The Future is Clear: Developing Models to Predict Student Performance

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Does a credible difference exist between gender groups and ethnicity groups?

Bayesian Estimation of Group Differences on Post-IMCA
- Reveals “relative credibility of every possible difference of means, difference of standard deviations, and all possible effect sizes” ³

Male vs. Female Performance
- Y¹=male students
- Y²=female students
- Males outperformed females on pre-IMCA

White vs. Non-White Performance
- Y¹= white students
- Y²= non-white students
- White students outperformed non-white students on pre-IMCA

Discussion:
- Bayesian estimation reveals a credible difference between male and female performance
  - Further research should investigate whether IMCA is a gendered assessment
- Small number of non-white students could possibly contribute to what is seen as a difference in white vs. non-white performance

References

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Introduction
- Instructors gather data from multiple sources and hope to be able to use these data to inform instruction
- E.g., course exams and Introductory Molecular and Cell Biology Assessment (IMCA)⁴
- Instructors can then analyze these data to make credible inferences about student performance and differences in how various groups perform
- Inferences can lead to better support for students during semester and changes in curriculum and instruction

Discussion:
- How do A/B students differ in motivation/study skills than others?
- To what degree does perceived rigor of preparation in chemistry and biology influence course performance?
- How does completing a cell biology course prior to BIOC 460 affect student performance?

Which student variables contribute to differences in course performance and IMCA performance?

Predicting Final Grade

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<th>Predictor</th>
<th>Unstandardized Coefficient</th>
<th>P-value</th>
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<tr>
<td>Intercept</td>
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<td>Exam 1</td>
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<tr>
<td>GPA</td>
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<td>&lt;0.001</td>
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</table>

R²: 0.71, Adjusted R²: 0.71
P-value < 0.001

Variables:
- Exam 1
- GPA

Predicting Post IMCA

<table>
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<tr>
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<td>Major</td>
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<tr>
<td>Remediation</td>
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<td>Ethnicity</td>
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<tr>
<td>Semester</td>
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<td>0.08</td>
</tr>
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</table>

R²: 0.56, Adjusted R²: 0.56
P-value < 0.001

Variables:
- Exam 1
- GPA
- Pre-IMCA
- Final grade
- Major
- Gender
- Ethnicity
- Semester

Discussion:
- Based on how student performance is measured, different variables influence that performance
- Regression model predicting final grade explains over 50% of variation
- GPA has been previously shown to be predictive of student performance¹
  - This model confirms GPA matters
  - GPA based on course grades which is based on other factors besides content, unlike post-IMCA
- Since GPA and pre-IMCA score are predictive of final course grade, instructors may develop special instruction to assist students with low GPAs and IMCA scores
- Course has no biases toward major, gender or ethnicity, so does not cause or strengthen a gap in achievement
- Before any instruction, students’ prior knowledge and confidence in chemistry preparation are most predictive of final grade

Future Research
- How do A/B students differ in motivation/study skills than others?
- To what degree does perceived rigor of preparation in chemistry and biology influence course performance?
- How does completing a cell biology course prior to BIOC 460 affect student performance?