Assessment Using Capstone Experiences

Maximizing the Assessment Potential of What you are Already Doing

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http://www.che.cemr.wvu.edu/ugrad/outcomes/
Outline

- How to include as many outcomes as possible in a capstone experience
- Desired attributes of capstone experiences
- Development of rubrics to assess capstone experiences
- Using oral presentations for assessment of capstone experiences
- Summary
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Required Outcomes

- Apply math, sci, engr
- Experiments
- Design
- Teams
- Solve engr problems
- Ethics
- Communication
- Broad education
- Life-long learning
- Contemp. Issues
- Modern tools
Exercise 1

- Suggest a capstone experience that includes as many required outcomes as is possible
- Focus on what needs to be added to commonly used experiences to include additional outcomes
Some Ideas

- Comprehensive individual/group design project
- Includes all technical aspects
- Include material not taught in class
- Can include safety, life-cycle analysis, pollution prevention, environmental impact statement
- Requires use of specialized, sophisticated software
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Attributes of Capstone Experiences

- What attributes do you expect to see in your capstone experiences?
- What skills and/or knowledge do you expect to be demonstrated in capstone experiences?
Exercise 2

- List as many attributes as possible for the capstone experience described in Exercise 1
- Focus on what you would be evaluating when grading the final project report
Some Ideas

- Writing – grammar, punctuation, format, good technical explanations, logical development
- Oral – use of visual aids, organization, delivery mechanics
- Technical – apply math, science, engineering; design of equipment; optimization based on economics
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Development of Rubrics

- What attributes do you expect to see in your capstone experiences?
- What skills and/or knowledge do you expect to be demonstrated in capstone experiences?
Development of Rubrics (cont’d)

- How would you describe excellence for each attribute?
- What is not acceptable for each attribute?
- Fill in intermediate descriptions
Four-Point Scale for Rubrics

- 4 – exceeds expectations
- 3 – meets expectations
- 2 – below expectations
- 1 – not acceptable
Use of Rubrics

- Oral Reports
- Written Reports
- Technical Content
Advantages of Method

- Can involve many faculty members
- Standardization of evaluation
- Is done while grading
- Can be adapted to guideline for grading
Exercise 3

