Methods of Assessing Student Learning in Capstone Design Projects with Industry: A Five Year Review

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Senior Design

- Winter and Spring Quarters
- External Projects
- 25 - 35 Teams, 100 - 125 Students
- 2 Hrs Credit each Quarter
Assessment Methods

- Design Reports
- Oral Reports
- Status Reports
- Peer Reviews
- Student Self-Assessments
- Company Evaluations
- Design Faculty Subjective Judgments
Design Reports

- Title Page
- Abstract/Executive Summary
- Table of Contents
- Nomenclature
- Problem Definition
- Goals and Constraints

- Possible Solutions
- Recommended Final Design
- Performance Analysis
- Conclusions and Recommendations
- Appendices
Oral Reports

- Introduction
- Statement of Problem
- Goals and Constraints
- Possible Solutions
- Final Design Description
- Conclusions
Status Reports

- Weekly team meetings with faculty
- Weekly status memo to faculty and to company contact
Peer Reviews

- Preparation for Professional Practice
- Submission of Confidential Forms
  - hypothetical distribution of money
  - team members’ strengths and weaknesses
  - team members’ citizenship rating
  - detailed evaluations of team members
Student Self-Assessments

- Electronic Portfolio Used to Assess:
  - Students’ Ability to Demonstrate Teaming Skills (Figure 1)
  - Students’ Ability to Demonstrate Design Skills (Figure 2)
Figure 1: Percent of Submissions Demonstrating Teaming Criteria

<table>
<thead>
<tr>
<th>Criteria Demonstrated</th>
<th>2000 Results</th>
<th>2001 Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Share responsibilities</td>
<td>27</td>
<td>29</td>
</tr>
<tr>
<td>Take on different roles</td>
<td>29</td>
<td>29</td>
</tr>
<tr>
<td>Analyze ideas objectively</td>
<td>75</td>
<td>90</td>
</tr>
<tr>
<td>Discern a feasible solution</td>
<td>9</td>
<td>95</td>
</tr>
<tr>
<td>Develop a strategy for action</td>
<td>24</td>
<td>22</td>
</tr>
<tr>
<td>Build consensus</td>
<td>65</td>
<td></td>
</tr>
</tbody>
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Figure 2: Percent Demonstrating Design Criteria

Data from 2000

Criteria Demonstrated

- Elicit customer needs and constraints: 50%
- Develop PDS: 72%
- Carry out conceptual design: 69%
- Carry out detail level design: 32%
- Test and refine: 24%
- Document: 89%
- Present to customer: 33%
Figure 3: Comparison of Company Responses

<table>
<thead>
<tr>
<th>Question</th>
<th>Average Response for 2000</th>
<th>Average Response for 2001</th>
<th>Average Response for 2002</th>
</tr>
</thead>
<tbody>
<tr>
<td>Written Report</td>
<td>4.2</td>
<td>4.3</td>
<td>4.5</td>
</tr>
<tr>
<td>Communication</td>
<td>3.5</td>
<td>3.7</td>
<td>3.9</td>
</tr>
<tr>
<td>Grasp of Problem</td>
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<td>4.2</td>
<td>4.2</td>
</tr>
<tr>
<td>Design Methodology</td>
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<td>4.5</td>
</tr>
<tr>
<td>Company Benefit</td>
<td>9.3</td>
<td>4.1</td>
<td>4.3</td>
</tr>
<tr>
<td>Educational Benefit</td>
<td>3.8</td>
<td>4.5</td>
<td>4.7</td>
</tr>
</tbody>
</table>
Conclusions

Design Report is a Necessary but not Sufficient Assessment Tool

We also need:

- oral reports
- student peer and self-assessments
- company evaluations

In order to obtain:

- students’ abilities to understand clients’ needs
- student teaming skills
- students’/client communication skills