Best 2019 PIC V Paper : Mapping and Strengthening Curriculum-Based Industry/Academia Intersections

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Abstract

This theoretically-grounded research paper presents a study out of the University of Colorado Boulder focused on mapping the use of industry-based problems and examples across the undergraduate core curriculum in Mechanical Engineering. The study uses a material-semiotic approach based on actor-network theory (ANT), which focuses on the interactions between people, things, and ideas within a constantly shifting network. That approach is used to study the intersections between students' network of academic practice and the network of industry-based practice that they are preparing to enter. Specifically, it looks at how industry-based problems and examples are represented in material aspects of students' academic practice through homework, lecture slides, and other course materials.

The study was designed to provide a foundation for a new initiative being launched in Spring 2019. That initiative is part of a multi-year effort in the Department of Mechanical Engineering that was established with the goal of bringing students, alumni, industry, and the curriculum closer together. Translated into the language of ANT, the goal is to identify and expand on points of intersection between the academic experience of studying to become an engineer and the real-world experience of being an engineer. Current efforts include both curricular and co-curricular components, but have so far been largely focused on both a specific cluster of classes and real-time interactions between students and industry. The goal moving forward is to build on that foundation through the addition of a material component that can be transported through the space-time of academic practice, to be used by multiple faculty during multiple semesters. Specifically, the goal is to develop a new database of industry-based problems and examples tailored to fit into courses across the core curriculum.

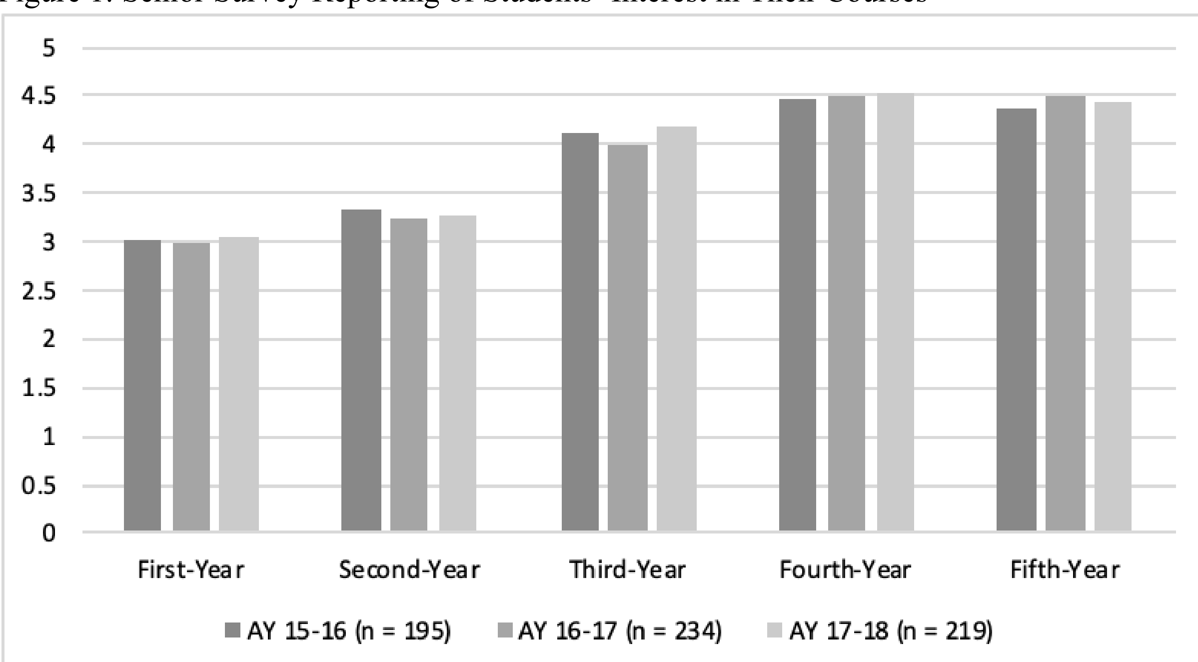
A central tenet of ANT is its emphasis on the interaction between material and human actors. In keeping with that approach, the primary data source for the study was an inventory of curriculum-related materials drawn from across the undergraduate program. A total of 753 documents were reviewed from 15 core courses, with specific documents including syllabi, homework, lecture slides, and exams. Problems and examples from those materials were grouped according to emergent themes, in order to map how and where examples drawn from engineering practice are being used. The material component of the study was supplemented by classroom observations and a short series of interviews with students, alumni, and faculty. Findings are presented and discussed, with a focus on identifying insights that will be of use in developing new, industry-based course content.

