The Society for Standards Professionals

Education Challenge Grant
- Multimedia Standards Case Studies

NIST Grant 60NANB12D289

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1. Introduction

In September 2012, SES – The Society for Standards Professionals was awarded a grant by the National Institute of Standards and Technology (NIST) under its Education Challenge Grant program. The grant program was a special funding opportunity offered that year by the NIST Standards Services Group (SSG) to strengthen education and learning about standards and standardization and support the integration of standards education into the undergraduate or graduate course curriculum in a meaningful way.

SES received NIST funding to develop four standards case studies using multimedia technology with a focus on a STEM (Science, Technology, Engineering, and Mathematics) curriculum for undergraduate and graduate classes. The project for which SES was awarded a NIST grant supports the goals of the SSG Grant Program, "to educate students about the impact and nature of standards and standardization so that they enter the workforce and or continue their academic studies with a strong understanding and appreciation for the value and benefits of standards and standardization." In addition, the SES project meets the secondary goal of this program "to identify new approaches, methods, and models that can be replicated or built-on by other educational programs."

The Case Study Project Methodology consisted of four phases:
Phase 1 – Develop Case Studies
Phase 2 – Develop Multimedia Presentations
Phase 3 – Pilot Study
Phase 4 – Project Evaluation

The results of this pilot project were to tell us:
1. How easily the prototype can be adopted by teaching professionals
2. Whether multimedia case studies engage students
3. The level and depth of content and ease of use required by both faculty and students

2. The Problem

Standards are widely used in the workplace. Graduates often are expected to use standards, but rarely are they equipped with the standards literacy (knowledge of standards, and how to work with and apply them to real-world situations) to practically apply them. The following examples illustrate this problem:

Graduates are expected to use standards in the workplace, but rarely are they equipped with knowledge of standards and how *to practically apply them*

a) The typical STEM faculty member has not received any education in standards. Because the educational background of STEM faculty likely did not include standards or standardization, they are generally ill-equipped to impart standards literacy. This problem will persist until the cycle is broken.

b) Standards are a difficult subject to teach without access to the actual documents or

excerpts from the standards. Often, access to standards is expensive and may be cost prohibitive for schools. In "The State of the Use of Standards in Engineering and Technology Education," a paper given at the American Society for Engineering Education annual conference in 2013, the authors noted the following obstacles to teaching about standards:

- Lack of text books that provide the fundamentals and examples of application of technical standards
- Cost of access to technical standards documents
- Lack of faculty expertise on application of standards
- Lack of access to technical standards documents
- Other (including limited time, too many standards to teach, lack of faculty time, standards are continuously changing, standards use complex language, and lack of standards knowledge by faculty and administrators)

c) Retirement of the baby boomer generation is reducing standards literacy in the workforce. According to the Pew Research Center, 10,000 people in the United States will reach retirement age every day between January 1, 2011 and 2030. This prediction translates to a problematic drain on the institutional and corporate knowledge base. Newly-employed STEM graduates need training in standards. As a result, graduates who enter the workforce unfamiliar with standards and their practical application in the workplace put the burden of training on their employers, many of whom are already strapped for resources. In many cases, the task of training recent graduates in the use of standards is carried out by senior staff. With these staff retiring, industry is relying on academia to better educate undergraduates in the areas of standards and standardization.

3. Original Project Goals

The original goals of this project, as stated in the SES proposal to NIST, were to:

a) Connect concepts to real world workplace scenarios with engaging and informative case studies written by industry experts.
b) Evaluate data from faculty and student users on the multimedia presentation techniques, and revise if necessary.
c) Provide faculty with a Standards Education Toolkit of instructional materials, lecture notes, and case studies with access to student courses, tests, and standards documents.

4. Multimedia Presentations

Upon being awarded the grant from NIST, SES established a project team consisting of the following persons:

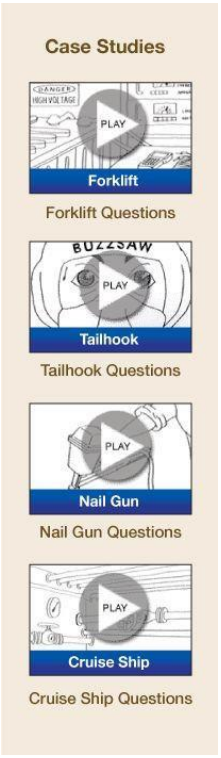
- Craig Cerniglia (Chair, SES Education Training Subteam)
- Ashley DeGiacomo (Director, SES Education Council)
- Bruce Harding (Professor, Purdue University)
- JoAnne Overman (Member, SES Education Committee)
- Karen Reczek (Chair, SES Education Committee)[1]
- Mike Morrell (SES Executive Director)
- Trudie Williams (Member, SES Education Committee)
- Diane Thompson (Director, SES NIST Grants Project)

Richard Forselius has provided editorial additions to this document.

As stated, the multimedia case studies project consisted of multiple phases. In the first phase, four standards development organizations were identified and contacted to assist with the preparation of the case studies. SES worked with the American Society of Mechanical Engineers (ASME), ASTM International, IPC – Association Connecting Electronics Industries, Underwriters Laboratories Inc. (UL), as well as with IHS Inc. to identify standards that would be used for the case studies and to create research questions and answers based on the scenarios.

[1] Ms. Reczek resigned from the SES project team upon her employment at NIST in 2013

The next phase of the project involved issuing a request for proposals (RFP) and selecting a company to develop the multimedia case studies. SES obtained bids from three vendors for development of the multimedia presentations. Mudpuddle Creations, a small business located in Maryland, was chosen to create four three-minute videos that combined whiteboard drawing and animation with a narrative voiceover. The scripts and storyboards were produced, reviewed by the project team, revised, and finalized to transform the written case studies into multimedia presentations.



