Undergraduate Writing Assignments in Mechanical Engineering: Targeting Attribute 7

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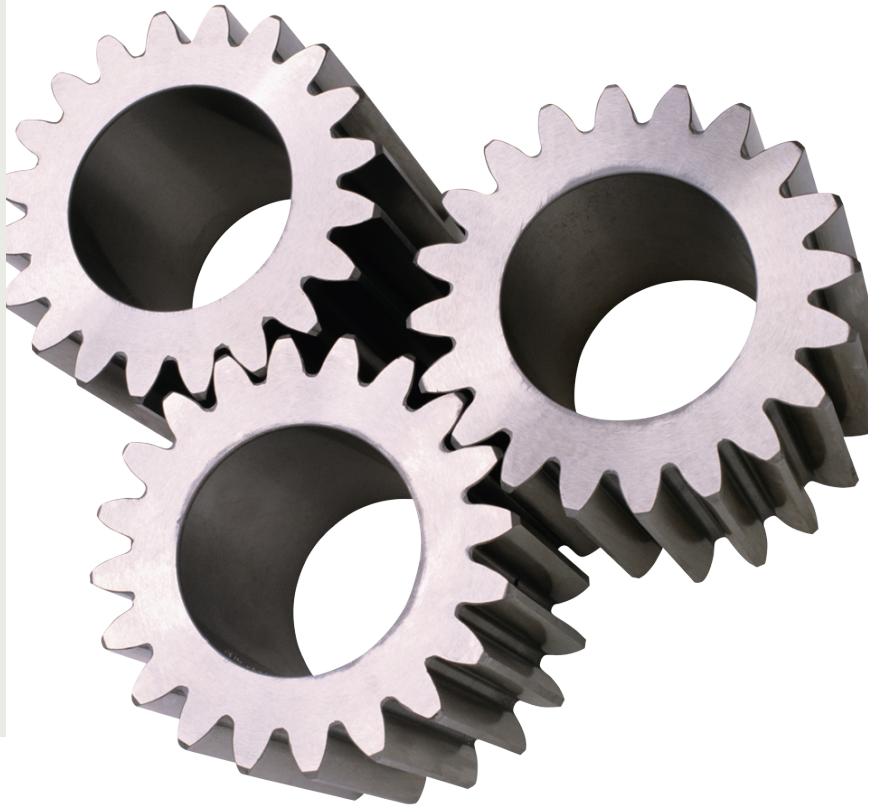

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Agenda

- Quick Overview: The Context
- The Writing Assignment Project: Targeting Attribute 7
- The Faculty-Wide Initiative: Developing the Rubrics
- Some Conclusions & Connections

Quick Overview

The Context

The 12 Attributes in Engineering

1. Knowledge base for engineering
2. Problem analysis
3. Investigation
4. Design
5. Use of engineering tools
6. Individual & team work
7. Communication skills
8. Professionalism
9. Impact of engineering on society/environment
10. Ethics & equity
11. Economics & project management
12. Lifelong learning

C.E.A.B., Outcomes & the Attributes

- ***Accreditation process*** – must identify indicators for the 12 attributes & establish outcomes [i.e., what students know & can do] (http://www.engineerscanada.ca/accreditation-resources)
- ***Outcomes–based assessment*** – requires evaluation of student learning + encourages accountability, taking a step back & reflecting on such things as
  - The "design readiness" of our graduates – their technical proficiency
  - The communicative competence of our graduates – their proficiency in communicating the engineering work
- ***Implicit in the list of 12 attributes*** – *all are equally important* to the Engineering program & the engineering professional [though the expected competency level can vary]

Attribute 7: Communication Skills

- Also called "professional skills" – i.e., they are integral to the profession
- We know the skills will include proficiency in writing & speaking
- But more difficult to *define* & *measure* than the traditional technical skills

This difficulty can lead to….