Introduction

The Department of Mechanical Engineering at the University of Colorado Boulder is currently engaged in a multi-year effort to increase the level of integration between students, alumni, industry, and the curriculum as a whole. That effort includes a variety of curricular and co-curricular components but has so far been largely isolated to a small cluster of classes. The goal moving forward is to launch a significant expansion into the broader curriculum through the design of industry-based examples and problem sets that can be inserted into core classes in the sophomore and junior year. The goals of the initiative include increasing student engagement and academic motivation, encouraging students to proactively think about potential career paths, and providing opportunities for industry partners to meaningfully engage with students outside of an event setting.

The current effort was inspired by a combination of interested, engaged alumni and assessment data showing that students' level of interest in their coursework increased dramatically as they progressed through the curriculum. Figure 1 below is drawn from the department's senior survey data [1] and shows graduates' average reported interest in their classes for each year of the curriculum. There is a large increase from the second to third year, with smaller increases from the first to second and third to fourth years. While there are likely many reasons for that shift, there was a consistent trend in the associated qualitative feedback of students indicating that their interest increased as they started to see a clearer connection between what they were learning and the kinds of work they were likely to encounter as practicing engineers.

Figure 1: Senior Survey Reporting of Students' Interest in Their Courses



In addition to the potential benefits in terms of student engagement, there is also a corresponding benefit for the department's industry partners. The department's current industry engagement efforts focus on design project sponsorship, large-scale events, and opportunities for one-on-one mentorship. Those efforts provide a broad range of opportunities for industry to engage with the department, while also providing some insight into the kinds of opportunities that could be valuable and that are not included in the current model. The push to increase the use of industry-based examples across the curriculum is unique in that it focuses specifically on classes that haven't traditionally been highly industry-based, and in that it requires a one-time input of resources to develop a problem or example that can be used for multiple years. The potential benefit for industry partners is increased brand visibility through a unique format that allows students to see an example of what working for their company could look like.

The present study focuses on mapping how industry-based examples are currently being used across the curriculum, in order to provide a foundation for the effort described above. The study approaches the question of student motivation and application-based learning from a material-semiotic perspective based on Actor-Network Theory. The primary research method was a review of physical curriculum materials collected as part of the department's accreditation review during Spring 2017. That data collection was supplemented by a short series of interviews (6) and classroom observations (5) which were used to add context to the material component. Research questions addressed by the study include:

- How and where are engineering application and industry-based examples currently being used across the curriculum?
- What can be learned from the current practices that will help inform integration of additional industry-based content for future terms?

Study Context

The University of Colorado Boulder is a large public university with an R1 research designation. As of the Fall 2018 census date, the university had a total undergraduate enrollment of 28,756. The total undergraduate enrollment for the same term for the College of Engineering & Applied Science was 5,085 with 979 of those students (~19%) rostered in Mechanical Engineering. Within the Department of Mechanical Engineering, 19.4% of undergraduate students identified as female and 15.3% identified as first generation. A total of 63.1% of the department's undergraduate students self-identified as White, 12.7% as Hispanic/Latino, 8.9% as Asian, 1.2% as African American, 1.2% as American Indian, and 0.6% as Pacific Islander. An additional 11.5% of students self-identified as International, with no specific race/ethnicity indicated [2].

