions of topics at the crossroads of engineering, technology, economy, market, politics, and human behavior! Examples include
 - The rise and fall of ATM
 - WDM PONs
 - The DSL Line-Code War



Other Course/Project Activities

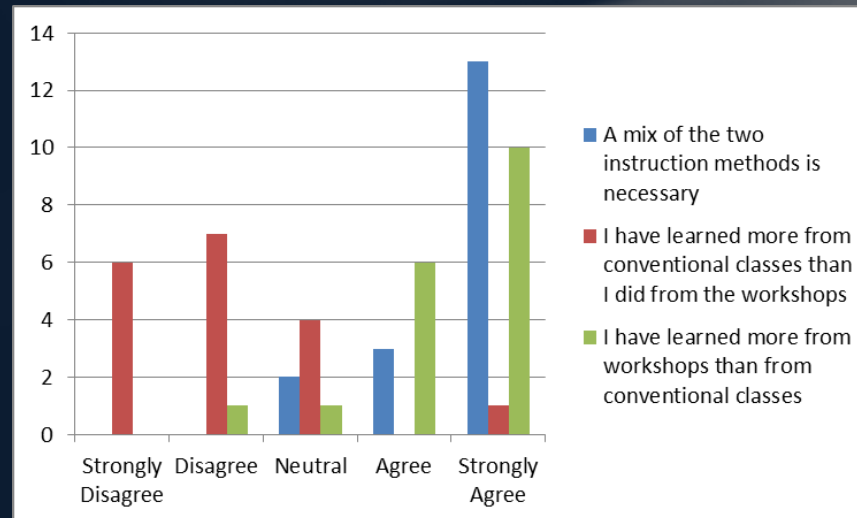
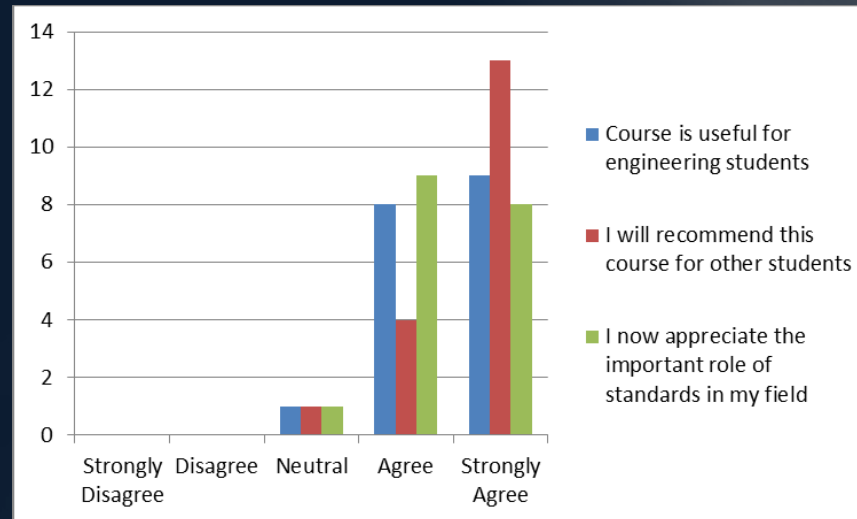
- Term Paper: “A World without Standards”- Fall 2016
 - ANSI’s 2016 student paper competition was designed around this theme. Students were asked to contribute papers in this topic
- Multiple-choice Quizzes- Spring 2016
 - Designed to measure students’ appreciation of standards and standardization processes
- RAs are assigned a task of examining status of technical standards’ education in the US in comparison to other countries (November 2016 through end of project)