- "sterile notions of traditional grammar" – because grammar can be more quantifiable
- The engineering penchant for *templates* – reduces an engineering genre to a "static recipe" rather than an "adaptive response to rhetorical exigencies"

[Broadhead, pp. 24-25]

Working definition – the ability to:

- communicate complex engineering concepts within the profession and with society at large;
  - includes reading, writing, speaking and listening;
  - also includes the ability to comprehend and write effective reports and design documentation;
  - also means the ability to give and effectively respond to clear instructions
- *More than just remediation of writing deficiencies*

Targeting Attribute 7 in a course

- Developing students' communicative competence
- Developing their disciplinary knowledge, including knowledge of the discipline-specific genres
- Developing "layered literacies" that encompass all the ways that engineers can "use language in producing information & solving problems" [Cargile Cook, pp. 5-6]

"Reality Check" – in Engineering

- Communication – rarely mentioned as contributing to engineering success [Davis, 2010]
- The technical work – often viewed as the "real work" [Ford and Riley, 2003]

"Reality Check" - in Engineering programs:

- limited number of course options available for developing communication skills throughout a student's program - but even were this not the case –

- "paucity of requirements for writing instruction" – few guidelines as to what communication skills require – *mastery of the material* or *correct grammar*?

[G. Broadhead, 1999]

At the University of Manitoba

- Received 6 years of accreditation in 2012
- Our dean initiated an ambitious project to:
  - Analyze & define what the proficiency levels of our graduates might be for all 12 attributes at the student, course & program levels
  - Evaluate & improve our performance –
- Overarching goal is the continual improvement of student learning
- For Attribute 7 – 2 initiatives may help us meet these objectives and fulfill the C.E.A.B.'s requirements

The Writing Assignment Project

Targeting Attribute 7 at the U of M

Objectives of the National Study

- Provide systematic research about the writing demands placed on students in a variety of disciplines
- Identify the goals of discipline-specific student writing
- Map these writing demands & create a "program profile"
- Ultimately, promote discussion at the department & the faculty level – curriculum, pedagogy, …….
- Findings can help to initiate the way writing is taught & supported within the departments/faculties

Variables studied include:

- "Nesting" or linking of assignments
- Audience
- Length of an assignment
- Time to complete the assignment
- Grading criteria & feedback provided
- Genre
- Frequency of assignments according to program year

Definition of "written assignment"

"course assignments where students were required to write extended prose in the documents that they handed in; a self-contained unit of discourse" [included writing reports in class time & reports that received a separate grade]

The Project at the U of M

- Collected course syllabi from all the departments [of Mechanical Engineering, Electrical and Computer Engineering, Biosystems Engineering, Civil Engineering and Design Engineering]
- Coded and reported on the data collected from ***36*** Mechanical Engineering course syllabi offering ***102*** written assignments [2013-2014] – focus today

Findings

Mechanical Engineering

Written Assignments in M.E.

- Analyzed course syllabi that cited 102 written assignments given in 36 courses
- Missing or incomplete information about:
  - the feedback provided [only lab reports did] or criteria used [1 course syllabus did]
  - the relative weightings of the written & technical elements
  - assignment length & the time given to complete the assignment
  - the genre

Genre (instructor's term used)

