

## **Finessing the Introductory Standards Workshop: Efforts Toward Active Learning**

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## **Abstract**

The opportunity to introduce engineering students to technical standards literature is a rewarding experience for the engineering librarian. Librarians must be careful not to rely too much on the lecture as an educational technique. This paper describes creative efforts to introduce active learning techniques to the typical one-hour workshop. Following a shorter lecture, workshop attendees will be given topics to tackle in small groups. The lecture will include ideas for discovering standards of possible interest such as literature searching (databases such as Compendex, which indexes standards or full-text databases like IEEE Xplore and ASTM Compass), references in handbooks or specialized encyclopedia entries (or other monographs), articles on the design of artifacts (products), discussions with colleagues/bosses, product descriptions when sourcing materials for a design, labels on items or cartons, or searching a standards supplier database. Attendees will work on the problem of finding related standards to a given engineering scenario. Scenario possibilities include 1) standards information needs for a small business for innovative piezoelectric products, 2) locating standards related to tissue engineering, and 3) standards need to be gathered for a university research group that explores microgrids. Scenarios have the possibility of appearing contrived unless academic librarians reach out to engineering professors for possibilities that could be explored for engineering design courses and capstone project courses.

## **Introduction**

At Carnegie Mellon University, information literacy efforts are challenged to incorporate active learning approaches into all efforts. Because of this challenge, the authors are attempting an

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overhaul of their introductory workshop on industrial standards resources and tips for locating relevant standards as needed, something all engineering students should master throughout their undergraduate study. Activities focus on scenarios that students can attempt during the workshop after a resource and strategy introduction. Although the librarians concerned have reasonably good engineering backgrounds, it was felt that engaging the teaching faculty of the College of Engineering would provide more interesting scenarios. In addition, the engagement might help to enhance attendance or provide additional information literacy opportunities, since workshop attendance has been a chronic concern and garnering any opportunity for student contact has been challenging.

## **Literature Review**

Standardization is the backbone of the modern world, enabling products and processes we take for granted as everyday conveniences to exist. <sup>1</sup> Most industry employers expect engineering and technology college graduates to have experience with standards. <sup>1</sup> The Accreditation Board for Engineering and Technology (ABET) requires the integration of engineering and industry standards into the curriculum as defined in the ABET 2022 – 2023 Criteria for Accrediting Engineering Technology Programs. <sup>2</sup> A survey conducted in a mechanical engineering technology design course showed that most undergraduate students had not been introduced to technical standards. <sup>3</sup> In addition, a recent faculty survey found that most faculty integrated standards into their course, but only a few of them partnered with the libraries to help them integrate standards education into their curriculum. <sup>4</sup>

Academic librarians have been using active learning in library instruction sessions to promote student engagement. During the library instruction session, students utilized clickers to actively engage and respond to in-class information literacy questions about scholarly information sources and citations, thereby enhancing their overall participation. <sup>5</sup> In a collaborative effort, librarians at Purdue University teamed up with faculty members to develop instructional modules grounded in problem-based learning and the primary objective of these modules was to enhance the active learning experiences of the students. <sup>6</sup> The science laboratory classroom setting presents a favorable environment for librarians to incorporate active information literacy instruction, fostering a natural and engaging learning experience for students. <sup>7</sup> The instruction librarians at the University of Texas at Austin implemented a team-based active learning exercise to teach nutritional sciences students a method for reading research papers. <sup>8</sup> An academic library implemented virtual anatomy table services to bolster active learning within anatomy educational communities. <sup>9</sup> Technical communication instructors and academic librarians collaborated to design active learning classes. <sup>10</sup>

The integration of standards into engineering and technology curricula has yielded positive outcomes, as evidenced by numerous studies. The collaborative efforts of an engineering

librarian, faculty member, and professional from a standards-developing organization (SDO) led to the creation of a customizable standards course module that was designed to integrate seamlessly into existing engineering courses.<sup>11</sup> The American Society of Mechanical Engineers (ASME) created instructional packages containing engineering standards and these packages were designed to be easily integrated into undergraduate courses.<sup>12</sup> A survey conducted among students who participated in the standards-embedded course revealed a significant improvement in their understanding of technical standards upon completion of the standards class projects.<sup>13</sup>

## **General Approach**

The authors reviewed the curricula of the departments of the College of Engineering for coursework that might benefit from the introductory standards workshop. Courses of interest tended to involve engineering research projects, product design, and capstone courses. As the review of the curricula was aligned with recent course instructors, a short list of engineering professors was identified for scenario ideation.