Evaluation Plan

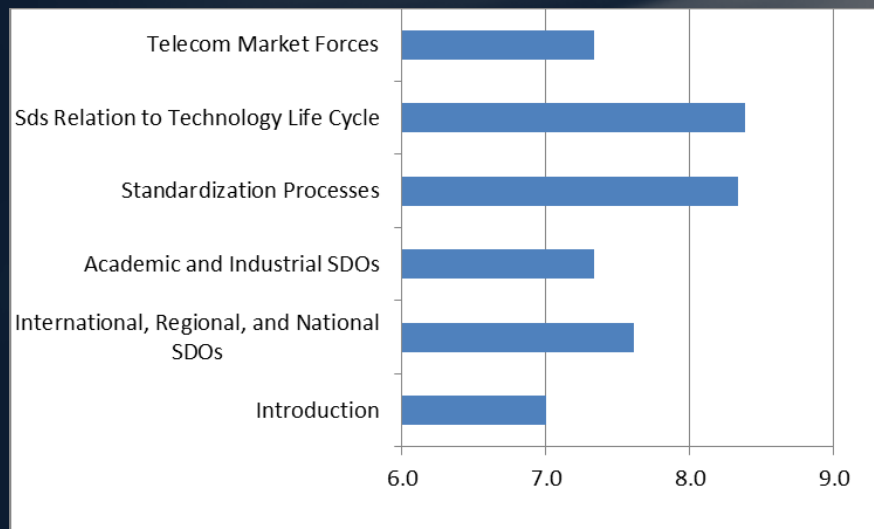
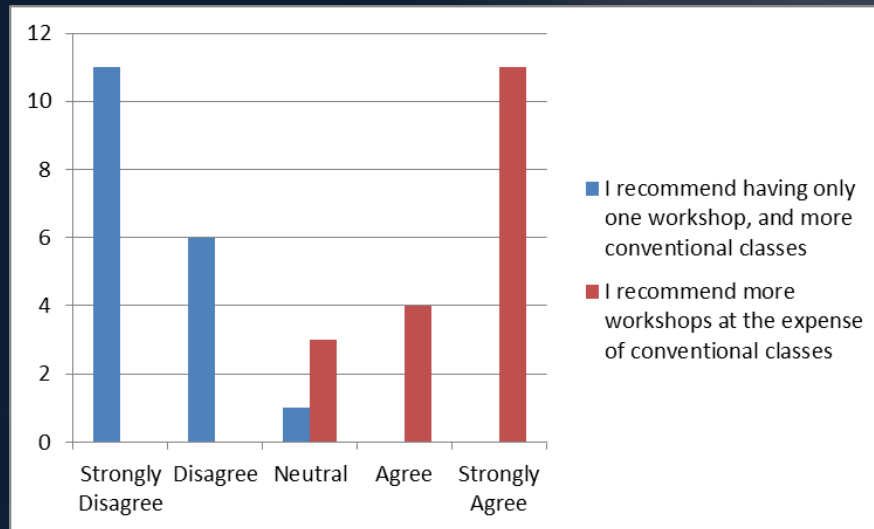
Evaluation Plan (1/4)

- To measures the impact of this course on students' learning and measure their appreciation of:
 - the role standards play on modern (21st century) life, and
 - the combination of technical, regulatory, market, political, and other factors involved in standards and standardization.
- Two types of metrics are involved in evaluation plan
 - Questionnaire based (none-ABET-type) metrics; already used in Fall 2016. These help finalize course material by the end of project. They may continue thereafter for improvement, if needed.
 - ABET-type formal metrics to measure course outcomes, and how aligned they are with typical engineering programs objectives
- Evaluation should guide our way to continuous Improvement

Fall 2016 Survey/Questionnaire (2/4)



Fall 2016 Survey/Questionnaire (3/4)



Evaluation Plan (4/4)

- The other type of evaluation metrics uses ABET assessment methods
- The new course offers an opportunity to measure certain ABET-assessment metrics which are not traditionally easy to measure in university programs, for example:
 - design within real-life constraints,
 - function on multi-disciplinary teams,
 - understand professional/ethical responsibilities,
 - communicate effectively,
 - know about contemporary issues, and
 - appreciate the need for life-long learning.

Communication and Dissemination Plan

Communication/Dissemination Plan (1/4)

- Execution of this plan started already in May 2016 (upon completion of first course offering)
- Ambitious plan; diverse in terms of:
 - geographical coverage (from Jackson MS to Kuala Lumpur Malaysia),
 - targeted communities (from engineering practitioners to academic researchers), and
 - publication type (from invited presentations/talks to peer-reviewed scholarly papers)
- Includes short-life and long-life deliverable, with the latter having potential for sustained extended impact through future

Communication/Dissemination Plan (2/4)

- Conferences & Workshops
 - The IEEE International Conference on Communications (ICC'2016): panel on Standards Education, Kuala Lumpur, Malaysia (May 25, 2016).
 - The 7th Southeast Symposium on Contemporary Engineering Topics (SSCET 2016): invited Presentation, Jackson, MS (August 26, 2016).
 - The IEEE Conference on Standards for Communications & Networking (CSCN'2016): scholarly peer-reviewed paper presented in Berlin, Germany (November 1, 2016).
 - NIST Workshop, Presentation on November 4, 2016
 - Invitation to speak in the International conference on Frontiers of Information Technology (FIT), Islamabad, Pakistan (Dec. 2016).

Communication/Dissemination Plan (3/4)

- IEEE Distinguished Lecturer tours
 - One anticipated in December 2016
- Other publications and on-line media
 - IEEE Standards University.
 - Standards Engineering, journal of SES (Society for Standards Professionals), IEEE ComSoc's Global Communications Newsletter (GCN) and/or IEEE Standards Education eMagazine,
- Course material will be available to accredited programs and industrial educators.
- Final summary report of *ISTEE's* major conclusions will be released by project end.

