

Standards Modules for Engineering Curriculum:
A Case Study Approach

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Primary Grant Goal

Develop standards education case studies

- Develop modules suitable for remote or on-site learning.
- Modules intended for integration into
 - First year course (Intro to Biomedical Engineering),
 - Senior year capstone courses (BME/EE/ME)
 - Graduate-level engineering courses
- Tested at University of Mount Union.

Impetus

Concerns with educational environment

Needed a better way to meet accreditation guidelines

- ❖ Curriculum did not allow for in-depth teaching of standards
- ❖ Limited expertise in teaching standards in academia
- ❖ Standards mostly used in capstone projects (if at all)
- ❖ Limited access to standards due to prohibitive costs

Industry expectations of students was a concern

Impetus

Concerns with status quo

Student perspectives

- ❖ ... instruction is rushed
- ❖ ... “dull” topic
- ❖ ... not critical knowledge
- ❖ ... key engineering concepts are under-emphasized
- ❖ ... poor student engagement
- ❖ ... lack of incorporation of concepts

Students discount the value of standards to profession

Students discount the importance of standards to their careers

Moot court is simulated court proceedings

Create a new classroom experience

In-class experience enhances:

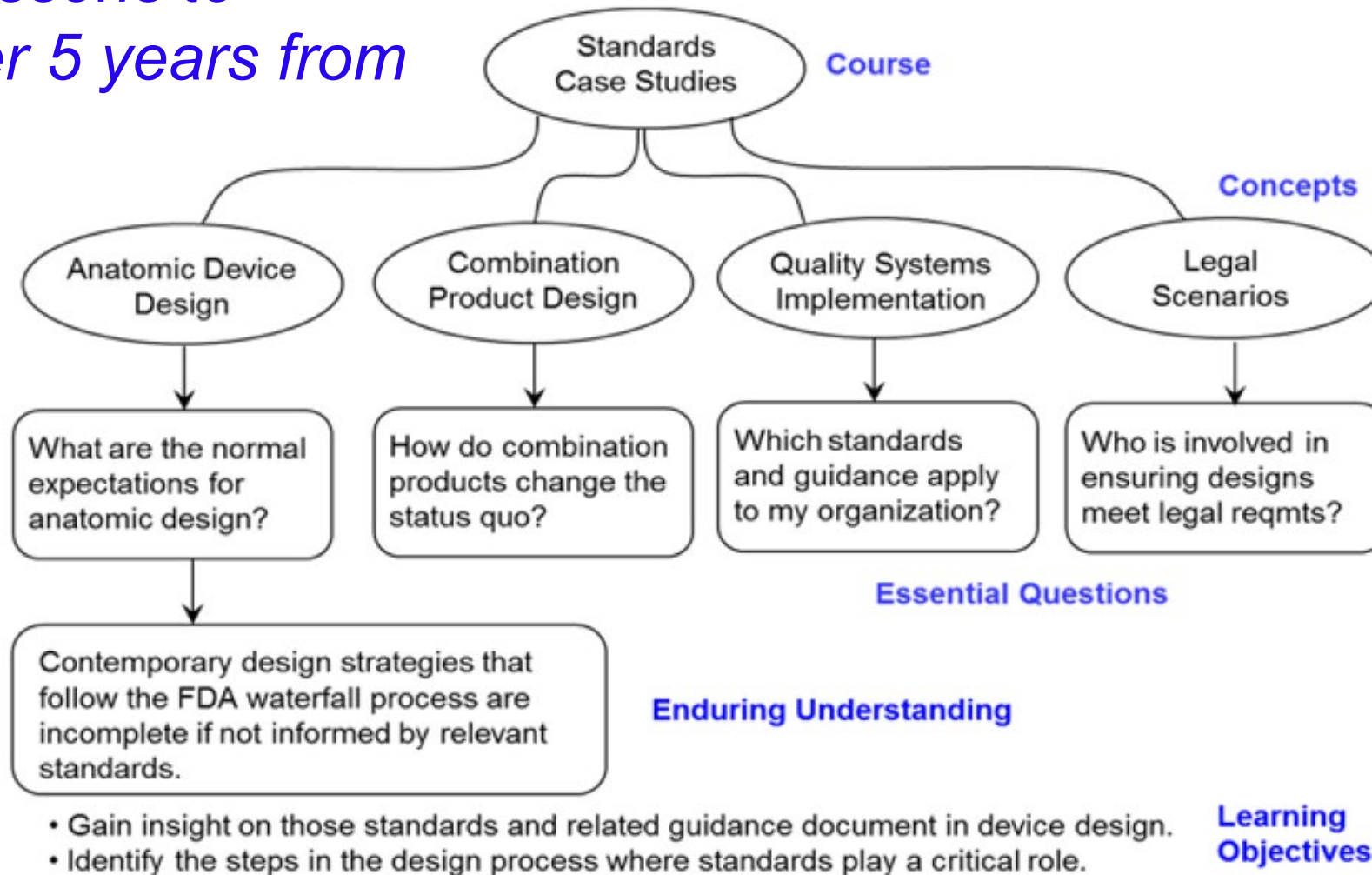
- ❖ Students' immersion
- ❖ Self-direction alongside teamwork building
- ❖ Creativity
- ❖ Oral present with critical thinking in real-time
- ❖ Research and awareness of standards