The results of outreach to engineering faculty in biomedical engineering, chemical engineering, civil/environmental engineering, electrical/computer engineering, materials science/engineering, and mechanical engineering were encouraging. Three of the six departments that were contacted replied in less than a week. Two of the replies indicated an assurance that instructors would convey the opportunity to their students. One offered a new challenge to the effort - what if the students brought their topics to the engineering librarians? This last reply would be an example of workshop outreach efforts leading to other opportunities to engage with the College of Engineering.

A review of the lecture slide deck led to a cut down on the amount of lecture. The learning objectives were adjusted by dropping “Understand the basic structure of standards” and keeping in place “Get familiar with definitions and types of technical standards,” “Be aware of major standards databases,” and “Develop effective standards searching strategies.”

The general approach is to have the active learning scenarios follow a bit of lecture on the possible strategies an engineer might take to locate standards. The students would be offered a selection of problems involving the need to gather information on relevant standards. The goal of the activity would be to bolster the student’s confidence in locating relevant standards when facing a similar information need.

There are several ways to approach the problem. All workshop participants would be reminded that standards are often considered “gray literature” which means that they can be hard to discover often owing to poor bibliographic control. The discoverability of standards has improved with the advent of new search tools, but the digital information landscape that has

resulted can be confusing to engineering students. The lecture covers some possible search strategies that have proven to be successful. Some of the possibilities are described in the following paragraphs.

Since Compendex now indexes standards literature in addition to other more traditional engineering publications like journal articles and conference papers, a user can quickly locate a set of standards related to a topic like zeolites (for example). Using a database like Compendex can often be far more effective than the bibliographic tools that standards vendors and standards development organizations provide for what they have to sell.

In contrast, although vendor databases like TechStreet and the Standards Store (by Accuris, formerly IHS) contain vast collections of standards, their search strengths tend to be using the standard number to locate a particular standard when needed. These numbers can often be located in the references of engineering handbooks, specialized encyclopedias, and government regulations. Specific standards are also frequently mentioned in journal articles and conference papers that discuss engineering designs.

Two of the better searching tools have sprung from standards development organizations. ASTM Compass provides access to the ASTM standards and related information. The breadth of coverage of ASTM standards is quite extensive. Many students will achieve quick success in locating relevant ASTM standards. The IEEE Standards have long been part of the IEEE Xplore database and they also cover quite a swath of topics. Standards, once located, usually refer to other highly related standards to provide additional help.

Engineers often ask each other when they have information needs. Perhaps their colleague has faced a particular design problem in the past. A senior engineer or an engineering professor might serve on the committee that has developed relevant standards.

The students can employ all of these methods to locate standards relevant to their engineering designs. Even thinking about who to approach with their information needs can be a part of a scenario in an introductory standards workshop.

## **Discussion**

Engineering coursework has been notably packed with material to cover. Owing to this time constraint, a standards workshop could be an extra credit assignment or an assignment to do outside of class. This might require the engineering librarians to increase their number of offerings or to offer consultation visits in addition to workshops. A workshop recording could be prepared with student consultations with the librarians.

The engineering librarians currently await the challenge of student-generated topics as scenarios for standards needs. The risk here is that students might have such a difficult search that immediate gratification will not be achieved.

Assessment efforts at the University Libraries are just ramping up for information literacy workshops. The approach, in general, is a pre-workshop survey that focuses on the student's self-evaluation about each learning objective. It is simple in approach and can allow for a flexible number of learning objectives:

“Please indicate your level of certainty that you can [INSERT LEARNING OBJECTIVE]. If you aren't sure, just go with your first instinct. There is no right or wrong answer!”

A Likert scale allows the student to gauge their pre-workshop knowledge on a scale of 1 to 10 with 1 being uncertain and 10 being certain.

The post-workshop survey repeats the question(s) about each learning objective and proceeds to ask the student the following questions:

- What did you hope to learn today?
- When might you use this knowledge, skill, or resource?
- Describe one useful feature of this workshop.
- Describe one opportunity to improve this workshop.
- Please share any other feedback you have or ideas for future workshops.

## **Conclusion**

The efforts being made to engage with the College of Engineering through an introductory standards workshop should make a larger contribution to student learning. It has been a rewarding experience to explore our possibilities and to follow in the footsteps of engineering librarians at other colleges and universities. By taking the introductory standards workshop, students could learn the various types of standards, how they were created, and how to effectively find them through standards databases. The authors are excited to continue the collaboration with the College of Engineering regarding standards education integration.

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