Communication/Dissemination Plan (4/4)

Feature topic (special section) on Standards education in IEEE Communications Magazine

Textbook Project, starting before end of 2016

The screenshot shows the IEEE Communications Magazine website. The URL is comsoc.org/commag/cfp/education-training-telecommunication%20standards-education. The page features the IEEE Communications Magazine logo and a navigation bar with links: HOME, IEEE COMMUNICATIONS MAGAZINE HOME, CALL FOR PAPERS, EDUCATION & TRAINING: COMMUNICATIONS STANDARDS EDUCATION. The main heading is 'EDUCATION AND TRAINING: TELECOMMUNICATION STANDARDS EDUCATION'. Below this, there is a 'Feature Topic' section titled 'CALL FOR PAPERS'. The text describes the importance of technical standards in engineering, science, and technology, and how they impact STEM education and the workforce. A sidebar on the right lists various links: HOME, CURRENT ISSUE, CALL FOR PAPERS, GUEST EDITOR KIT, REVIEWER GUIDELINES, AUTHOR GUIDELINES, EDITORIAL BOARD, GLOBAL COMMUNICATIONS NEWSLETTER, and THE PRESIDENT'S PAGE. At the bottom, there is a QR code and a link to the series homepage and Springer.com/authors.

The screenshot shows the Springer website. The URL is springer.com. The page features the Springer logo and a navigation bar. The main heading is 'Textbooks in Telecommunication Engineering'. Below this, there is a 'Textbooks in Telecommunication Engineering' section. The text describes the series, which aims to provide high-quality textbooks in the field of telecommunication engineering. The series is edited by T.S. El-Bawab. The text also mentions that the series is recognized by the Accreditation Board for Engineering and Technology (ABET) and that the Springer's Series Textbooks in Telecommunication Engineering capitalizes on this milestone. The series aims to produce high-quality volumes featuring interactive content, innovative presentation media, classroom materials for students and professors, and dedicated websites. Book proposals are solicited in all topics of telecommunication engineering, including but not limited to: network architecture and protocols; traffic engineering; telecommunication signaling and control; network security; network design, measurements, and modeling; broadband access; MSO/cable networks; VoIP and IPTV; transmission media and systems; switching and routing (from legacy to next-generation paradigms); telecommunication software; wireless communication systems; wireless, cellular and personal networks; satellite and space communications and networks; optical communications and networks; free-space optical communications; cognitive communications and networks; green communications and networks; heterogeneous networks; dynamic networks; storage networks; ad hoc and sensor networks; social networks; software defined networks; interactive and multimedia communications and networks; network applications and services; e-health; e-business; big data; Internet of things; telecom economics and business; telecom regulation and standardization; and telecommunication labs of all kinds. Proposals of interest should suggest textbooks that can be used to design university courses, either in full or in part. They should focus on recent advances in the field while capturing legacy principles that are necessary for students to understand the bases of the discipline and appreciate its evolution trends. Books in this series will provide high-quality illustrations, examples, problems and case studies. For further information, please contact: Dr. Tarek S. El-Bawab, Series Editor, Department of Electrical and Computer Engineering, Jackson State University, telbawab@ieee.org; or Mary James, Senior Editor, Springer, mary.james@springer.com. At the bottom, there is a QR code and a link to the series homepage and Springer.com/authors.

Outcomes, Accomplishments, and Lessons Learned

Significant Outcomes and Accomplishments (1/2)

- Course successfully designed, delivered (two semesters), and attracted good number of students
 - ~ 40 in one year
- Instruction strategy effective and suited to standards education
- Many students performed so well in workshops and can be candidate standards' professionals.
- Course materials (syllabus, class slides, seminars, and workshops) will be published. They will be available to other programs, departments, institutions, and to general public

Significant Outcomes and Accomplishments (2/2)

- A high-budget communication plan implemented within smaller project budget by leveraging professional resources available to project team
- The project is producing short term (9-24 months) and long term (2-5 years) results
- *ISTEE's* model can be replicated, adopted, modified, and improved by others in other STEM disciplines
- We are well positioned on road to achieving nearly all our original goals and objectives

Lessons Learned (1/2)

- Instruction methods is key to attracting students' to any topic, and standards are no exception
- Logistics involved in launching a new course incorporating more than one workshops, and invited industrial speakers can consume considerable time and energy
 - Release time is important
 - These matters are also institution dependent
- Institution support and culture is critical for advancing standards education in principle.

Lessons Learned (2/2)

- Had budget permitted, I would have tried to hire
 - external evaluator to assess course outcomes
 - specialized person for video tapping the workshops
 - web developer
 - ... for a first-time project, the priority had to be assigned to other investments. Now, in future projects, we have an infrastructure and can invest in these hiring's/activities
- ISTEE can be a catalyst project that is paving the way for other efforts to advance and modernize standards education
 - Green ICT
 - IoT
 - Big Data

Wrapping up ...

- We presented project *ISTEE*'s rationale, motivation, and activities
- described the course we are delivering
- described evaluation plan
- described communication and dissemination plan
- discussed *ISTEE*'s outcomes, accomplishments, and lessons
- outlined avenues for future work

Questions?



Contact

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