All of the courses included in the study had a lecture component, with six courses also including either a recitation or a lab. The median enrollment for courses included in the study was 112. The largest course included in the study had 157 students enrolled and the smallest had 82. Each course had only one section. Eight of the classes were taught by full-time instructional faculty, five were taught by tenure-track faculty, and two were taught by graduate students.

Theoretical Foundation

Actor-network theory (ANT) focuses on the interactions between people, things, and ideas within constantly shifting networks. It is based on the foundational work of Latour [3], Law [4], and Callon [5] and has been applied to studies of educational environments by researchers including Nespor [6], Fenwick and Edwards [7], and Tsai [8]. A foundational concept in ANT is the idea that actors are enrolled into multiple, overlapping networks of interaction. Within the context of this study, there are two overlapping networks at play. One is the academic network that students must learn to navigate to successfully earn their degree. Material components of that network include textbooks, classrooms, curriculum flowcharts, and tests [6], [8]. The other network is the hugely complex and loosely bounded world of engineering practice, which students experience directly through internships and vicariously through experiences like networking events and industry-based case studies. Those networks are constantly flowing and changing, as actors move within and between them and as students' perceptions towards their enrollment in each network evolve. The present study looks at how the networks overlap and how components of the industry network can be pulled into the classroom, to help students bridge the gap between academia and engineering practice.

An important concept within ANT is the idea that knowledge changes both in its substance and in how it is perceived as it moves through and between networks, with different kinds of objects having varying levels of durability and mobility. Durability in this case referring to the object's ability to travel across time while mobility refers to its ability to travel through space [4], [7]. For example, a textbook is a highly durable and mobile way to convey information across the space-time of educational practice [6]. At the same time, the role that the textbook plays within students' educational networks is shaped not only by the knowledge it contains but by the fact that it is a static entity, packaged between two covers and distributed to thousands of students in roughly identical form [4]. The same qualities that make the textbook durable and mobile also limit its ability to be dynamic and responsive, which influences how students interact with the textbook and the role that it plays in their experience as students.

The primary application of actor-network theory within this study is with regards to how knowledge and experiences are transmitted across space and time, to travel from engineering practice to the classroom. An understanding of that question will help to inform the development of new industry-based content, by shedding light on how examples and problems drawn from engineering practice are transformed through the process of adapting them for use in a classroom environment. In what ways can the experience of practicing engineering be made durable and mobile? In what ways does that experience need to be transformed in order to fit into a classroom structure? And how can the value and relevance of the examples be maintained as they're converted from experiences and processes into objects and inscriptions? Those questions relate to how knowledge is transmitted (i.e.: photos, videos, words, equations) as well as how the scenarios themselves are changed to fit within the bounds of the curriculum.

The second application of durability and mobility across space-time centers on the need to develop content that can be easily integrated across multiple iterations of a course taught by different instructors. Given that each instructor approaches the material differently and has a different teaching style, how can the new course material be structured in a way that makes it durable without feeling disconnected from the rest of the class? Understanding how different faculty structure their courses and how they currently use industry-based examples is central to that effort, so that the new materials can accommodate a variety of teaching styles. There will also need to be a thoughtful approach to conveying the context of each problem between semesters and instructors, so that the value that comes with drawing examples from students' extended network (i.e.: alumni, student interns, senior design teams) isn't lost in translation.

Research Methods

Research methods included: (1) a comprehensive inventory of course materials; (2) interviews with students, alumni, and faculty; and (3) observation of five courses.

The primary research method was an inventory of course materials drawn from across the curriculum in the Department of Mechanical Engineering at the University of Colorado Boulder. The majority of those materials were collected as part of the department's ABET accreditation process during Spring 2017. The accreditation process required that faculty collect a syllabus, homework, and exams from every core undergraduate course [9]. Approximately half (7 out of 15) of the faculty who taught that semester also provided lecture notes or slides, with an additional 8 faculty providing those materials retroactively. The final inventory included 15 full course dossiers with a combined total of 753 course documents. Permission was obtained from each faculty member to use the materials they had submitted as part of the study.

