Math & Science Learning Center Data

Teaching & RPG Seminar

Aug. 26, 2013
Outline

• Fall 2012 MSLC tutoring numbers
• Analysis of 2010-2011 tutoring client data
• Preliminary analysis of 2011-2012 peer instruction data
MSLC Data Collection

• Visitors sign in with purpose for visit, data pulled from Banner:
  - Age
  - Gender
  - Ethnicity
  - Race
  - Major
  - Total visits
  - Visit date
  - Class
  - GPA
  - CSU Hrs
  - HS gpa
  - ACT
  - ACTM
  - SAT
  - SATM
  - Math placement

• Purposes: Quiet place to study, use computer, study group, tutoring
Fall 2012 Daily Tutoring Visits
Fall 2012 Visits

• 2,813 visits logged
• 2,214 visits for tutoring
• Tutoring visits by math course:
  – 600 College Algebra (104 unique students) 5.8 vps
  – 294 Pre-calculus (51 students) 5.8 vps
  – 141 Math Modeling (36 students) 3.9 vps
  – 131 Introductory Statistics (28 students) 4.7 vps
  – 118 Calculus 1 (23 students) 5.1 vps
  – 82 Applied Calculus (18 students) 4.6 vps
  – 41 Calculus 2 (9 students) 4.6 vps
Analysis of 2010-2011 Data

Joint work with Kimberly Shaw & Cindy Ticknor
## Grade Distributions

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>F/WF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-visitor</td>
<td>425</td>
<td>563</td>
<td>608</td>
<td>294</td>
<td>461</td>
</tr>
<tr>
<td></td>
<td>(416)</td>
<td>(547)</td>
<td>(615)</td>
<td>(318)</td>
<td>(454)</td>
</tr>
<tr>
<td>Mean test score</td>
<td>23.2</td>
<td>21.7</td>
<td>21.0</td>
<td>19.7</td>
<td>21.2</td>
</tr>
<tr>
<td>Visitor</td>
<td>55</td>
<td>68</td>
<td>102</td>
<td>73*</td>
<td>63</td>
</tr>
<tr>
<td></td>
<td>(64)</td>
<td>(84)</td>
<td>(95)</td>
<td>(49)</td>
<td>(70)</td>
</tr>
<tr>
<td>Mean test score</td>
<td>21.4</td>
<td>19.6</td>
<td>19.0</td>
<td>18.9</td>
<td>18.1</td>
</tr>
</tbody>
</table>

\[ \chi^2 (4, \text{N}=2712) = 20.15, \ p \leq 0.001 \]

Cramer’s V = 0.089

* = largest contributor to \( \chi^2 \) statistic

**Finding:** Significantly different grade distributions

Looking at courses serving at least 5 students
Looking at gender and race

MSLC Visitors Compared to Undergraduates

- Black Female: 16% MSLC, 23% Undergraduates
- Black Male: 5% MSLC, 11% Undergraduates
- Non-Black Female: 50% MSLC, 37% Undergraduates
- Non-Black Male: 28% MSLC, 29% Undergraduates
Grades Among Black Males

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>F/WF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-visitor</td>
<td>28 (26)</td>
<td>47 (41)</td>
<td>69 (75)</td>
<td>30 (36)</td>
<td>56 (52)</td>
</tr>
<tr>
<td>Mean test score</td>
<td>21.6</td>
<td>20.3</td>
<td>20.4</td>
<td>19.1</td>
<td>19.6</td>
</tr>
<tr>
<td>Visitor</td>
<td>5 (7)</td>
<td>6 (12)</td>
<td>27 (21)</td>
<td>16* (10)</td>
<td>10 (14)</td>
</tr>
<tr>
<td>Mean test score</td>
<td>21.0</td>
<td>19.2</td>
<td>18.7</td>
<td>17.4</td>
<td>18.8</td>
</tr>
</tbody>
</table>

\[ \chi^2 (4, N=294) = 12.79, \ p < 0.012 \]

Cramer’s V = 21

* = largest contributor to \( \chi^2 \) statistic
Contemplating Selection Bias

One-way ANOVA tests between subjects ➔ significant difference in course performance.  
\[ p < 0.001 \text{ level}, F(2,5779) = 16.29, p=0.000. \]

Tukey-Honest post-hoc comparisons indicate the following:
• Significantly lower gpa for group A than group B (\( p = 0.000 \))
• Significantly higher gpa for group A than group C (\( p = 0.009 \))

<table>
<thead>
<tr>
<th>Groups</th>
<th>N</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Non-visitors</td>
<td>4700</td>
<td>2.21</td>
<td>1.38</td>
<td>[2.17, 2.25]</td>
</tr>
<tr>
<td>B. Visitors, not tutored</td>
<td>630</td>
<td>2.47</td>
<td>1.27</td>
<td>[2.38, 2.57]</td>
</tr>
<tr>
<td>C. Visitors tutored</td>
<td>456</td>
<td>2.01</td>
<td>1.31</td>
<td>[1.89, 2.13]</td>
</tr>
</tbody>
</table>
Peer Instruction Leader Data