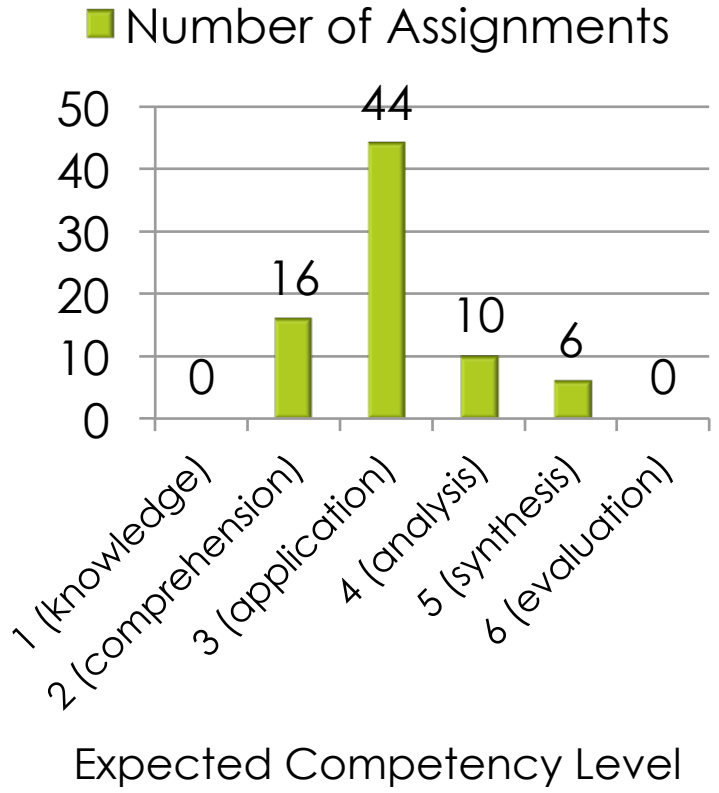
Term Used	Number
"Assignment"	48
Research, project, progress or draft report	22
Lab assignment, report, laboratory	16
Design project, problem, work	11
Mini-project	3
Meeting minutes	1
Poster	1
Total # of Assignments	**102**

Observations

- 29 course syllabi identified A7 [102 assignments]
- Most writing assignments identified A7
- "reports/projects" represent over ½ of all assignments [most common genre]
- Lab reports – most common genre in 2nd & 3rd years

Expected Competency Levels: A7

- Most writing assignments asked students to apply knowledge (combine separate elements into whole)
- Determined by the instructors



Frequency of Written Assignments

	Year 2	***Year 3***	***Year 4***	***Total***
# of courses in sample	4	10	22	36
Total # of written assignments	16	18	68	102
Average # of written assignments per course	4.0	1.8	3.1	2.8

Observations

- Amount & type of written work required –varies in each year of a student's program – but significantly higher in 4th year
- *On average* - students write almost 3 assignments per course (2.8) throughout their undergraduate M.E. degree
- CEAB attributes & outcomes were clearly indicated on each syllabus, but assignment-specific detail was not

More observations

- Engineering – very adept at creating charts – of attributes, outcomes & competency levels
- Less adept – at such pedagogical "stuff" as clarifying assignment genres, evaluation protocols, intended audience or even the requirements of the assignment
- And what are the relative weightings given to the written & the technical components of an assignment? – is the "real work" the technical work after all? – hard to tell

The Faculty-wide Initiative

Developing the Rubrics

For Attribute 7 –

How do we include it in our engineering curriculum?

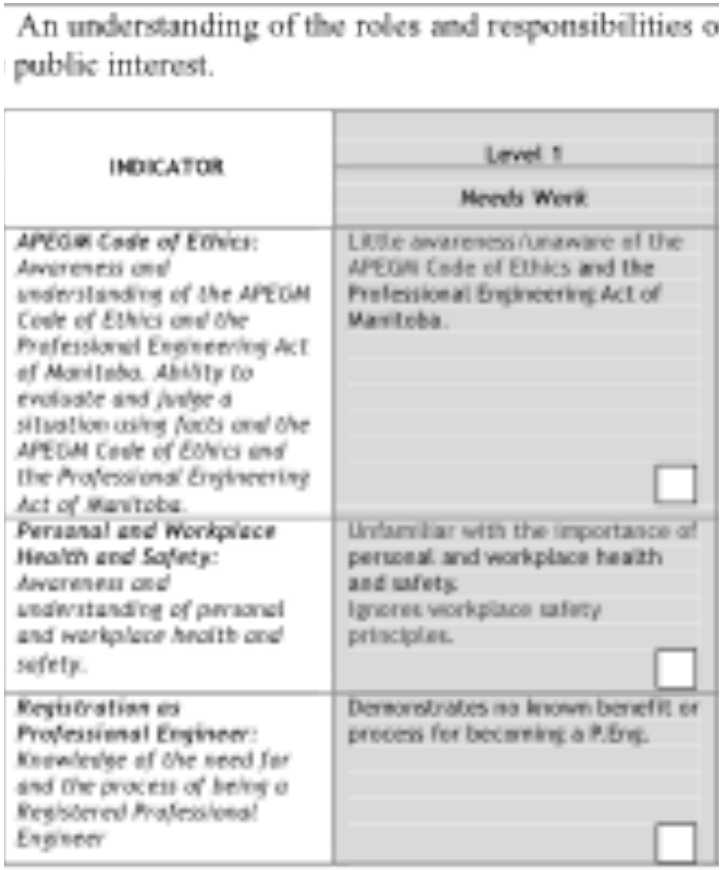
How do we show that the desired outcomes have been met?