Courses included in the review process are listed below in Table 1. The review process included only undergraduate core (i.e. required for all students) courses with an MCEN prefix and did not include the department's sophomore seminar or senior design capstone course. Non-MCEN core courses were excluded because they are managed by other departments and are therefore largely outside the current initiative's realm of influence. The sophomore seminar and senior capstone were excluded because they are already highly industry focused, with nearly 100% of the course content centering specifically on exposing students to processes, projects, and contacts within the network of engineering practice. Those courses are outliers within the curriculum and are not the focus of the current initiative.

Table 1: Courses and Materials Included in Review Process

Course Number	Course Title	Course Materials Reviewed	Documents Reviewed
MCEN1024	Chemistry for Energy and Material Science	Syllabus, Lecture Slides, Homework, Quizzes	51
MCEN1025	Computer-Aided Design and Fabrication	Syllabus, Lecture Slides, Homework, Labs, Quizzes	65
MCEN2023	Statics and Structures	Syllabus, Lecture Slides, Homework, Exams	36
MCEN2024	Material Science	Syllabus, Lecture Slides, Homework, Exams	47
MCEN2043	Dynamics	Syllabus, Lecture Notes, Homework, Exams	49
MCEN2063	Solid Mechanics	Syllabus, Lecture Slides, Homework, Exams	57
MCEN3012	Thermodynamics	Syllabus, Lecture Notes, Homework, Exams	49
MCEN3021	Fluid Mechanics	Syllabus, Lecture Notes, Homework, Exams	49
MCEN3022	Heat Transfer	Syllabus, Lecture Notes/Slides, Homework,	56

		Exams	
MCEN3025	Component Design	Syllabus, Lecture Slides, Homework, Workshops, Exams, Quizzes, Labs	63
MCEN3030	Computational Methods	Syllabus, Lecture Notes, Homework, Exams	47
MCEN3032	Thermodynamics 2	Syllabus, Lecture Slides, Homework, Exams	53
MCEN3047	Data Analysis and Experimental Methods	Syllabus, Lecture Notes, Homework, Workshops, Labs, Exams	40
MCEN4026	Manufacturing Processes and Systems	Syllabus, Lecture Slides, Homework, Labs, Quizzes	49
MCEN4043	System Dynamics	Syllabus, Lecture Notes, Homework, Labs, Exams	42

The first step in the data analysis process was a review of the materials included in the course dossiers. That process focused on compiling an inventory of the different kinds of references to engineering practice that were used in the course materials. Problems and examples were grouped according to emergent themes, which were then refined based on frequency of occurrence and relevance to the research questions. Once themes had been identified, an additional review of the course dossiers was completed. That review focused on capturing images of each example or problem that corresponded to one of the selected themes. Those images were coded by theme and counted in order to compile an inventory of the occurrence of each kind of content. A third review was conducted after the images had been coded, in order to calibrate the sorting process across courses.

Interviews and course observations were completed concurrently with the course dossier review process. A total of six interviews were completed with alumni (2), current students (3), and faculty (1). Interview protocols for students and alumni focused on strategies that faculty have used to bring engineering applications into their teaching. Students and alumni were asked to identify examples of teaching practices that helped them to clearly connect their classroom learning with how the material could be applied or used in engineering practice. What was helpful for them in drawing those connections? What strategies were attempted that were not as successful? And what ideas or recommendations did they have for integrating additional industry-based content across the curriculum?

