Two Cultures or One?
Student Engagement of Liberal Arts College STEM Majors within and outside of Science

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Outline of the Presentation

• “Two Cultures” Hypothesis
• NECASL panel study of the Class of 2010
• Patterns of Course Enrollment
• Orientations toward Courses outside of Science
• Conclusions
• Discussion
“Two Cultures” Hypothesis

• STEM majors differ from humanities/social science majors in “culture of engagement”

• STEM fields:
  – Collaborative work → quantitative skills
  – Lucrative careers

• Humanities and social science fields:
  – High level of interaction → exploring and understanding ideas

“Two Cultures” Hypothesis

• Is this a valid hypothesis at liberal arts colleges?
• Do students at liberal arts colleges bridge the two cultures of engagement?
• If they do, how does this benefit their educational experience holistically?
Panel Study of the Class of 2010

- New England Consortium on Assessment and Student Learning (Bates, Bowdoin, Colby, Middlebury, Smith, Trinity and Wellesley)
- www.wellesley.edu/NECASL
- Goals:
  - Better understand students’ transition from high school to college
  - Better understand how students make important academic and social decisions
  - Explore student learning in relation to institutional policies and practices
Panel Study of the Class of 2010

- Interviews attempt to capture immediacy of experience
- 3 in first year and 1 each semester thereafter
- Interviews conducted by students
- **Academic experiences**: best/worst courses, choice of major, study habits, interactions with faculty, self-assessment of knowledge and skills
- **Social experiences**: interactions with friends, residential life, extracurricular activities, social life
- **Personal experiences**: managing time and life, being away from home, balancing competing demands
- **Aspirations, expectations, and self-reflection**: definitions of success, perceptions of change, hopes and fears, self-identity
Panel Study Science Subset

- 44 STEM majors/minors from the NECASL project
- Gender
  - Female 77%
  - Male 23%
- Race/ethnicity
  - African American 9%
  - Asian American 20%
  - International 23%
  - Latina/o 14%
  - Native American 2%
  - White 32%
Panel Study Science Subset

• STEM fields of majors/minors
  – Mathematics 30%
  – Neuroscience 20%
  – Chemistry 18%
  – Biology 14%
  – Computer Science 7%
  – Geological Sciences 7%
  – Other/pre-medical 16%
## Patterns of Course Enrollment

<table>
<thead>
<tr>
<th>Descriptor</th>
<th>Percentage of units/credits in STEM fields</th>
<th>Number of STEM majors/minors</th>
<th>Typical major/minor profile</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>More than 60%</td>
<td>16</td>
<td>Single or double major in STEM field(s)</td>
</tr>
<tr>
<td>Medium</td>
<td>40% to 60%</td>
<td>12</td>
<td>STEM major + non-STEM major/minor OR interdisciplinary major</td>
</tr>
<tr>
<td>Low</td>
<td>Less than 40%</td>
<td>16</td>
<td>STEM minor and/or pre-medical track</td>
</tr>
</tbody>
</table>
Orientations toward Courses outside of Science

- Samplers (n=15, 34%)
- Explorers (n=5, 11%)
- Straddlers (n=6, 14%)
- Connectors (n=14, 32%)
- Inverse Samplers (n=4, 9%)
“Because I have to”

“I don’t really know what I want to do, so like they’re helpful in terms of like making sure I get a good look at everything. But then again I kind of, you know I want to do math and science so like I don’t really want to be, not really wasting my time, but using the time that I could be for focusing, for getting credits in that one area or general area of science.”

Josh (White, Math/Economics)
Samplers

“Because I’m at a liberal arts college”

“I’m hoping that maybe I will find room to take classes in all different areas and stuff just to explore and to do something different. Because if I am going to be a biology major then that’s going to be really intensive and science focused, and I want to be able to take maybe at least one class a semester that’s something completely different. Some kind of a break. I’m hoping to take a huge variety, a really good variety of class in the next four years.”

Tiffany (White, Neuroscience/chemistry)
“Because I value a liberal arts education”

“If I weren’t at a place that offers all kinds of different philosophy and all kinds of languages including Chinese, I probably wouldn’t be taking them. I highly considered going to a prestigious technical college, and then I decided against it because I really like [my college’s] program and they really sold it to me well. And if I were going to this other college, I wouldn’t be taking Chinese. They don’t offer it. And I’m really enjoying that. It’s a really good thing for me.”

Michelle (White, Engineering)
Straddlers

“Because there are two sides to me”

“A lot of people who major in languages I find don’t like the sciences, but I’m in both, and I consider myself more a science person than a humanities person. So I don’t really think I can identify with all those, like one thing or another, so I don’t think it defines who I am.”

Jessica (Latina, Chemistry/Spanish)
“I think the junction between science and business and science in general economics is a huge deal. States like X, where they have a booming biomedical sciences industry, you can clearly see the junction between science and business and science and economics and how it drives society in general, and how it’s an interesting place to be. And so I think having a major in a science and a background in economics and business-type classes being an advantage to working in that kind of industry, or working in that kind of society.... Even though you’re providing a medical service, the service is based on an industry economic base.”

Michael (Asian-American, Neuroscience/economics)
Connectors

“Because it makes me a better problem-solver”

“In math, and economics, you’re just constantly presented with situations, or problems, within a context, that you have to analyze and you have to come up with a way to solve it, or do it, in some manner. And there’s no one way to do it. There’s multiple ways, and you’ve got to think about, how can I do this? We’re not usually pushed to do this, but there’s also that other piece of, what’s the best way of doing it, not just let’s do it. What’s the most efficient way of doing it.”

Christopher (Asian-American, Math/Economics)
Science Connectors

“Because faculty helped me see connections”

“A lot of professors really try to branch out to other academic areas. In science we’ll often do a small research paper on the impact of this climate, and then also in terms of the government, they also look at that same climate issues. And those, they kind of mesh. The same goes with physics, it kind of mixes with chemistry. But then also art can also, you can put that into history. Then also you can put that into science too, or mathematics. So there’s that kind of diversity in the teaching, and I feel like a lot of the faculty have a very good awareness that one subject can lead to a lot of other subjects, especially since there’s a lot of students who take classes that aren’t in their major, and who have all those different interests.”

Matthew (Latino, Physics/chemistry)
Patterns of Course Enrollment and Orientations toward Non-Science Courses

<table>
<thead>
<tr>
<th>Enrollment Pattern</th>
<th>Sampler</th>
<th>Explorer</th>
<th>Straddler</th>
<th>Connector</th>
<th>Inverse Sampler</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>10</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Medium</td>
<td>5</td>
<td>0</td>
<td>1</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>Low</td>
<td>0</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>4</td>
</tr>
</tbody>
</table>

**High** = >60% STEM  **Medium** = 40-60% STEM  **Low** = <=40% STEM
Conclusions

• More courses outside of science increase the likelihood that students will integrate knowledge and experiences between their science and non-science courses.

• ~2/3 of the students in our sample (Connectors, Explorers, Straddlers) take significant advantage of the range of courses at liberal arts colleges.

• Almost all students recognized that their liberal arts education had provided them with skills in writing and speaking that prove valuable in the workplace or graduate school.

• Unexpectedly large flux in choices among the sciences for even students w/ strong science focus
Implications

- General education requirements insufficient to provide students with a deep understanding of the nature of any discipline
- Better approach might be to require students to study a field other than their major up to at least the intermediate level, rather than sampling from several at the introductory level
- The second field may enhance students’ appreciation for their science major and even promote retention
Acknowledgements

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