Fall 2011 – Fall 2012 Preliminary Analysis
Also work with Kimberly Shaw & Cindy Ticknor
Models in the literature

1. Colorado Learning Assistant Program, UC Boulder
2. Structured Learning Assistance, Ferris State University
3. Structured Learning Assistance, Austin Peay State University
4. Supplemental Instruction, University of Missouri-Kansas City
What others have found

• Colorado Learning Assistant Program
  – Increased # in physics teaching by factor of 3
  – Increased student learning gains & knowledge retention in biology and physics

• UMKC SI Model
  – Increased number of A’s and B’s
  – Improved retention rates
  – Better long-term knowledge retention
  – Better problem-solving
What others have found, p.2

• **Structured Learning Assistance**
  – Increased ABC rates
  – Improved retention rates
  – Cost effectiveness
### PIL Session Attendance

<table>
<thead>
<tr>
<th></th>
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<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 1215</td>
<td>71</td>
<td>166</td>
<td>43%</td>
<td>MATH 1111</td>
<td>14</td>
<td>116</td>
<td>12%</td>
<td>BIOL 1215</td>
<td>58</td>
<td>93</td>
<td>62%</td>
</tr>
<tr>
<td>PHYS 2211</td>
<td>11</td>
<td>45</td>
<td>24%</td>
<td>CHEM 1212</td>
<td>13</td>
<td>38</td>
<td>34%</td>
<td>GEOL 1110</td>
<td>37</td>
<td>162</td>
<td>23%</td>
</tr>
<tr>
<td>STAT 1127</td>
<td>11</td>
<td>65</td>
<td>17%</td>
<td>BIOL 1215 (A)</td>
<td>40</td>
<td>125</td>
<td>32%</td>
<td>CHEM 1211</td>
<td>58</td>
<td>115</td>
<td>50%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>BIOL 1215 (B)</td>
<td>34</td>
<td>75</td>
<td>45%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>93</td>
<td>276</td>
<td>34%</td>
<td>TOTAL</td>
<td>101</td>
<td>354</td>
<td>29%</td>
<td>TOTAL</td>
<td>153</td>
<td>370</td>
<td>41%</td>
</tr>
</tbody>
</table>

- Attendance improving but still a challenge
- Implications for future arrangements
  Targeting classes w/high DFW rates, large enrollments
- PIL scheduling
## Compare Scores & Session Attendance

<table>
<thead>
<tr>
<th></th>
<th>Fall 2011</th>
<th>Spring 2012</th>
<th>Fall 2012</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td>70.1</td>
<td>70.3</td>
<td>70.2</td>
<td>70.2</td>
</tr>
<tr>
<td>Once</td>
<td>70.4</td>
<td>68.3</td>
<td>75.5</td>
<td>72.0</td>
</tr>
<tr>
<td>More than once</td>
<td>73.1</td>
<td>77.9</td>
<td>76.9</td>
<td>75.9</td>
</tr>
</tbody>
</table>

Two-tailed t-test for independent samples results:

\[ t(722) = 2.84, \ p < 0.005 \]

End-of-course score info available for 722 cases.
Grade Distribution Versus Attendance

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attended</td>
<td>14%</td>
<td>25%</td>
<td>37%</td>
<td>17%</td>
<td>8%</td>
</tr>
<tr>
<td>Never attended</td>
<td>10%</td>
<td>21%</td>
<td>25%</td>
<td>23%</td>
<td>21%</td>
</tr>
</tbody>
</table>

One-tailed t-test results: \( t(998) = 5.68, p < 0.001 \)

- ABC rate of 75% among those who attended
- ABC rate of 56% among those who never attended
### Looking at Attendance Versus GPA

<table>
<thead>
<tr>
<th>PIL Attendance</th>
<th>N</th>
<th>Mean GPA</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>High School GPA</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attended</td>
<td>227</td>
<td>3.06</td>
<td>0.49</td>
</tr>
<tr>
<td>Never Attended</td>
<td>414</td>
<td>3.07</td>
<td>0.52</td>
</tr>
<tr>
<td><strong>CSU GPA</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attended</td>
<td>275</td>
<td>2.54</td>
<td>1.21</td>
</tr>
<tr>
<td>Never Attended</td>
<td>487</td>
<td>2.43</td>
<td>1.19</td>
</tr>
</tbody>
</table>

Differences not statistically significant (p=0.05).
Partial PIL Bibliography

Colorado program:


Partial PIL Bibliography

UMKC model:
Structured Learning Assistance:


Partial PIL Bibliography

CSU program:
