Undergraduate Writing Assignments in Engineering: Some Preliminary Findings

Roger Graves, Anne Parker and Kathryn Marcynuk
1. Overview – Anne Parker
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3. C.E.A.B. Graduate Attribute 7 and Undergraduate Writing Assignments in Engineering – Kathryn Marcynuk
4. Some Preliminary Conclusions – Anne Parker
Overview
• The importance of “communicative competence” in Engineering graduates – reflected in:
  
  o industry stakeholders’ complaint that engineering graduates have “weak” communication skills [Donnell, Aller, Alley and Kedrowicz, 2011; Rhoulac and Crenshaw, 2006] –

  o C.E.A.B. – engineering graduates must demonstrate “an ability to communicate complex engineering concepts within the profession and with society at large” [“Accreditation Criteria and Procedures,” 2008]
• The current study – part of a larger study on the assignments we are asking our students to write
  o Collected the course outlines from Electrical and Computer Engineering, Civil Engineering and Mechanical Engineering – from all available core and elective courses offered by each department
  o Documented the inclusion of “Attribute 7, Communication Skills”
## Core & Elective Courses

### [by department]

<table>
<thead>
<tr>
<th>Department</th>
<th>Total</th>
<th>Attribute 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Civil Eng</td>
<td>34</td>
<td>27</td>
</tr>
<tr>
<td>Computer Eng</td>
<td>33</td>
<td>21</td>
</tr>
<tr>
<td>Electrical Eng</td>
<td>33</td>
<td>21</td>
</tr>
<tr>
<td>Mechanical Eng</td>
<td>33</td>
<td>26</td>
</tr>
</tbody>
</table>
• Typically – undergraduates take only a subset of the elective courses
• Minimum number of courses with Attribute 7 that an undergraduate can take – while still fulfilling the requirements of the program =
<table>
<thead>
<tr>
<th>Attribute 7</th>
<th>Min. # of Courses Needed to Fulfill Program Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Civil Eng</td>
<td>27</td>
</tr>
<tr>
<td>Computer Eng</td>
<td>21</td>
</tr>
<tr>
<td>Electrical Eng</td>
<td>21</td>
</tr>
<tr>
<td>Mechanical Eng</td>
<td>26</td>
</tr>
</tbody>
</table>
Challenges Faced in the Engineering Study

• Writing content of each assignment – difficult to extract from the course outlines
  o do not explicitly list each assignment
  o referred generally to “assignments” or lab reports or projects – e.g., “mini-projects” may be called “assignments,” not “projects”
  o consequently, we kept the terms used by the departments
• Each discipline - also emphasized writing differently
• These challenges led to several assumptions
Assumptions

• Assumed that outlines identifying Attribute 7 included writing components
• Assumed that, if a course had an outline that we could retrieve – it was offered each year – if an outline was not available, then it was not considered
• Assumed that the genres were the usual engineering ones – like lab reports and design projects [tests and exams excluded]
Undergraduate Writing Assignments: The Larger Study

Roger Graves, Principal Investigator, University of Alberta
The Problem

- Even writing studies researchers are hard-pressed to describe or identify the kind and the frequency of writing assignments undergraduates are being asked to write.

- Students are graduating in record numbers – but often without the ability to share or communicate the knowledge they have gained.
  - May be unable to pursue a post-graduate degree
  - Inability of graduate programs to “fix” the problem
  - May derail their efforts to find – and keep – a job in their area of interest
Partner institutions

- University of Alberta
- University of Manitoba
- University of Calgary
- University of British Columbia
- Huron University College
- Wilfrid Laurier University
- University of Toronto
- Royal Military College
- University of Western Ontario
Objectives of the Study

• Provide systematic research about the demands placed on students in a wide variety of disciplines
• Map these writing demands by collecting the writing assignments
• Identify the goals of discipline-specific student writing
• Examine the writing practices and strategies of students in order to uncover how they approach the writing demands of their discipline
Some Findings

• Collected syllabi from 5 different curricular units
• Findings highlighted the variability of writing across the disciplines
  o The “nesting” of assignments, the genre required and the number of assignments required differed widely
  o Total of over 1000 assignments
  o 60+ genres in liberal arts; 13 genres in nursing
• This approach shows how writing assignments differ even within a specific program at one college or between disciplines as well
Genres vary across the disciplines

<table>
<thead>
<tr>
<th></th>
<th>Liberal Arts</th>
<th>Political Science</th>
<th>Service-Learning</th>
<th>Geography</th>
<th>Nursing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Papers</td>
<td>20</td>
<td>32</td>
<td>22</td>
<td>25</td>
<td>18</td>
</tr>
<tr>
<td>Reports</td>
<td>18</td>
<td></td>
<td></td>
<td>30</td>
<td>12</td>
</tr>
<tr>
<td>Essay</td>
<td>27</td>
<td>21</td>
<td></td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Summary</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-evaluation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>24</td>
</tr>
<tr>
<td>Handouts</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>11</td>
</tr>
<tr>
<td>Presentation</td>
<td>15</td>
<td>17</td>
<td>13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Journal</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: numbers are reported in percent of all assignments.
Who isn’t assigning writing?

