Learning from Your Classmates: A Multi-Method Assessment of Classmate Peer Effects in First-Year Core Courses at Three Colleges

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Project Goal

• Learn whether and how classmate peers affect student learning in core humanities courses
  ▫ What are the important individual attributes of beneficial peers?
  ▫ What attributes of the classroom distribution of peer characteristics are associated with learning success?
  ▫ Can peer effects guide admission decisions or section assignments to improve learning
Project Design

- **Statistical analysis**
  - Do characteristics of the classroom distribution of measurable peer characteristics affect measurable learning outcomes?
  - Do classmates’ higher average SAT scores improve a student’s grades in other courses?

- **Instructor interviews**
  - What are instructors’ perceptions of how classmates affect students’ learning?
    - Through individual behavior
    - Through collective group behavior
Reed College
• Jeff Parker, Economics
• Jon Rivenburg, IR
• Nigel Nicholson, Core

Lewis & Clark College
• James Grant, Economics
• Jay Beaman, IR
• Ben Westervelt, Core

Whitman College
• Jan Crouter, Economics
• Neal Christopherson, IR
• Ruth Russo, Core
Core courses

- Required of all first-year students
- Mostly common syllabus across course sections
- Students are randomly or quasi-randomly assigned to course sections
- Course structure stable over many years
  - Humanities content
  - Discussion-based format
  - Emphasis on reading, writing, and intellectual discussion
  - Common pool of instructors over time
Peer effects in core courses

- Strong because of interaction in discussion format
- Strong because first-year students are defining themselves as college students at this time
- Strong because reading, writing, and discussion skills are central to all college courses
- Strong because interdisciplinary course provides introduction to many humanities disciplines
Statistical Evidence

Linking measurable outcomes to measurable peer characteristics

```
. reg uggpa satm100 satv100 hsgpa hsp if humfresh==1, robust

Linear regression

Number of obs =    2627
R-squared = 0.1386
Root MSE = 0.55042

               | Coef.     Std. Err.     t    P>|t|   [95% Conf. Interval]
------------- | ----------- ----------- ------ -------- ---------------------
      uggpa    |           |            |       |           |
    satm100    | 0.0458213  | 0.0162001  | 2.83  | 0.005     | 0.0140549  0.0775876
    satv100    | 0.1071898  | 0.0166006  | 6.48  | 0.000     | 0.0750271  0.1401513
     hsgpa     | 0.412315   | 0.0462722  | 8.91  | 0.000     | 0.3215812  0.5030487
      hsp      | 0.4151115  | 0.1224883  | 3.39  | 0.001     | 0.2749281  0.555295
    _cons      | 0.0506707  | 0.0398826  | 1.28  | 0.771     | -0.2628381 0.3641795
```
What is measurable?

Outcomes
• Grade-point average
  ▫ Always exclude core-course GPA because of smart peers might drive up the curve
  ▫ Undergraduate GPA
  ▫ GPA in 1\textsuperscript{st} and 1\textsuperscript{st} & 2\textsuperscript{nd} years
  ▫ GPA in core-related courses
• Persistence

Peer characteristics
• SAT scores
• High-school GPA
• High-school class rank
• Demographic characteristics

Missing data problems...
• High-school variables
  ▫ Missing at random
• L&C missing SAT scores
  ▫ Not missing at random
Does the core-course section matter?

- Yes.
- Regress GPA measures on dummy variables for core-course sections:

<table>
<thead>
<tr>
<th>Outcome (excluding core grades):</th>
<th>Lewis &amp; Clark</th>
<th>Reed</th>
<th>Whitman</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cumulative GPA</td>
<td>0.001</td>
<td>&lt;0.001</td>
<td>0.001</td>
</tr>
<tr>
<td>First-year GPA</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>0.016</td>
</tr>
<tr>
<td>1st &amp; 2nd year GPA</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>0.002</td>
</tr>
<tr>
<td>Narrow core-related GPA</td>
<td>0.001</td>
<td>&lt;0.001</td>
<td>0.003</td>
</tr>
<tr>
<td>Broad core-related GPA</td>
<td>0.003</td>
<td>&lt;0.001</td>
<td>0.003</td>
</tr>
</tbody>
</table>

The table above shows the p values of ANOVA F tests for different outcomes across Lewis & Clark, Reed, and Whitman. The outcomes include cumulative GPA, first-year GPA, 1st & 2nd year GPA, narrow core-related GPA, and broad core-related GPA. The results indicate a statistically significant difference in GPA measures across the core-course sections at a significance level of 0.05.
Is this just an instructor or year effect?

- **Probably not.**
- **Regress GPAs on section dummies with instructor & year dummies, and individual characteristics**

<table>
<thead>
<tr>
<th>GPA measure (excluding core):</th>
<th>Lewis &amp; Clark</th>
<th>Reed</th>
<th>Whitman</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAT</td>
<td>0.003</td>
<td>&lt;0.001</td>
<td>0.052</td>
</tr>
<tr>
<td>No SAT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full sample</td>
<td></td>
<td></td>
<td>Full sample</td>
</tr>
<tr>
<td>Narrow core-related courses</td>
<td>0.002</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Broad core-related courses</td>
<td>0.005</td>
<td>&lt;0.001</td>
<td>0.008</td>
</tr>
</tbody>
</table>

- **Something** about core section other than instructors affects non-core GPA
Is the section effect due to measurable peer characteristics?