The faculty interview focused on a specific course within the curriculum, which one of the student interviewees had identified as a strong example of how industry-based learning could be integrated into a lecture based course. The interview protocol was similar to the one used for alumni and students, but with a shift towards understanding the approach used in a specific class by a specific instructor. What was the instructor's general philosophy and approach to including industry-based learning in the course? What did that integration look like within the context of the class being taught? And how might that approach be different for a course with different content or at a different level in the curriculum?

Classroom observations were conducted during the same time frame as the interviews. Five classes were observed: Statics, Thermodynamics, Fluid Mechanics, Computational Methods, and

System Dynamics. Those courses were selected in order to get a broad cross section of the curriculum. They were also selected based on recommendations from students and alumni of faculty who they felt did a particularly good job of drawing connections between the course material and engineering practice. The goal of the course observations was to better understand how examples drawn from engineering practice were used in a lecture setting. Were they presented visually through course slides or verbally through narrative description? And what did the related discussions look like, in terms of level of detail and student engagement?

Both the interviews and the course observations were structured to provide context for the material aspect of the study. They provided an opportunity to ask questions and make observations related to how faculty delivered the material and how students interacted with the content. Notes were taken during all of the interviews and course observations.

Study Limitations

The primary limitation of the study is that it is not fully representative of every relevant practice currently in use within the department of study. The course materials from the Spring 2017 ABET Review represent a snapshot in time and only included course components that could be captured in paper form. Because of that partial view, it is important to note that the results of the study are not intended to be a complete assessment. They are intended to provide insight and direction, not to identify faults or weaknesses.

A potential source of error within the study is associated with the strategy of classifying a highly diverse collection of course materials according to theme. While every effort was made to define precise themes and multiple reviews of the course materials were conducted to calibrate the coding process, it is probable that examples that could have fallen into one of the themes were excluded due to differences in interpretation. That is a limitation of most coding processes associated with qualitative study and should be kept in mind when using the resulting data.

It should also be noted that this research was conducted as part of a quality improvement study and that it is not intended to be broadly generalizable. While certain components of the findings are likely to be helpful for faculty and staff at other universities, no claims are made as to whether a similar ecology of practice is present at other schools.

Presentation of Findings

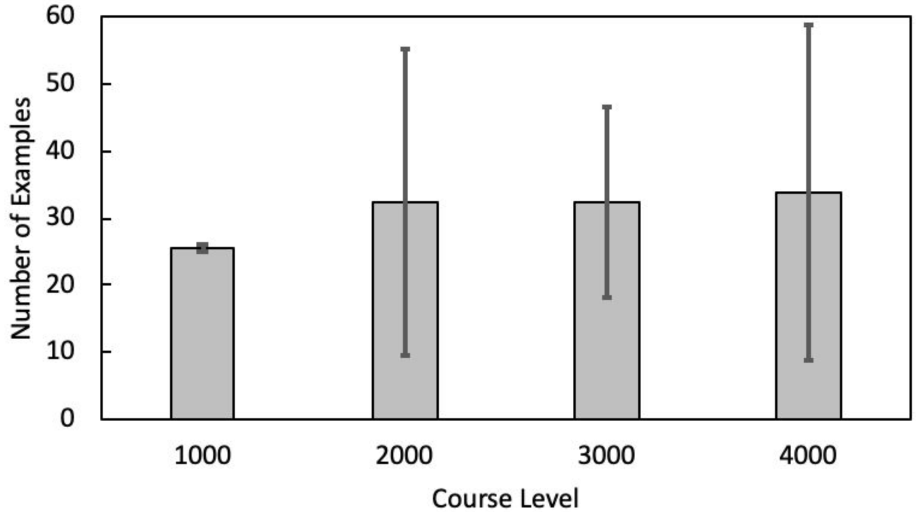
The initial dossier review and interview/observation process resulted in the identification of five themes for further study. Each theme is described below in Table 2. The themes were selected based on their relevance to the research questions and frequency of occurrence within the course materials. Other themes that were considered include use of outside resources (i.e.: material property tables, product supply catalogs), hands-on activities, references to career development, and global impact of engineering practice.