Provide perspective to standards and regulations

Applicable across engineering disciplines and topics

Enduring Understanding

Create lessons to remember 5 years from now



Getting going

Preliminary work

- ❖ Interviewed six key opinion leaders from industry
- ❖ Outreach to experienced Moot Court organizations
- ❖ OSF account for sharing with all NIST partners.
- ❖ Drafted a full case on cybersecurity wearables technology
- ❖ Had the opportunity to attends ASEE, BMES, NISTevents

Implementation strategy

Expand student engagement incrementally

Forum	Intent	Case Study	Setting
In-class Vignette	Highlight standards as guidance documents	One-paragraph case summary	Small group in-class discussion w/faculty moderation Takes 15 minutes.
Team-Based Learning	Student-led exploration of issues illustrating the role of standards	One-page summary with greater context of the situation to introduce ambiguity	Recitation-based in-class discussion lead by students. Takes one hour
Moot Court Session	Student-role arguing point/counterpoint on detailed points from research.	Detailed case with some sample evidence documents to analyze.	Trial-like atmosphere in mock courtroom with third-party actors. One Day

Moot court

Tactical activities

- ❖ Class discussions on standards
- ❖ Library presentation on standards availability
- ❖ Introducing the case and selection of moot court volunteers (~10 students serving in various court roles - lawyers, plaintiff, defendant, and witnesses)
- ❖ Dedicated class time for moot court activity (50 min)
- ❖ Active class participation
- ❖ Pre and post event survey

Moot Court

Implementation considerations

- ❖ Solid plan for the session
- ❖ Multiple volunteers comfortable with public speaking
- ❖ Enough time for volunteers to do research
- ❖ Incentives for volunteers
- ❖ Real-time quiz for observers due at the end of the session

Results – Cybersecurity of Wearables

Self-reported rate of 3:1 in favor of the exercise

“...knowledge easily acquired in a more organic way”

“...exposes us to an important aspect of engineering aside from purely math and science”

“...it’s one thing to learn about these standards in a vacuum but seeing first hand how they can be applied and used to cover many angles was incredibly valuable in seeing the lack of my comprehension”

Survey says

Improved understanding of standards

- ❖ Value of regulatory language (12%)
- ❖ Applicability of quality systems to labeling requirements (11.3%)
- ❖ Responsibility of end-user for cybersecurity (10%)
- ❖ Confidence in understanding role of standards (16%)
- ❖ Confidence in foundational knowledge of BME regulatory affairs (12%)

Lessons Learned

Moot Court is rewarding but challenging

- ❖ Instructional team familiarity with moot court practice is acquired over time.
- ❖ Finding and setting up an appropriate room for large classes (>80 students) takes coordination
- ❖ Availability of volunteers: Student actors warm up slowly but universally glad they went through it
- ❖ Availability of good moot court cases

Moot court

Reflections

- ❖ Real-world cases revised to remove identifiable details and relevant to specific engineering field
- ❖ Cases should provide rich detail for context but have ambiguous endpoints to allow for exploration
- ❖ Research materials can be included in class , but students should be encouraged to look beyond the materials provided
- ❖ Recently surprised with ChatGPT stories

Moot Court

It's fun!!

- ❖ We are actively seeking partners from Standards Developing Organizations to join us and co-develop a set of case studies that will enhance the awareness, knowledge, and importance of industry standards
- ❖ Curriculum materials developed for these moot court exercises are available under the Creative Commons license, see <https://osf.io/79s6z/>