The scenarios we developed included determining the optimum threaded fastener to be used for nail gun housings using an ASME standard, and verifying the requirements and testing for electric-battery-powered industrial trucks with information found in a UL standard. An ASTM standard for lap joint flange pipe ends provided the basis for a storyline about plumbing on a cruise ship, and the solution for a tailhook malfunction on an aircraft carrier incorporated information from the IPC standard for electronics assembly manufacturing. To view the final videos, go to www.ip-shield.com/nist.aspx.

During the last semester of 2013, Purdue University students in the College of Technology, Department of Mechanical Engineering Technology undergraduate and graduate classes participated in a pilot study of the multimedia standards case studies. Professor Bruce Harding incorporated the case studies into his course syllabi to enable us to conduct the pilot study, an important phase of this project. In preparation for the pilot studies, IP-Shield developed an online site for easy access to the case studies. The four standards developers (ASME, ASTM, IPC, and UL) provided access to the documents used in the case studies through the IHS Standards Expert™ system at Purdue University. The purpose of the pilot study was to solicit feedback from the students about how easily the case study prototypes could be adopted by teaching professionals, whether multimedia case studies engage students, and what level and depth of content and ease of use is required.

5. Findings

Following are the Findings associated with the Purdue University students College of Technology, Department of Mechanical Engineering Technology undergraduate and graduate classes participating in the pilot study of the multimedia standards case studies.

After viewing the case study videos, the Purdue students were required to respond to an online survey. 47 responses were received and overall, the feedback from the students was very positive.

Overall, students were 60% satisfied with the case studies (28 students), 17% indicated being very satisfied (8 students), and 17% (8 students) were neutral. 3 students or approximately 6% responded very unsatisfied.

33% of the students strongly agreed and 57% agreed that the video content was clear and

easy to understand. 5 students or approximately 10% responded neutral with no responses either "disagree" or "strongly disagree."

When asked if the questions at the end of each case study were useful in improving understanding of the use of standards, students responded 23% (11 students) strongly agree, 53% (25 students) agree, 17% (8 students neutral), and 4% (2 students) disagreed with 2% (1 student) strongly disagreeing..

83% of students responding indicated they found the case studies informative (39 Students); 55% (26 students) found these engaging. On the negative side, 15% (7 students) thought the case studies to be boring, 2% (1 student) too easy and 6% (3 students) too hard.

Students ranked the case studies in this order:

1. Forklift
2. Tailhook
3. Cruise Ship
4. Nailgun

94% (44 students) indicated either agree or strongly agree to having a better understanding of how standards impact their everyday lives. 74% (35 students) would recommend these case studies to others to learn more about standards.

All but 2 students accessed the case studies from a computer and 4 students experienced technical problems with the videos.

"these case studies helped me to relate the importance of standards to everyday life"

Comments such as, "these case studies helped me to relate the importance of standards to everyday life" and "I learned that standards can be used in real life situations" were typical of the feedback we received. Reinforcing a key message of the project, one student remarked, "The variety in these scenarios shows the likelihood that, no matter where an engineer goes, standards will almost certainly be a part of their everyday work experience."

SES has developed a tool for STEM faculty that connects concepts to real world workplace scenarios with engaging and informative case studies, thereby meeting the original goals of this project. Additional multimedia case studies could be created for other disciplines and applications using the format developed by SES.

An article about this project was written by the Project Director and published in the March/April 2014 issue of the SES Journal, *Standards Engineering*.

6. Lessons Learned

With the sudden death of Professor Harding, a key member of the project team, we had to make adjustments to the Project Director's tasks to prepare the final deliverable (this report). A secondary contact at the university would have been helpful to carry out the final report of the project. Additionally, during the project it was often difficult to reach Professor Harding. A backup contact could have helped us throughout the project's entirety in terms of keeping it moving forward.

Despite these setbacks, the required deliverables were completed and overall, the project was a success.

These are the Lessons Learned associated with the original project goals, as stated in the SES proposal to NIST, were to:

a) Connect concepts to real world workplace scenarios with engaging and informative case studies written by industry experts.

We learned this is an essential aspect in developing case studies. SES was able to engage both industry experts and the four standards developers. Case studies developed by those without immediate access and experiences gained from situations are not as valuable as those developed by first party engagement with the real world scenarios. Industry experts often are focused on solving problems and frequently do not naturally come forth willingly to share scenarios that might be told as case studies in academia.

b) Evaluate data from faculty and student users on the multimedia presentation techniques, and revise if necessary.

An online survey was created and the results indicate previously in the section on Findings. Unfortunately with Professor Harding's passing we were not able to speak to him about the multimedia presentation techniques. What we do know is that Professor Harding was personally engaged in all aspects of the case study creation process, therefore it is important to include the professor's guidance and judgment when creating case studies to ensure they are in concert with course and academic goals.

c) Provide faculty with a Standards Education Toolkit of instructional materials, lecture notes, and case studies with access to student courses, tests, and standards documents.

The case studies are available on-line, as stated. Unfortunately we do not have access to lecture notes or tests. Again, reiterating that a backup University contact would have been helpful. Access to standards documents is available several ways to academics and students. These include through the Standards Developing Organizations directly, through the American National Standards Institute (ANSI) Committee on Education (COE) and many are available through third party standards subscription services.

We also have found with the assistance of Donald E. Purcell of Catholic University that only three U.S. university engineering schools currently offer a standards course at the graduate level:

– The Catholic University School of Engineering
– University of Colorado (Boulder)
– University of Pittsburgh

No standards courses are currently offered at any university school of business, public policy, economics, international trade, or law in the U.S.