The Approach

Identifying the course-taking patterns of credential completing students can:

• Reveal what courses students are actually taking in college (as opposed to what we think they should be taking)

• Suggest pathways for current students
Overview of Presentation

- Identifying programs of study for students
- Designing an electronic advising system
- Understanding credits taken in excess of those required for a degree
- Extending the idea of gatekeeper courses beyond English and math
- Examining grade differences in various courses between completing and non-completing students
Assigning a Program of Study to a Non-Completing Student

• We employ a machine learning method to:
  – Assign a program of study to every student based on completers’ course taking and programs

• This can be used to:
  – Understand course-taking activity at a given college
  – Advise students
Designing an Electronic Advising System

• Unlike Degree Audit systems, an Electronic Advising system would:
  – Be based only on transcript data
  – Have no rules
  – Would utilize completing students as models for non-completing students

• We are prototyping an advising system to illustrate these ideas
Aspects of an Electronic Advising System

• Student can select one of a few suggested programs based on courses taken to date.

• The system would then suggest courses:
  – Taken by completers in same program
  – Taken by students with similar course-taking patterns
  – That are next in a sequence (e.g., History 202 follows History 201)
  – That are associated (e.g., students who take Math 201 also take Chem. 201)

• Would show student progress to date
Deducing the Order of Courses in a Program

• For each completer, identify:
  – Which semester when they took each course

• Then assign each course to:
  – The semester in which it is most likely to be taken (across all completers)

• Select the top six courses by semester to assemble the course ordering

• In advising, such a course ordering could help determine where a student is in the program
Example: Associate of Science in Business Admin. at One College

<table>
<thead>
<tr>
<th>Semester</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pattern based on student top enrollments</td>
<td>ENG 111&lt;br&gt;BUS 100&lt;br&gt;ITE 115&lt;br&gt;SDV 100&lt;br&gt;HIS 121&lt;br&gt;STD 100</td>
<td>ENG 112&lt;br&gt;MTH 163&lt;br&gt;HIS 122&lt;br&gt;MTH 166&lt;br&gt;MTH 174&lt;br&gt;SPD 126</td>
<td>ACC 211&lt;br&gt;ECO 201&lt;br&gt;SPD 110&lt;br&gt;BIO 101&lt;br&gt;BUS 200&lt;br&gt;PED 135</td>
<td>ECO 202&lt;br&gt;ACC 212&lt;br&gt;PED 116&lt;br&gt;MTH 271&lt;br&gt;BIO 102&lt;br&gt;MTH 241</td>
</tr>
<tr>
<td>Program as listed on website</td>
<td>ENG 111&lt;br&gt;ITE 115&lt;br&gt;SDV 100&lt;br&gt;HIS elective&lt;br&gt;MTH elective&lt;br&gt;Science elective</td>
<td>BUS 100&lt;br&gt;ENG 112&lt;br&gt;PED 116&lt;br&gt;Science elective&lt;br&gt;Math elective</td>
<td>ACC 211&lt;br&gt;ECO 201&lt;br&gt;General elective&lt;br&gt;Public speaking&lt;br&gt;Humanities&lt;br&gt;P.E. or Rec.</td>
<td>ACC212&lt;br&gt;ECO202&lt;br&gt;General elective&lt;br&gt;Humanities</td>
</tr>
</tbody>
</table>
Take-aways

- The following are feasible and could be useful for student advising and in understanding student activity:
  - Assigning programs of study to current students
  - Identifying pairs of courses found in sequence or often together in transcripts
  - Identifying courses often taken by completing students
  - Identifying the sequence of courses of completing students

- Electronic student advising could boost student outcomes
Excess Credits

• Many credential earners earn more credits than they need
  – Are these extra courses useful or not?
  – Are there substantial efficiency losses associated with this?
Possible Reasons for Excess Credits

• Students are not well self-directed
• Limited advising available; unclear information; too much information
• Structural or scheduling problems (e.g., class is full)
• Needed classes not listed in formal requirements
• Can transfer excess to a four-year college
• Student interest in courses outside their program
Excess Credits by Program

• Programs have different credit requirements
• Need to use different baseline for each program
• For one state community college system, I determined these credit baselines for the associate degree programs in that system
Counting Excess Credits

- Excess credits index: share of total credits that are in excess
- System-wide, for 14,259 associate degree completers in six cohorts:
  - Mean number of excess credits was 14
  - Median was 9
  - Index was 12 percent
- Excess credits accounted for about 9 percent of the cost of courses
Auditing a Program’s Requirements

- Look at excess credits by subject of completers of a particular program
- Faculty and administrators can then compare course-taking activity by program completers with requirements
## Requirements Audit: AS in Business Admin. at a College