Table 2: Themes

Theme	Description
General Engineering Applications	Problems or examples that focus on non-specific engineering related scenarios. For example, the use of a crane or the construction of a bridge without additional context.
Company or Project Specific Engineering Applications	Questions or examples that reference a specific engineering scenario from industry, research, or the project-based components of the curriculum. For example, a problem that references a challenge encountered by the SAE Baja Team or a reference to a specific research effort focused on nanophotonics manufacturing.
Historic Engineering Examples	References to the history of engineering. For example, a bridge that broke records for height or length, a description of a well-known engineering disaster, or a timeline showing the history of a specific technological innovation.
Extended Case Studies	Multi-part questions that ask about different aspects of a detailed engineering scenario and that are built using real-world parameters. For example, asking students to make different kinds of calculations related to the function and profitability of a particular kind of power plant.
Industry-Based Guest Lectures	Lectures led by a guest presenter who shared information about how their work within a specific industry or at a specific company relates to the course content.

After themes were identified, a subsequent more detailed review of the course materials was conducted. That review focused on capturing images of relevant questions and examples, which were sorted by theme and course number. It was originally anticipated that lower level courses might have fewer instances of industry-based problems and examples. While there was an increase in the average frequency of examples from the 1000 to the 2000 level, there was very little change after that point. The variation within course levels was also very high. For example, the average number of examples used in a 3000 level class was 32.43 with a standard deviation of 14.08. That indicates that while there may be some relationship between use of examples from engineering practice and course level, it’s likely that more of the variation between courses is due to differences in teaching style and content than is due to course level. Descriptive statistics for each course level are included below in Figure 2.

Figure 2: Quantity of Examples Fitting an Identified Theme by Course Level (Means ± 1 SD)



After being categorized by theme, the compiled examples were sorted by mode of use across the curriculum. Inventoried examples included both problems written by department faculty and textbook problems required as part of the coursework. Examples that could reasonably be placed in multiple categories were sorted as accurately as possible, based on the definitions for each theme. The resulting data is included below in Table 3.

Table 3: Results of Course Inventory Sorted by Mode of Use and Theme

Theme	**Lecture Examples**	**In-Class or Workshop Problems**	**Homework Problems**	**Quizzes or Exams**	**Total**
General Engineering Applications	111	110	131	47	399
Company or Project Specific Engineering Applications	16	2	6	2	26
Historic Engineering Examples	29	0	3	0	32
Extended Case Studies	0	4	8	0	12
Industry-Based Guest Lectures	7	0	0	0	7
Total	163	116	148	49	476

As shown in the table above, general engineering applications were frequently referenced both within lectures and through course assessments. The total for that theme alone was 399 references, compared with a total of 77 for the other four categories combined. The lowest count was for industry-based guest lectures, although notably, the content included in each of those lectures was much more thorough than in any single example from the other categories. The company or project-specific engineering applications theme included 26 items. A detailed breakdown of the problems and examples included in that theme is shown below in Table 4.

Table 4: Company or Project-Specific Engineering Applications

Description	Instances
Lecture slide referencing a specific product from industry in order to illustrate a course concept. For example, a video showing the deflection of an airplane wing or an illustration of a particular running shoe.	7
Lecture slide, homework, or exam problem referencing a specific product or scenario from industry and asking that students solve a related problem.	5
Lecture slide, homework, or exam problem referencing the SAE Baja vehicle.	4
Lecture slide referencing a research effort currently underway within the department of study.	4
Lecture slide referencing a research publication external to the department of study.	3
Lecture slide featuring a graphic from a company's annual performance report.	1
Homework problem that provided an article about a particular product and asked students to use the course content to describe the product's development process.	1
Extra credit assignment encouraging students to tour a local company relevant to the course topic.	1

Based on the inventory in the tables above, it is reasonable to conclude that problems based on specific scenarios encountered in engineering practice are not currently in frequent use across the curriculum. Out of 476 total examples identified as part of the inventory process, only ten would reasonably fall into that category. That observation indicates that a new effort focused on increasing industry-based content would address an area of opportunity in the curriculum, rather than duplicating existing efforts.

