Integration of Desired Learning Outcomes in a First Year Design Course

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Abstract – Our first year design and communication course is an interdisciplinary course involving the application of engineering principles, design, communications, leadership and project management concepts through a sequence of team-based design projects. Integrating and translating these components from lectures to labs and vice versa is a challenge. During the upcoming Fall semester a paper project will be introduced that combines all communications deliverables into a submission for a student design challenge. The instructors expect a greater appreciation for the communications components as a part of the design course.

Keywords: Engineering design, communication, integration, paper project, student design challenge.

1. INTRODUCTION

The paper addresses the critical need to fully integrate most, if not all, learning outcomes in a first year design course. As background, in fall 2009 the Schulich School of Engineering adopted a first year design course based on a theoretical introduction to design and communications in a lecture environment, followed by hands on experiences in a workshop/design project environment. While the course was deemed largely successful, it was felt there was a partial disconnect between the material given in the lectures and the skills and knowledge required for the communications workshops and projects.

2. PAST EXPERIENCE

2.1. Lecture component modifications

For the fall 2011 offering of the course, the lecture component of the course was revised to increase the linkages between the lectures and the projects. This was partly done by replacing more theoretical project management material with more practical hands on techniques that can be applied to student’s projects (Fig. 1). Without being able to reference quantitative studies, the teaching team also found that lectures that focused on presenting foundational material were not very effective compared to lectures that integrated case studies or discussions of projects the students where completing (Fig. 2).
2.2. Integration using a paper project

With respect to integration and impact of the communications component of the course, a revamping of the communications content is proposed for the fall of 2012. Students were taught communications components in the past, but often these were seen as ‘make work’ assignments. The instructors did see many positive outcomes: an increase in sketching in the logbooks (Fig. 5) and the use of concept sketches during meetings (Figs. 3 and 4).

A paper project based on a broad real world student design challenge will take the place of separate communications portfolio components. The project will follow the design process ‘via’ communications deliverables, in our case: concept sketches, technical writing components (from grammar practice to various stages of report writing), CAD modeling, oral presentations, a final report and a slide presentation (Fig. 6). These components are also required for the competition. By modeling an entire design communication process, we expect the communications components will be seen as integral to engineering design.

3. CONCLUSION

Communications is vital to any engineering design process. Students in the fall of 2012 will work towards a student design challenge as they fulfill their communications requirements in our course. We expect that participation in this real world challenge will encourage and excite the students while completing this integral part of the course.

Acknowledgements

We would like to acknowledge the students who allowed us to show their logbook pages.
<table>
<thead>
<tr>
<th>Week</th>
<th>Comms Lecture</th>
<th>Workshop/Lab</th>
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| 4 -- Oct. 1 | Communications #2  
- Sketching practice  
- Writing in Engineering  
- In-class writing exercise  
- Sust. workshop  
- [LP #2] | | |  
* Produce introductory engineering writing and selection  
* Produce introductory technical reports  
* Produce introductory technical presentations  
* Produce introductory oral communication  
* Produce introductory design process  
* Produce introductory sketching  
* Produce introductory CAD renderings and drawings  
* Produce introductory sustainability assessments and environmental analyses  
* Produce introductory design process  |  
| 5 -- Oct. 5 | Communications #3  
- Biomimicry case studies  
- Sust. workshop  
- Oral presentations  
- Slide Design  
- [LP #3] | | |  
* Produce introductory engineering writing and selection  
* Produce introductory technical reports  
* Produce introductory technical presentations  
* Produce introductory oral communication  
* Produce introductory design process  
* Produce introductory sketching  
* Produce introductory CAD renderings and drawings  
* Produce introductory sustainability assessments and environmental analyses  
* Produce introductory design process  |

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| 2 -- Sept. 17 | Communications #1  
- Introduction to paper project & components  
- Introduction to Biomimicry  
- [LP #1]  
- Sketching practice  
- Sust. workshop | | |  
* Produce introductory engineering writing and selection  
* Produce introductory technical reports  
* Produce introductory technical presentations  
* Produce introductory oral communication  
* Produce introductory design process  
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| 6 -- Oct. 18 | Communications #4  
- Sketching practice  
- Sust. workshop  
- [LP #4] | | |  
* Produce introductory engineering writing and selection  
* Produce introductory technical reports  
* Produce introductory technical presentations  
* Produce introductory oral communication  
* Produce introductory design process  
* Produce introductory sketching  
* Produce introductory CAD renderings and drawings  
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| 7 -- Oct. 22 | Paper project work  
- Executive Summary work  
- Autodesk Inventor time  
- Oral presentations | | |  
* Produce introductory engineering writing and selection  
* Produce introductory technical reports  
* Produce introductory technical presentations  
* Produce introductory oral communication  
* Produce introductory design process  
* Produce introductory sketching  
* Produce introductory CAD renderings and drawings  
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| 8 -- Oct. 29 | Paper project work  
- Draft report  
- Autodesk Inventor  
- Sketching practice  
- Sust. workshop  
- Oral presentations | | |  
* Produce introductory engineering writing and selection  
* Produce introductory technical reports  
* Produce introductory technical presentations  
* Produce introductory oral communication  
* Produce introductory design process  
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| 9 -- Nov. 5 | Communication #5  
- Sketching practice  
- Report writing 1 | | |  
* Produce introductory engineering writing and selection  
* Produce introductory technical reports  
* Produce introductory technical presentations  
* Produce introductory oral communication  
* Produce introductory design process  
* Produce introductory sketching  
* Produce introductory CAD renderings and drawings  
* Produce introductory sustainability assessments and environmental analyses  
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| 10 -- Nov. 12 | Communication #6  
- Sketching practice  
- Report writing 2 | | |  
* Produce introductory engineering writing and selection  
* Produce introductory technical reports  
* Produce introductory technical presentations  
* Produce introductory oral communication  
* Produce introductory design process  
* Produce introductory sketching  
* Produce introductory CAD renderings and drawings  
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| 11 -- Nov. 19 | Communication #7  
- Sketching practice  
- Report writing 3 | | |  
* Produce introductory engineering writing and selection  
* Produce introductory technical reports  
* Produce introductory technical presentations  
* Produce introductory oral communication  
* Produce introductory design process  
* Produce introductory sketching  
* Produce introductory CAD renderings and drawings  
* Produce introductory sustainability assessments and environmental analyses  
* Produce introductory design process  |

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Fig. 6. Fall 2012 paper project plan.