<table>
<thead>
<tr>
<th></th>
<th>Number of writing assignments</th>
<th>Percent of courses with writing assignments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liberal Arts</td>
<td>485</td>
<td>79%</td>
</tr>
<tr>
<td>Nursing</td>
<td>157</td>
<td>86%</td>
</tr>
<tr>
<td>Political Science</td>
<td>198</td>
<td>100%</td>
</tr>
<tr>
<td>Geography</td>
<td>186</td>
<td>77%</td>
</tr>
<tr>
<td>Service Learning</td>
<td>163</td>
<td>100%</td>
</tr>
</tbody>
</table>
## Number of assignments by year in program

<table>
<thead>
<tr>
<th>Year</th>
<th>Liberal Arts</th>
<th>Political Science</th>
<th>Service-Learning</th>
<th>Geography</th>
<th>Nursing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>34/1.5</td>
<td>7/1.4</td>
<td>42/10</td>
<td>15/3.8</td>
<td>17/3.4</td>
</tr>
<tr>
<td>Year 2</td>
<td>225/2.5</td>
<td>39/2.3</td>
<td>12/4</td>
<td>40/2.2</td>
<td>33/5.5</td>
</tr>
<tr>
<td>Year 3</td>
<td>189/4.1</td>
<td>40/2.4</td>
<td>35/6</td>
<td>24/1.85</td>
<td>50/4.2</td>
</tr>
<tr>
<td>Year 4</td>
<td>56/3.0</td>
<td>112/4.2</td>
<td>74/6.7</td>
<td>107/3.5</td>
<td>57/4.4</td>
</tr>
</tbody>
</table>

First number is total number of assignments. Second number is average number of assignments per course.
### Length of writing assignments

<table>
<thead>
<tr>
<th>Length in pages</th>
<th>Liberal Arts</th>
<th>Political Science</th>
<th>Service-Learning</th>
<th>Geography</th>
<th>Nursing</th>
</tr>
</thead>
<tbody>
<tr>
<td>under 2</td>
<td>31</td>
<td>5</td>
<td>16</td>
<td>18</td>
<td>0</td>
</tr>
<tr>
<td>2 - 4</td>
<td>26</td>
<td>27</td>
<td>39</td>
<td>34</td>
<td>74</td>
</tr>
<tr>
<td>5 - 6</td>
<td>12</td>
<td>15</td>
<td>14</td>
<td>19</td>
<td>2</td>
</tr>
<tr>
<td>7 - 10</td>
<td>17</td>
<td>23</td>
<td>14</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>11 - 12</td>
<td>8</td>
<td>11</td>
<td>6</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>13 +</td>
<td>6</td>
<td>19</td>
<td>11</td>
<td>6</td>
<td>6</td>
</tr>
</tbody>
</table>

Note: numbers are reported in percent of all assignments.
## Audience of writing assignments

<table>
<thead>
<tr>
<th>Audience</th>
<th>Liberal Arts</th>
<th>Political Science</th>
<th>Service-Learning</th>
<th>Geography</th>
<th>Nursing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instructor or peer</td>
<td>90</td>
<td>92</td>
<td>91</td>
<td>100</td>
<td>99</td>
</tr>
</tbody>
</table>

Note: numbers are reported in percent of all assignments.
Value of the Study

• Information gathered has proven to be a catalyst for curriculum review and change
• Optimize the way we structure our assignments
• Support our students as they write the kinds of texts that their discipline demands
• Create program profiles of departments [Anson and Dannels, 2009]
• Map these demands onto the curricula
C.E.A.B. Attribute 7 and Undergraduate Writing Assignments

Kathryn Marcynuk, Research Assistant, University of Manitoba
Methodology

• Examined the relative distribution of writing components in the departments of Civil, Electrical & Computer, and Mechanical Engineering

• Assumed that all courses are offered every year, and only included courses that identify C.E.A.B. Attribute 7

• Course work that may include a written component was organized into the following categories:
  o Assignments
  o Lab Reports
  o Design Projects
Findings by Department

Electrical & Computer Engineering (Average)

- Emphasis on Labs
- Most potential writing components are worth <25% of the total grade
- Writing skills may be worth at least 50% of the total grade in 1 class
Findings by Department

Civil Engineering

- Mix of assignments, labs, and projects
- Most assignments are worth <10%
- Writing skills may be worth at least 50% of the total grade in 3 classes
Findings by Department

Mechanical Engineering

- Emphasis on Projects
- Writing skills may be worth at least 25% of the total grade in 22 classes
- These skills may be worth at least 50% in 6 classes
Some Preliminary Conclusions

Anne Parker, Co-Investigator, University of Manitoba
Larger study – systematic research on

- The complexity of developing literacy in undergraduate students
- What kinds of demands our own programs put on students – and students will have to do more specialized kinds of writing as they progress in a program
What instructors intend when they create these assignments – students may struggle to respond to a writing prompt and thus produce a lower quality document.

Learning what causes students to develop – or fail to develop – advanced literacy skills.
Engineering Study: Preliminary Findings

1. reflect the emphasis placed on written assignments at the undergraduate level in Engineering –

   - Each department includes some written work – but
   - Different degree of emphasis between departments
   - Reflected in the different evaluation weightings
   - Most pronounced emphasis in Mechanical Engineering – 22 of 33 classes have projects where written component is worth at least 25% of the grade
2. Course outlines (distributed at the beginning of the course) – do not always include sufficient information on the following:

- What writing tasks students are being asked to do
- ..... and in what genre? what are they being asked to create?
- Who is the audience for the document? Instructor? Peer? Client?
- What are the relative weightings of the technical and the written components?
- How will they be assessed?
3. Apparent differences in the amounts and the kinds of writing expected in different departments –
   - may impact how we respond to calls for improvement of student writing in Engineering
   - may need to focus on specific disciplines

4. Learning what causes students to develop these skills - may help us to meet C.E.A.B.’s requirements
Acknowledgements

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Thank You!