<table>
<thead>
<tr>
<th>Subject</th>
<th>Classes Required</th>
<th>Percent of Completers Exceeding Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business</td>
<td>1</td>
<td>34</td>
</tr>
<tr>
<td>Accounting</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Economics</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Science</td>
<td>2</td>
<td>50</td>
</tr>
<tr>
<td>Humanities</td>
<td>3</td>
<td>25</td>
</tr>
<tr>
<td>Computers</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>College Success</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>English</td>
<td>2</td>
<td>29</td>
</tr>
<tr>
<td>Math</td>
<td>2</td>
<td>39</td>
</tr>
<tr>
<td>Physical Education or Recreation</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Public Speaking</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>
Take-aways

– There is a significant level of excess credits overall (9 credit median) in the system studied
– Colleges and programs within colleges vary on excess credits
– Some excess credits are related to program of study, some not; varies by program
– Costly in time/money in any case, but may enable students to learn useful additional material
– Leads one to the idea of continuously auditing student transcripts
Continuous Degree Audit

• Every term:
  – Compare transcript with requirements to see if each student is on track
• Did this for excess credits above
• Similar to electronic advising system for students, but instead used administratively by faculty and staff
Generalizing the Idea of Gatekeeper Courses

- English and especially math remain gatekeepers to college success
- Completers do better than non-completers in many commonly taken courses beyond these, showing that there are many barriers: “obstacle” courses
Grade Differences in the Most Commonly Taken Courses

<table>
<thead>
<tr>
<th>Rank</th>
<th>Course Title</th>
<th>Enrollment Rate</th>
<th>Mean Grade</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Completers</td>
<td>Non-Completers</td>
<td>Completers</td>
</tr>
<tr>
<td>1</td>
<td>College Composition I</td>
<td>75.4%</td>
<td>57.5%</td>
<td>3.2</td>
</tr>
<tr>
<td>2</td>
<td>College Success Skills</td>
<td>47.4%</td>
<td>41.6%</td>
<td>3.5</td>
</tr>
<tr>
<td>3</td>
<td>College Composition II</td>
<td>68.6%</td>
<td>32.7%</td>
<td>3.2</td>
</tr>
<tr>
<td></td>
<td>Introduction to Computer Applications and Concepts</td>
<td>57.5%</td>
<td>31.5%</td>
<td>3.4</td>
</tr>
<tr>
<td>4</td>
<td>United States History I</td>
<td>44.1%</td>
<td>24.2%</td>
<td>3.1</td>
</tr>
<tr>
<td>5</td>
<td>General Biology I</td>
<td>43.2%</td>
<td>20.0%</td>
<td>2.9</td>
</tr>
<tr>
<td>6</td>
<td>United States History II</td>
<td>36.3%</td>
<td>14.5%</td>
<td>3.2</td>
</tr>
<tr>
<td>7</td>
<td>Introduction to Psychology I</td>
<td>24.3%</td>
<td>15.4%</td>
<td>3.2</td>
</tr>
<tr>
<td>8</td>
<td>Precalculus I</td>
<td>31.9%</td>
<td>11.4%</td>
<td>2.8</td>
</tr>
<tr>
<td>9</td>
<td>History of Western Civilization I</td>
<td>20.0%</td>
<td>12.3%</td>
<td>3.1</td>
</tr>
<tr>
<td>10</td>
<td>General Biology II</td>
<td>37.5%</td>
<td>9.3%</td>
<td>2.9</td>
</tr>
<tr>
<td>11</td>
<td>Introduction to Business</td>
<td>17.8%</td>
<td>11.6%</td>
<td>3.1</td>
</tr>
<tr>
<td>12</td>
<td>Principles of Psychology</td>
<td>20.8%</td>
<td>10.1%</td>
<td>3.0</td>
</tr>
<tr>
<td>13</td>
<td>Principles of Public Speaking</td>
<td>32.1%</td>
<td>8.7%</td>
<td>3.4</td>
</tr>
<tr>
<td>14</td>
<td>Principles of Sociology</td>
<td>20.8%</td>
<td>9.4%</td>
<td>3.1</td>
</tr>
</tbody>
</table>

CCRC: Community College Research Center
Teachers College, Columbia University
Models of Grade Differences

• We are constructing models to account for observable differences between completers and non-completers in terms of:
  – Demographics
  – Credit accumulation (comparing completers with non-completers with many credits)

• These models should reduce our estimates of the gaps between completers and non-completers’ grades, but should not eliminate them
Take-aways

– Need to generalize gatekeeper course concept beyond math and English

– Students who are unable to complete have difficulty in many frequently taken classes in many programs

– Analysis of gaps in grades can help identify those courses in which students need help
For more information:

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