Rubrics may help us do that……..

Rubrics help us to

- outline the performance levels [including the expected competency level]
- develop a comprehensive assessment tool

[J. Seniuk Cicek, Nariman Sepehri & J.P.Burak]



An understanding of the roles and responsibilities o
public interest.

INDICATOR	Level 1 Needs Work
APEGM Code of Ethics: *Awareness and understanding of the APEGM Code of Ethics and the Professional Engineering Act of Manitoba. Ability to evaluate and judge a situation using facts and the APEGM Code of Ethics and the Professional Engineering Act of Manitoba.*	Little awareness/unaware of the APEGM Code of Ethics and the Professional Engineering Act of Manitoba. ☐
Personal and Workplace Health and Safety: *Awareness and understanding of personal and workplace health and safety.*	Unfamiliar with the importance of personal and workplace health and safety. Ignores workplace safety principles. ☐
Registration as Professional Engineer: *Knowledge of the need for and the process of being a Registered Professional Engineer*	Demonstrates no known benefit or process for becoming a P.Eng. ☐

Finally…….. Rubrics help us to

- Develop a common language [a foundation for developing a shared understanding & common goals between all the stakeholders]
- Prepare our students to be "academically qualified to begin the process to be licensed as professional engineers"
- (http://www.engineerrscanada.ca/accreditation-resources)

E.G., For "Communication Skills," A7

- "Written Communication Skills" – one focus area for A7
- "genre & disciplinary conventions" – one "indicator" for the focus area [of written communication skills]
- performance levels – strong, *competent* [*benchmark*], developing or needing work

"Genre" indicator: "competent" performance level

Competent	**Demonstrates familiarity with, understanding of and use of the conventions inherent within the engineering genre and context/discipline**

Developing the Rubrics: Some Added Benefits

- Has created a "culture of engagement" in engineering education – includes the Faculty, the professors, our industry partners, our students [Seniuk Cicek, Sepehri & Burak]
- Has helped all of us consider what attributes & competencies an engineer ***must*** possess, including communicative competence

Some Conclusions & Connections

Connecting the Written Assignments Project & the Faculty Initiative

Communication & Engineering

- Communication skills within the engineering curriculum – should be integrated & iterative
- *practice-based* [not an "add-on"] – leads to a stronger performance
- acknowledged as "*equally important to engineering practice*"- recognition by the program & the students as integral to the job & employer expectations

[M. Davis, 2010]

Written Assignment Project & Rubrics

- Writing project illustrates the importance of time spent on
  - Clarifying our pedagogical goals
  - Defining our expectations, such as the length of the assignments, feedback provided & genre required
- Illustrates the need for thinking *deeply* about what we need to teach, *how* we teach it & how we assess it

What Engineering now needs to ask:

- What do we want students to learn when they do a written assignment?
- Increase the student's knowledge of the discipline?
- Improve the student's skill in communication – in particular, writing?
- Both?
- If so – *HOW?*

Written Assignment Project & Rubrics

- Writing project can help to inform the continued development of the rubrics – by highlighting what needs to be included & the language we use
- Likewise – the rubrics can help us to tailor our course assignments and syllabi so that accreditation outcomes are met, & attributes, indicators & assessment are clearly targeted

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