For one attribute listed in Exercise 2, develop a rubric for evaluation of these attributes.
<table>
<thead>
<tr>
<th>Attribute</th>
<th>1-Not acceptable</th>
<th>2-Below expectations</th>
<th>3-Meets expectations</th>
<th>4-Exceeds expectations</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Report Mechanics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organization</td>
<td>inappropriate content of most sections of report</td>
<td>some content in inappropriate section of report</td>
<td>content appropriate to all section of report</td>
<td>unique organization enhances readability and/or understandability of report</td>
<td></td>
</tr>
<tr>
<td>Complete Story Told</td>
<td>no story told, very incomplete</td>
<td>aspects of complete story missing</td>
<td>complete story told</td>
<td>additional material enhances quality of report</td>
<td></td>
</tr>
<tr>
<td>Aesthetics</td>
<td>unacceptable – e.g., tables and figures cannot be read/understood, fonts difficult to read</td>
<td>some portions are sloppy and difficulty to read</td>
<td>text, tables, figures readable and understandable</td>
<td>text, tables, figures so clear and understandable as to enhance report impact</td>
<td></td>
</tr>
<tr>
<td>Format</td>
<td>so many format errors as to make report useless</td>
<td>some format errors</td>
<td>format followed</td>
<td>unique format aspects that enhance report impact</td>
<td></td>
</tr>
<tr>
<td>Spelling</td>
<td>any spelling errors</td>
<td>only spelling errors are different spellings for same pronunciation</td>
<td>no spelling errors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grammar and Punctuation</td>
<td>too many grammar and punctuation errors</td>
<td>grammar and punctuation errors</td>
<td>only a very few grammar or punctuation errors</td>
<td>no grammar or punctuation errors</td>
<td></td>
</tr>
<tr>
<td>Length</td>
<td>far too long or too short</td>
<td>too long or too short</td>
<td>appropriate length</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attribute</td>
<td>1-Not acceptable</td>
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<td>3-Meets expectations</td>
<td>4-Exceeds expectations</td>
<td>Score</td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>------------------</td>
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<td>------------------------</td>
<td>--------------------------------------------</td>
</tr>
<tr>
<td><strong>Effective use of Visual Aids (VA)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clarity and readability</td>
<td>not clear or readable</td>
<td>difficulty reading</td>
<td>clear and readable</td>
<td>superior clarity and readability</td>
<td></td>
</tr>
<tr>
<td>Use of space on VA</td>
<td>VA unreadable because too crowded</td>
<td>too little or too much information of VA</td>
<td>appropriate amount of information on VA</td>
<td>VAs very well laid out</td>
<td></td>
</tr>
<tr>
<td>Lettering readable</td>
<td>font unreadable</td>
<td>font too small</td>
<td>font readable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Color, over- or under-use (if used)</td>
<td>colors too hard to distinguish, colors do not project well</td>
<td>poor choice and use of colors</td>
<td>primary/easily distinguishable colors</td>
<td>use of color enhances clarity of presentation</td>
<td></td>
</tr>
<tr>
<td>Wording concise</td>
<td>slides full of text</td>
<td>slides too wordy</td>
<td>slides appropriate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appropriate amount of information per VA</td>
<td>so much information per VA or so much missing information to make VA useless</td>
<td>too much information per VA, missing information such as size of total pie</td>
<td>appropriate level of information per slide</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Presentation Organization</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Logical order of topics</td>
<td>totally disjointed, no organization</td>
<td>some items presented out of order</td>
<td>organization as per guidelines</td>
<td>superior organization enhances communication</td>
<td></td>
</tr>
<tr>
<td>Appropriate use of time: Not too long /short</td>
<td>far too long or far too short</td>
<td>somewhat too long or too short</td>
<td>appropriate length</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complete &quot;story&quot; told</td>
<td>story missing, no story told</td>
<td>story incomplete</td>
<td>complete story told</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Introduction: Problem stated</td>
<td>problem not stated</td>
<td>problem poorly stated</td>
<td>problem clearly stated</td>
<td>problem clearly stated, good perspective on problem shown</td>
<td></td>
</tr>
<tr>
<td>Attribute</td>
<td>1-Not acceptable</td>
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<td>3-Meets expectations</td>
<td>4-Exceeds expectations</td>
<td>Score</td>
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<tr>
<td>--------------------------------------------------------------------------</td>
<td>-----------------------------------</td>
<td>----------------------</td>
<td>----------------------</td>
<td>------------------------</td>
<td>-------</td>
</tr>
<tr>
<td>Design of equipment, Analysis of performance of existing equipment, Understand interrelationship between equipment in process</td>
<td>major errors in individual equipment design</td>
<td>some errors in equipment design</td>
<td>equipment designed correctly</td>
<td>unique aspects of equipment design enhance result</td>
<td></td>
</tr>
<tr>
<td>Design of individual equipment</td>
<td>major errors in individual equipment design</td>
<td>some errors in equipment design</td>
<td>equipment designed correctly</td>
<td>unique aspects of equipment design enhance result</td>
<td></td>
</tr>
<tr>
<td>Understand interrelationship between equipment on flowsheet</td>
<td>no understanding of equipment interrelationship</td>
<td>minimum understanding of equipment interrelationship</td>
<td>clear understanding of equipment interrelationship</td>
<td>exploitation of equipment interrelationship to enhance result</td>
<td></td>
</tr>
<tr>
<td>Constraints/limitations of individual equipment and flowsheet understood</td>
<td>constraints/limitations not understood</td>
<td>not all constraints/limitations understood</td>
<td>constraints/limitations clearly understood</td>
<td>exploitation of constraints/limitations to enhance result</td>
<td></td>
</tr>
<tr>
<td>Response to questions indicates understanding of ChE principles</td>
<td>response to questions demonstrates lack of understanding</td>
<td>response to questions shows gaps in understanding</td>
<td>response to questions shows clear understanding</td>
<td>response to questions shows superior understanding</td>
<td></td>
</tr>
<tr>
<td>Significance of conclusions understood</td>
<td>lack of understanding</td>
<td>gaps in understanding</td>
<td>clear understanding</td>
<td>superior understanding</td>
<td></td>
</tr>
<tr>
<td>Apply chemistry, math, physics, engineering science</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apply engineering science</td>
<td>inability to apply principles</td>
<td>weak application of principles</td>
<td>good application of principles</td>
<td>superior application of principles</td>
<td></td>
</tr>
<tr>
<td>Response to questions indicates ability to apply these principles</td>
<td>response to questions demonstrates lack of ability to apply these principles</td>
<td>response to questions shows gaps in ability to apply these principles</td>
<td>response to questions shows clear ability to apply these principles</td>
<td>response to questions shows superior ability to apply these principles</td>
<td></td>
</tr>
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Feedback from Q & A Session

- Have presentation followed by question and answer session
- Students get immediate feedback
- Ask questions and follow-up questions
- Look for patterns – common errors or common good ideas
Types of Questions Asked

- Can they explain what was done and why?
- Quiz students on related or peripheral concepts
- Error is observed – convert session into tutorial
- How has student applied what was learned?
Information Seeking

- Level of understanding and ability to communicate it
- Was “right” answer obtained for wrong reason or accidentally?
- Is “big picture” understood?
- How was solution obtained?
Example – weak student

- Student chooses reactor temperature of 325°C
- Question: Why was this reactor temperature chosen?
- Good: Because it was economic optimum
- Bad: I just chose it
Example – better student

- Student chooses reactor temperature of 325°C and shows graph illustrating that it is economic optimum
- Question: Why is this optimum? Why are economics less favorable above and below this temperature?
- Good: Provides explanation
- Bad: I just tried a range of temperatures and this is what I found.
Example – very good student

- Student chooses reactor temperature of 325°C, shows graph illustrating that it is economic optimum, and explains why.
- Question: Did you investigate other variables such as pressure, conversion?
- Good: Yes, and explains result.
- Bad: No, I just investigated temperature.
Example – excellent student

- Student chooses reactor temperature of 325°C, shows graph illustrating that it is economic optimum, explains why, and does same for other decision variables

- Question: It becomes more difficult to find good questions
Exercise 4

- Ask me questions about this presentation aimed at revealing my understanding of assessment, ABET EC 2000, rubric development, etc.
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- Assessment using capstone experiences can complement surveys – assessment by the faculty
- It is possible to include many outcomes in capstone experiences
- Identify desired attributes of capstone experiences
Summary (cont’d)

- Can develop rubrics to assess capstone experiences
- Can use oral presentations as part of assessment of capstone experiences
Web Site

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