- Not that we can find

<table>
<thead>
<tr>
<th>Dependent variable is GPA (excluding core) in</th>
<th>Coefficient (standard error) on peer-mean predicted GPA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lewis &amp; Clark</td>
</tr>
<tr>
<td></td>
<td>SAT No SAT Full sample Full sample</td>
</tr>
<tr>
<td>All courses</td>
<td>-0.183 (0.119) -0.144 (0.182) 0.119 (0.151) -0.0445 (0.110)</td>
</tr>
<tr>
<td>First-year courses</td>
<td>-0.215 (0.148) 0.134 (0.231) -0.0580 (0.174) -0.0143 (0.129)</td>
</tr>
<tr>
<td>First- &amp; second-year courses</td>
<td>-0.201 (0.127) 0.129 (0.196) -0.0840 (0.161) -0.0399 (0.113)</td>
</tr>
<tr>
<td>Narrow core-related courses</td>
<td>-0.142 (0.161) 0.221 (0.281) -0.0043 (0.174) -0.0582 (0.125)</td>
</tr>
<tr>
<td>Broad core-related courses</td>
<td>-0.165 (0.122) 0.113 (0.182) 0.0824 (0.161) -0.0896 (0.112)</td>
</tr>
</tbody>
</table>
Endless variations we tried

• Other characteristics of peer distribution
  ▫ Median
  ▫ Dispersion: standard deviation or interquartile range
  ▫ Quantiles: % in each quartile of student distribution

• Other outcomes
  ▫ Core-course grade (veteran instructors only)
  ▫ Persistence to graduation
  ▫ Academic actions
Evidence from instructor interviews
Looking behind the numbers ...
Interview methodology

• 10 instructors from each college
  ▫ Interviewed by Parker and the local core-course project team member
• One-hour conversations based on prepared set of prompting questions
  ▫ Details are in the paper
• Results were analyzed by project team
  ▫ May 2008 conference assembled team with many interviewees and other core-course instructors to discuss and (perhaps) validate team’s tentative conclusions
Main result: Attitude over aptitude

- Within the population of students at these selective colleges ...
- Within the context of first-year, discussion-based core courses ...
- There was a strong consensus that positive or negative peer effects resulted:
  - Mostly from the peer’s personality and attitude, and
  - Very little from the peer’s academic aptitude.
Beneficial peer behaviors

- Attendance and careful preparation for class
- Maturity, leadership, and concern for class
- General intellectual curiosity
- Respect for others’ opinions
- Demonstrated enthusiasm for course and subject
- Openness to new ideas and approaches
- Cooperative rather than competitive attitude
- Willingness to speak in class
- Willingness to take chances
Detrimental peer behaviors

- Dismissive or judgmental behavior
- Rigidity of views
- Rejection of peer learning altogether
- Excessive loquaciousness
- Active or ostentatious disengagement

Quiet peers and nice peers: Not usually a problem
Individual Peer Behavior and Classroom Peer Interaction

• What makes a successful class?
  ▫ Obvious: More students with good peer behavior
  ▫ But most classes have some “good peers,” some less effective peers, and perhaps one or two detrimental peers

• Is there a formula or model for combining individual peer characteristics into a measure of class effectiveness?
A Simple Picture of Peer Distribution

- **Nucleus:** Positive peer behavior
- **Middle:** Ambiguous or inconsistent peer behavior
- **A Problem Peer**
Key Question: How Much do Student Behaviors Change During Class?

• Is the class “personality” determined by students’ characteristics when they walk in the door?
  ▫ Our preconception was to think of pre-existing student characteristics as “inputs”
• Does student behavior evolve in important ways during the semester?
  ▫ Is this influenced by peers?
  ▫ Can it be guided by instructors?
Modeling Classes with Stable Student Behavior

Critical-mass model

- Need a sufficient nucleus of students with good peer behavior to make the class successful (3-6 in class of 15-20)
- Can usually live with one disruptive peer
- The class will be successful if the nucleus is large enough to keep the discussion lively and if the negative peer(s) on the periphery are not too distracting
Modeling Classes with Changing Student Behavior

Gravitational-atraction model

- Students’ behavior evolves through the course
- Good peers provide positive role models that others emulate
- Sufficient nucleus of good peers can pull most of the class toward the nucleus $\Rightarrow$ outstanding class
- Detrimental peers can influence peers toward negative behavior and, in an extreme case, destroy class
- Instructor can influence peer behavior as well
Do We Want “All Good Peers” or Are There Desirable Differences?

Role-playing model

- Some behaviors are universally desirable
  - Respect, maturity, enthusiasm, preparation, etc.
- For others, a mix may be best
  - Analogy to a basketball team needing players with different skills to play different positions
  - Need one or two “first-speakers,” some “responders,” some “skeptics,” some “translators,” etc.
Conclusions

• Peer effects are very complex
• It may be impossible to measure peer effects statistically
  ▫ We have certainly failed!
• Statistical work based on attitudes and personalities of peers may be more successful
  ▫ Must generate the data for such analysis
  ▫ Prototype surveys done at Reed in 2009-10 might be a basis for future study
Questions?