Discussion of Findings

The findings from the curriculum inventory provide a mapping of how and where examples drawn from engineering practice are being used across the curriculum. It is not a perfect mapping, but it is a strong starting point for understanding the current landscape. This section builds on that understanding through a description of observations and insights gained from both the course inventory process and the corresponding interviews and course observations.

Building on Existing Strengths & Identifying New Opportunities

All of the inventoried courses included examples and/or questions focused on general engineering applications. However, the use of company or project-specific engineering examples was much more limited. That indicates both an interest from faculty in helping students connect course material with practice and an opportunity to add to that effort in a meaningful way. There were a total of six problems in use across the curriculum that referenced specific companies and four that referenced senior design teams, of which all four were focused on a single team (SAE Baja). Those questions were spread over six classes taught by five faculty members, with the SAE Baja questions spread over four classes taught by three faculty members. The current initiative has the potential to significantly increase both the quantity and variety of industry-based problems in use, which could help to improve students' sense that their coursework is building to a next step and their awareness of what that next step could look like.

While the study did not include a specific count of examples drawn from each disciplinary area within mechanical engineering, there was a noticeable trend of faculty tending to be more specific and consistent in their use of engineering application-based examples that were within their area of research focus. For example, the Statics and Structures course included in the inventory was taught by a biomedical faculty member who used frequent and diverse examples related to biomechanics. In contrast, there were only two brief references to biomedical engineering across the remainder of the course materials. There were also very few examples related to robotics, engineering for social innovation, or environmental engineering, all of which are areas of focus within the department. That points to an opportunity for expertise sharing across the faculty, as well as between industry and academia.

Each subject area within mechanical engineering also lends itself to examples from specific fields of practice. That makes sense but can lead to a lack of engagement from students without an interest in that specific field. A potentially exciting challenge for the group leading the new initiative would be to have them look for examples that are "off the beaten path" for a specific subject area. A strong example of that approach from the current curriculum materials was an exam problem from Heat Transfer focused on calculating the temperature rating for a sleeping bag. That problem was both uniquely tailored to appeal to the student population in Boulder, CO (where camping is a prevalent hobby) and a good example of a problem that's closely aligned with the course content while also pushing outward into less traditional areas of mechanical engineering.

Durability and Mobility Across Space-Time

Faculty varied widely in terms of how they integrated examples from practice and industry into their courses. Some of the course materials included intermittent use of industry-based examples across the full scope of the course (i.e.: lectures, homework, exams), while others focused on conceptual questions in certain course components and on applied questions in other components. That approach allows faculty to provide students with a consistent structure in terms of when they should expect different kinds of problems, while also providing students with different methods of engaging with the material. It also means that any examples that are developed as part of the initiative should be flexible enough that they could be used as part of lectures, during in-class workshops, or as homework assignments. If that flexibility isn't achieved, then the examples won't be durable or mobile enough to consistently maintain their usefulness across the space-time of teaching practice within the department.

Another observation was that extended case studies were relatively rare across the curriculum, with only 12 instances identified in the course inventory. A more frequent approach to using practice based examples was to provide a small amount of context (~1 paragraph), one or more visuals, and a succinct problem statement. The takeaway from that observation is that while extended case studies do have their place in the curriculum and are valuable in terms of students' ability to work through complex, real-world scenarios, they're not the only strategy that can be used to draw connections between industry and classroom learning. Less complex problems situated within a specific engineering context are also of value and should be considered as an opportunity for increased industry integration. That finding has implications for the mobility of engineering practice as it's transported into the classroom, because of the need to either simplify complex problem-solving processes or identify simple problems within highly complex organizations.

