A Basic Mathematics Proficiency And Algebra Assistance Class For Freshman College Students

Asst. Prof. Mark Louie Ramos, MMathEd.
Failure in Math 101

- Around 40%-50% of first time takers in College Algebra fail in the subject
  - Philippines: Billones (2011)

- Reasons:
  - Poor instruction (Islip, 2009; Lewkowicz, 2003; Greenberg, 1991; Goolsby, 1987)
  - Cognitive under-preparedness (Wu, 2001; Titus, 2011; McNeil et al., 2010)
Table 1: NAT Results
Source: Department of Education, Philippines

<table>
<thead>
<tr>
<th>Year</th>
<th>Elementary</th>
<th>Secondary</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>59.45%</td>
<td>46.20%</td>
</tr>
<tr>
<td>2004</td>
<td>59.10%</td>
<td>50.70%</td>
</tr>
<tr>
<td>2005</td>
<td>53.66%</td>
<td>47.82%</td>
</tr>
<tr>
<td>2005</td>
<td>60.29%</td>
<td>39.05%</td>
</tr>
<tr>
<td>2006</td>
<td>63.89%</td>
<td>42.85%</td>
</tr>
<tr>
<td>2007</td>
<td>63.89%</td>
<td>42.85%</td>
</tr>
<tr>
<td>2008</td>
<td>67.37%</td>
<td>38.03%</td>
</tr>
<tr>
<td>2009</td>
<td>63.26%</td>
<td>39.64%</td>
</tr>
</tbody>
</table>

In TIMMS 2003, the Philippines ranked 41st out of 45 countries in Mathematics.
Solutions to under-preparedness

• Traditional placement (Mekonnen & Reznichenko, 2007; Davis & Shih, 2007; Stigler, et al., 2010)

• Informed Self-Placement (Felder et al., 2010)

• High school intervention (Fine et al., 2009; Martino, 2009)

• Shadow education (Kersaint et al., 2011; Kane & Henderson, 2006; Buchmann et al., 2010; McCarthy, 2010)
Basic Mathematics Proficiency and Algebra Assistance Class

• Program Objectives
  – Raise the level of preparedness of identified underprepared students on the prerequisite knowledge required in undertaking a course in College Algebra
  – Provide further assistance of students on learning College Algebra by shadowing the lessons provided in the standard College Algebra courses that the students are attending

• Program schedule
  – Twice a week, 1-hour per session
Research objectives

• Identify underprepared freshman students in College Algebra at the UST College of Science at the beginning of the 1st semester 2011-2012
• Conduct BMP&AAC on a random sample of underprepared students in College Algebra
• Compare the performance in College Algebra of underprepared students who took the BMPC&AAC and those who did not and determine if there are significant differences in the two groups’
  – Average preliminary grades
  – Average final class standing grades
  – Average grades in the departmental preliminary examinations
  – Average grades in the departmental final examinations
  – Failure rates
• Provide a research-based recommendation on whether or not to launch BMP&AACs to accommodate all underprepared students in the succeeding academic year
Methods

• Sampling
  – CAPE (College Algebra Preparedness Exam) was administered to the freshman population of 2011-2012 to identify underprepared students
  – Stratified, cluster sampling was used to ensure that each course taking the 3-unit Math 101 subject would be represented
  – The underprepared students in the sample were randomly assigned as eligible/not eligible for BMP&AAC
  – 3 Main Groups
    • Students who passed the CAPE (Prepared, Negative Ctrl)
    • Students who did not pass CAPE but were not picked to attend the BMP Classes (Positive Ctrl)
    • Students who did not pass CAPE and were picked to attend the BMP Classes (Experimental Group)
Methods

• Data gathering
  – Demographic information
  – Grades from submitted grade sheets in the office
• Data analysis
  – MANOVA
  – MANCOVA
  – Chi-square
  – $\alpha=0.05$
<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
</table>
| **Gender**             | Male   | 95 (39%)
|                        | Female | 151 (61%)
| **Major**              | Biology/Microbiology | 162 (66%)
|                        | Psychology | 84 (34%)
| **Math 101**           | Passed | 186 (76%)
|                        | Failed  | 60 (24%)
| **Mean (sd)**          | CAPE   | 17.84 (5.21)
|                        | Prelim Grade | 68.85 (15.81)
|                        | Finals Grade | 66.15 (18.05)
|                        | Total Grade | 67.50 (15.79)
## Differences in Algebra Performance (Non-exclusive groups)

<table>
<thead>
<tr>
<th>Yes - No</th>
<th>Prelim CS</th>
<th>Prelim Exam</th>
<th>Prelim Grade</th>
<th>Finals CS</th>
<th>Finals Exam</th>
<th>Finals Grade</th>
<th>Average</th>
<th>MANOVA p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPASS</td>
<td>9.66</td>
<td>5.97</td>
<td>15.62</td>
<td>11.60</td>
<td>6.02</td>
<td>18.06</td>
<td>16.84</td>
<td>0.000</td>
</tr>
<tr>
<td>Eligible</td>
<td>-1.03</td>
<td>0.99</td>
<td>-0.02</td>
<td>1.28</td>
<td>-0.14</td>
<td>0.31</td>
<td>0.14</td>
<td>0.564</td>
</tr>
<tr>
<td>AT20</td>
<td>5.35</td>
<td>2.24</td>
<td>7.63</td>
<td>6.36</td>
<td>0.84</td>
<td>7.72</td>
<td>7.68</td>
<td>0.020</td>
</tr>
<tr>
<td>AT40</td>
<td>5.98</td>
<td>3.02</td>
<td>9.06</td>
<td>7.19</td>
<td>2.19</td>
<td>9.86</td>
<td>9.46</td>
<td>0.023</td>
</tr>
<tr>
<td>AT60</td>
<td>7.00</td>
<td>3.70</td>
<td>10.82</td>
<td>8.14</td>
<td>3.31</td>
<td>11.90</td>
<td>11.36</td>
<td>0.001</td>
</tr>
<tr>
<td>AT80</td>
<td>10.10</td>
<td>2.92</td>
<td>13.35</td>
<td>12.17</td>
<td>3.91</td>
<td>16.52</td>
<td>14.94</td>
<td>0.000</td>
</tr>
</tbody>
</table>
## Differences in Average End-of-Semester Grade (Exclusive groups)

