Curricular Integration of Design and Material Standards in Engineering (CID-MaSE)

Award No. 70NANB21H175

Period of Performance: 09/15/2021 - 03/14/2024

Project Team

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Project Objectives

Goal: Stimulate students' interest in standards and standardization methods in a way that will increase their use of standards throughout their professional career.

Focus: Standards related to engineering design, and material testing and characterization.

Specific Objectives:

- Educate engineering students about design- and materials-related standards, the standardization procedures and standards-related organizations.
- Through repeated classroom practice, embed a deep appreciation and understanding of standards in students.
- Through reinforcement in multiple courses and a certificate program, instill the importance of standards and standardization into students in a way that will promote life-long use of standards in their professional careers.

Project Accomplishments

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Standards-related Course Module Implementation

Level	Mechanical Engineering	Civil and Architectural Engineering
Freshman	**GEEN 1201**: Engineering as a Career (**Fall 2022**).	
Sophomore	**MEEN 3145**: Material Science Laboratory (**Spring 2022**). **MEEN 3344**: Materials Science (**Spring 2022**). **CEEN 3311**: Strength of Materials (**Spring 2022**).	**CEEN 3311**: Strength of Materials (**Spring 2022**).
Junior	**MEEN 3349**: Fundamentals of Manufacturing Processes (**Spring 2022**).	**CEEN/AEEN 3303**: Structural Analysis (**Spring 2022**). **CEEN/AEEN 3304**: Reinforced Concrete Design (**Spring 2022**). **CEEN 3145**: Construction Materials Lab (**Spring 2022**). **CEEN 3244**: Construction Materials (**Spring 2022**).

Project Accomplishments (Cont'd)

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Standards-related Course Module Implementation

Level	Mechanical Engineering	Civil and Architectural Engineering
Senior	**MEEN 4382**: Polymer Science & Engineering (**Spring 2022**). **MEEN 4385**: Manufacturing of Composites (**Spring 2022**). **Senior Design Project** (**Spring 2022**).	**CEEN/AEEN 4316**: Structural Steel Design (**Fall 2022**). **CEEN Senior Design Project** (**Spring 2023**).
Graduate	**MEEN 5331**: Advanced Materials Science (**Fall 2022**). **MEEN 5333**: Polymer Science (**Spring 2022**).	**CEEN 5361**: Advanced Structural Steel Design (**Spring 2023**).

Project Accomplishments (Cont'd 2)

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Transcripted Certificate on Standards for Material Testing, Characterization and Applications

Undergraduate:

- Attend 6 one-hour seminars, offered through the certificate program
- Complete 12 credits from a list of courses with a grade of "B" or better in each
- Senior Design Project that has significant components on standards

Graduate:

- Attend 6 one-hour seminars, offered through the certificate program
- Complete 9 credits (3 courses) from a list of courses with a grade of "B" or better in each
- MS Thesis that has significant components on standards

Project Accomplishments (Cont'd 3)

Spring 2022 Seminar Series on Standards

Date	Speaker	Affiliation
March 9, 2022	Mr. Antonio Reyna	TxDOT
March 23, 2022	Mr. Travis Murdock	ASTM International
March 30, 2022	Dr. Larry D. Peel	TAMUK
April 6, 2022	Dr. Mohammad M. Hossain	TAMUK
April 13, 2022	Dr. Hoang Pham	Avery Dennison
April 20, 2022	Dr. Pavan Valavala	Dow Inc.

