Multidimensional Comparison of Project-Based Learning Programs

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Motivation: Freshman Imaging Project
Goal

- Create a tool to compare project-based courses
- Provide common language to discuss these topics
Outline

1. Previous Research
2. Dimensions
3. Rubric
4. Examples
5. Space
6. Equation
7. Future Work
8. Summary
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Dimensions

• Power Distribution
• Multi-Disciplinary
• Utilization of Time
• Evaluation
• Size of Class
• Interaction Between Students
• Equipment/Materials
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<table>
<thead>
<tr>
<th>Dimensions</th>
<th>1 (Traditional)</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5 (Non-traditional)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Distribution</td>
<td>All power is held by the instructor.</td>
<td>The instructor holds most of the power but students hold a little influence.</td>
<td>Power is distributed evenly between students and instructor.</td>
<td>Students mostly control the class but the instructor still has control.</td>
<td>Power is in the hands of the students. The instructor acts as an advisor and resource.</td>
</tr>
<tr>
<td>Multi-Disciplinary</td>
<td>Only spans one main discipline.</td>
<td>Can be applied to a couple of disciplines.</td>
<td>Spans a few related disciplines.</td>
<td>Spans many disciplines but in limited ways.</td>
<td>Spans multiple disciplines.</td>
</tr>
<tr>
<td>Utilization of Time</td>
<td>Time is spent in lecture alone.</td>
<td>Most time is spent in lecture with the occasional lab or group activity.</td>
<td>Time is split somewhat evenly between lab/project time (e.g., lab period) and lecture.</td>
<td>The majority of class time is spent doing labs or a large project but there are still lectures.</td>
<td>No strict schedule exists and class is used to get work completed.</td>
</tr>
<tr>
<td>Evaluation</td>
<td>Students are graded using assessments (especially exams) and homework.</td>
<td>Grades are based on assessments (mostly exams, few projects) and homework with some consideration of effort.</td>
<td>Students are graded with exams, projects, and homework as well as a consideration of effort.</td>
<td>Grades take effort into account and may include project and/or homework grades. Few if any exams.</td>
<td>Grades are based on how much effort students put into the class/projects. Basically no exams or homework.</td>
</tr>
<tr>
<td>Size of Class</td>
<td>Classes are large and impersonal (e.g., large lecture hall).</td>
<td>Classes are typically large but there is some personalized attention.</td>
<td>Medium class size with some personalized instruction.</td>
<td>Classes are typically small with close student-teacher relationships.</td>
<td>Class sizes are small with close student-teacher relationships.</td>
</tr>
<tr>
<td>Interaction Between Students</td>
<td>Small amount of interactions. Little to no group work.</td>
<td>Students occasionally interact with each other in class.</td>
<td>Students interact regularly within class.</td>
<td>Students interact regularly in class and sometimes out of class.</td>
<td>Constant interaction between students inside and outside of class.</td>
</tr>
<tr>
<td>Equipment/Materials</td>
<td>Textbooks and manuals are the materials needed for the course.</td>
<td>Textbooks and manuals are needed as well as a few lab pieces.</td>
<td>Textbook and lab equipment is needed for this course.</td>
<td>Lab materials and project-specific materials are used.</td>
<td>Most of the materials are project-specific and purchased throughout.</td>
</tr>
</tbody>
</table>


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Examples

• Colorado School of Mines
  o EPICS (Engineering Practices Introductory Course Sequence)

• Drexel University
  o Freshman Design I & II
  o Freshman Design III

• University of Michigan
  o Solar Cells: Renewable Energy
  o Underwater Vehicle Design

• Rochester Institute of Technology (RIT)
  o Freshman Imaging Project

• Western New England University (WNE)
  o Introduction to Engineering
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Characteristic Equation

\[ d = \left[ (a_1 - b_1)^2 + (a_2 - b_2)^2 + \ldots + (a_7 - b_7)^2 \right]^{\frac{1}{2}} \]

University of Michigan (Underwater Section) vs. Rochester Institute of Technology

\[ d = 3.0 \]

Western New England University vs. Rochester Institute of Technology

\[ d = 7.2 \]
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Future Work

- Online database of programs
  - Schools can discuss their own projects
  - All can be mapped onto the space and compared

- More interactive representation of multidimensional space (Java script)
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Summary

- Created a tool to compare non-traditional classes
- Mapped several examples onto multidimensional space using tool
- Compared two programs quantitatively with the distance equation
Questions?