<table>
<thead>
<tr>
<th>Difference with CAPE passers</th>
<th>Std. Error</th>
<th>p-value</th>
<th>Lower Bound</th>
<th>Upper Bound</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control group of underprepared students</td>
<td>-16.715</td>
<td>2.0541</td>
<td>.000</td>
<td>-22.154</td>
</tr>
<tr>
<td>Underprepared students eligible for BMP&amp;AAC but attended less than 20% of sessions</td>
<td>-19.314</td>
<td>2.3420</td>
<td>.000</td>
<td>-25.515</td>
</tr>
<tr>
<td>Students who attended 20% to less than 40% of sessions</td>
<td>-13.850</td>
<td>4.3366</td>
<td>.009</td>
<td>-25.332</td>
</tr>
<tr>
<td>Students who attended 40% to less than 60% of sessions</td>
<td>-10.638</td>
<td>4.8079</td>
<td>.153</td>
<td>-23.368</td>
</tr>
<tr>
<td>Students who attended at 60% to less than 80% of the sessions</td>
<td>-8.300</td>
<td>6.0038</td>
<td>.655</td>
<td>-24.197</td>
</tr>
<tr>
<td>Students who attended at least 80% of the sessions</td>
<td>-2.033</td>
<td>7.6832</td>
<td>1.000</td>
<td>-22.377</td>
</tr>
</tbody>
</table>
## Covariates of Algebra Performance

### Variables

<table>
<thead>
<tr>
<th>Effect</th>
<th>Pillai's Trace</th>
<th>F</th>
<th>p-value</th>
<th>Partial Eta Squared</th>
<th>Observed Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAPE Score</td>
<td>0.30</td>
<td>5.39</td>
<td>0.000</td>
<td>0.30</td>
<td>0.98</td>
</tr>
<tr>
<td>Attendance</td>
<td>0.25</td>
<td>4.24</td>
<td>0.002</td>
<td>0.25</td>
<td>0.95</td>
</tr>
</tbody>
</table>

CAPE Score and Attendance were not found to be significantly correlated ($r=0.047, p=0.696$)

<table>
<thead>
<tr>
<th>Factor</th>
<th>Pillai's Trace</th>
<th>F</th>
<th>Sig.</th>
<th>Partial Eta Squared</th>
<th>Observed Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>0.02</td>
<td>0.20</td>
<td>0.961</td>
<td>0.02</td>
<td>0.094</td>
</tr>
<tr>
<td>Course &amp; Section</td>
<td>0.85</td>
<td>2.38</td>
<td>0.000</td>
<td>0.17</td>
<td>0.999</td>
</tr>
</tbody>
</table>
Tests of Differences between Independent Proportions of Passers

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eligible</td>
<td>39(55%)</td>
<td>46(71%)</td>
<td>0.057</td>
</tr>
<tr>
<td>AT20</td>
<td>19(73%)</td>
<td>66(60%)</td>
<td>0.215</td>
</tr>
<tr>
<td>AT40</td>
<td>12(75%)</td>
<td>73(61%)</td>
<td>0.272</td>
</tr>
<tr>
<td>AT60</td>
<td>6(75%)</td>
<td>79(62%)</td>
<td>0.707*</td>
</tr>
<tr>
<td>AT80</td>
<td>3(100%)</td>
<td>82(62%)</td>
<td>0.451*</td>
</tr>
</tbody>
</table>

* Applies Yate's correction
Conclusions and recommendations

• Students who were able to attend at least 40% of the BMP&AAC sessions were able to perform better in the College Algebra course than those students who were not selected to attend the BMP&AAC or those who were selected but did not only attended a few of the sessions.

• Furthermore, it was found that students who attended enough of the BMP&AAC sessions tended to become as prepared as the students who initially passed CAPE.

• Consistent with Wu (2001), McNeil et al. (2010), and Titus (2011) that the main hindrance which higher education students face in taking on a course in College Algebra is an underprepared background in basic mathematics.

• It is recommended that the BMP&ACC be made available to future batches of freshman students who are identified by CAPE as underprepared to take the College Algebra course.

• It is also recommended for further research to be conducted into the factors that contributed to BMP&ACC eligible students’ attendance of the BMP&ACC sessions.
Attendance in BMP&AAC

![Bar chart showing the frequency of number of sessions attended.](chart.png)
Follow-up qualitative research

• Conducted independently by the researcher with the guidance office during the second semester of 2011-2012

• Sought to develop a grounded theory on why BMP&AAC-eligible students who failed in Math 101 did not attend at least 40% of the shadow classes

• Initial, unofficial results based on interviews conducted focused on the following themes
  – Not required
  – More important things to do
Implementation of Recommendations

• S.Y. 2012-2013 1st Semester
• Two BMP&AA Classes of around 25 students per class (lowest 50 based on CAPE test)
• Number of Math 101 special classes (for those who failed) offered in second semester reduced from 3-4 to 2 classes
• Problem of “non-requirement” still persistent
• Official research outcomes still in progress
References

References

Thank you!!!!

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