A total of 93 students attended these seminars

Project Accomplishments (Cont'd 4)

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Spring 2023 Seminar Series on Standards

Date	Speaker	Affiliation
February 8, 2023	Dr. Brian McFall	US Army Corps of Engineers
February 15, 2023	Dr. Ruth Chatelain-Jardon	TAMUK
February 22, 2023	Mr. Steven Bailey	Nine Energy Service
March 1, 2023	Mr. Erik Puskar & Dr. Titilayo Shodiya	NIST

A total of 54 students attended these seminars

Project Accomplishments (Cont'd 5)

Spring 2024 Seminar Series on Standards

Date	Speaker	Affiliation
April 1, 2024	Dr. Jacob Bice	Walter P. Moore
April 8, 2024	Dr. Larry Peel	TAMUK
April 15, 2024	Mr. Richard Martinez	Retired, Chemours Chem.
April 22, 2024	Mr. Alfredo Trevino	Keller – North America

A total of 60 students attended these seminars

12 Recorded Presentations

Project Impact

- More than 1,700 students learned about the standards and standardization methods with the course modifications
- 207 students attended the seminars on standards
- 12 seminar presentations have been recorded and are available to students unable to attend seminars in person
- 4 students have received the transcripted certificate, all majored in Mechanical Engineering
- Project Website at TAMUK (https://www.tamuk.edu/engineering/departments/mien/projects/NIST-CID-MaSE.html)
  - All standards-related modules, revised course syllabi, and related publications are posted on this website
- A conference paper has been published and presented at the American Society of Engineering Education (ASEE) Conference in Baltimore, MD, June 25-28, 2023 (B. Bailey, M.M. Hossain, L.D. Peel, "Work-In-Progress: Curricular Integration of Design and Material Standards in Engineering", *American Society of Engineering Education (ASEE) Conference, Baltimore Convention Center, MD, June 25-28, 2023,* https://peer.asee.org/44200).

Project Evaluation

Summary of Survey Conducted in Spring 2022

Survey Questions: On a scale of 1 to 5, indicate your…	Responses High or Above
Overall understanding of standards	29%
Overall appreciation of standards	50%
Understanding of standards for engineering design / materials	57%
Appreciation of standards for engineering design / materials	43%
Ability to identify relevant standards	36%
Ability to apply relevant standards	50%

- **Only 14 students completed the survey**
- Strict IRB Regulations

Project Evaluation 2

TEXAS A&M UNIVERSITY KINGSVILLE

Summary of Survey Conducted in Fall 2022

Survey Questions: On a scale of 1 to 5, indicate your…	Responses High or Very High	
	Early Sem.	Late Sem.
Overall understanding of standards	57%	77%
Overall appreciation of standards	69%	85%
Understanding of standards for engineering design / materials	57%	77%
Appreciation of standards for engineering design / materials	74%	85%
Ability to identify relevant standards	43%	77%
Ability to apply relevant standards	61%	62%

- **Addition of course modules is making a difference**
- **Only 23-early/13-late in semester, students completed survey**
- Strict IRB Regulations

Project Evaluation 3

TEXAS A&M UNIVERSITY KINGSVILLE

Summary of Survey Conducted in Spring 2023

Survey Questions: On a scale of 1 to 5, indicate your…	Responses High or Very High	
	Early Sem.	Late Sem.
Overall understanding of standards	33%	22%
Overall appreciation of standards	50%	67%
Understanding of standards for engineering design / materials	17%	56%
Appreciation of standards for engineering design / materials	33%	67%
Ability to identify relevant standards	50%	56%
Ability to apply relevant standards	17%	56%

- **Addition of course modules is making a difference**
- **Only 6-early/9-late in semester, students completed survey**
- Strict IRB Regulations

Project Evaluation 4

Summary of Survey Conducted in Spring 2023

Survey Questions: On a scale of 1 to 5, indicate your…	Weighted Average		Change
	Pre-Course	Post-Course	
Overall understanding of standards	3.17	3.22	+0.05
Overall appreciation of standards	3.50	4.00	+0.50
Understanding of standards for engineering design/ materials	3.00	3.78	+0.78
Appreciation of standards for engineering design/ materials	3.17	4.33	+1.16
Ability to identify relevant standards	3.17	3.44	+0.27
Ability to apply relevant standards	2.83	3.44	+0.61

- **Addition of course modules is making a difference**
- **Only 6-early/9-late in semester, students completed survey**
- Strict IRB Regulations