A related finding from the student interviews and course observations was that while students are interested in more applied forms of learning, they have a very low tolerance for assignments that aren't an efficient use of their time. During one of the course observations included in the study, the instructor referenced a narrative that he had written to provide context for a homework problem and asked the students how many of them hadn't read it. More than half the class raised their hand. That answer was aligned with the feedback from student and alumni interviewees who noted that they often skimmed word problems to find the numeric values without reading the full text. Although the interviewees expressed an interest in learning more about engineering practice and the potential applications of what they were learning, they expressed a stronger interest in being able to finish the assignment and move on to other tasks.

When asked what strategies they would recommend for making the context of a problem meaningful, students and alumni emphasized that the context needed to be both engaging and necessary for solving the problem. One recommended strategy was showing videos during class to provide the context for problems that would then be completed as part of in-class workshops or homework assignments. At the same time, student interviewees also emphasized that videos are often overused in their classes and that any videos included in the new initiative should both convey important content (i.e.: incentive for the students to pay attention) and demonstrate that content in an interesting way (i.e.: show how something works, don't say how it works). Related strategies from the inventoried course materials included the use of multi-part questions that added content at each step and the use of a mixed-media approach including photos, videos, and/or engineering drawings.

Another approach that the interviewees recommended was to include references to specific materials, components, etc. in the problem and require that students use outside resources to look up their properties, instead of being able to pull the numbers out of the problem. That recommendation aligned with related comments that using real world (i.e.: 2x4 lumber, nails) or industry based (i.e.: AISI 1020 steel, Nylatron®) terminology to refer to objects within course problems was a refreshing change in contrast to the frequent use of "mystery materials". The interviewees noted that while the extra step of determining the material properties would take longer, it was better aligned with what the problem-solving practice would look like in a non-academic environment. It would also push students to read the full problem, because words are much harder to skim for than numeric values.

A consideration that spans all of those recommendations is the question of how the new content could be provided in a way that allows it to feel dynamic and relevant, rather than static and immediately outdated. Potential strategies for addressing that concern include continuously pulling in new industry-based content and selecting content that is already in close proximity to the students’ networks of practice and interaction. For example, content pulled from a senior design project could feel more relevant for a class of juniors than content drawn from the practice of full-time, post-graduate engineers. The same could be said of content drawn from student internships, from companies located in geographic proximity to the campus, and from research conducted by department faculty. It would also be important that the examples be modern, representing current engineering practice and the challenges inherent in that practice. Those recommendations relate to the original goal of pulling content from the network of engineering practice into students’ academic network, by emphasizing that content can more easily flow between networks if it’s already in close proximity to where those networks overlap.

Next Steps & Conclusion

The next step in this process is to take the findings from the study and apply them to the process of developing a database of industry-based examples for use in core courses. That process is set to begin during Spring 2019 and will involve stakeholders including faculty, students, alumni, and industry partners. The first set of examples will be developed by a student leadership team that was formed during Summer 2018. The student leadership team is responsible for implementing initiatives that bring industry and academia closer together, including both the current initiative and many of the existing program components mentioned in the introduction (i.e.: networking events, career symposiums, etc.).

Implementation of the initiative will be part of the department’s larger assessment plan, which includes evaluation of students’ understanding of what it means to be an engineer in practice. Ongoing feedback will also be gathered from department faculty, in order to continue developing the initiative in a way that allows the content to be integrated effectively into their courses. Effective in this instance meaning both productive and seamless for the instructors, and meaningful for the students.

A potential future area of study focuses on evaluating the extent to which the examples being used across the curriculum correspond with students’ professional interest areas. That study would use the data collected through the course inventory process, while also drawing on senior and alumni survey data that provides insights into the areas of practice where students have interned and alumni have found full-time employment. That effort would allow for an additional level of connection, drawing a link between the examples that are provided and the specific industries that employ the largest proportion of the department’s graduates.

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