Measuring Success in Mathematics Trailer Sections
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INTRODUCTION
An analysis of the success of students in selected trailer and non-trailer general education mathematics courses is conducted. It is assumed that trailer students are typically less successful in sequential courses and, based on the Student Learning Outcomes Assessment Office "Student Learning @ RIT Assessment Grant" 2013-2014, analysis is possible to make recommendations and implement policies and procedures that will assist them in completing their coursework effectively. The failure rate in these types of courses is high enough to warrant concern for those students requiring better resources, adequate review of prerequisite concepts, or enhance student motivation and persistence.

THE COURSES

<table>
<thead>
<tr>
<th>Calculator B</th>
<th>Calculator C</th>
<th>Statistics I</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-trailer Section</td>
<td>Spring Semester</td>
<td>Fall Semester</td>
</tr>
<tr>
<td>Trailer Section</td>
<td>Fall Semester</td>
<td>Spring Semester</td>
</tr>
<tr>
<td>Non-trailer Student</td>
<td>Student is taking the course either in their semester recommended in their timeline or before (credit by examination).</td>
<td></td>
</tr>
<tr>
<td>Repeating course</td>
<td>Repeating the course. Repeated one or more prerequisites courses. Began in lower level than recommended by program of acceptance.</td>
<td></td>
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THAT STUDENT ANALYSES

The sample of trailer and non-trailer students are independent of one another so it is sufficient to make some inferences concerning the difference between their means. Assuming the populations of trailer and non-trailer students have normally distributed success rates with means μT and μN respectively, the null hypothesis is that no difference in the means exists and, alternatively, there is enough of a difference to warrant some concern about the success rate of one of the populations.

H0: μT = μN = 0 H1: μT − μN ≠ 0

Using a 0.05 level of significance, the hypothesis tests for the difference of the mean success rates of trailer and non-trailer students for each of the learning outcomes, regardless of semester course offering, were conducted and confidence intervals constructed. Below are the estimated differences of the means and standard errors.

Statistics I | Calculator B | Calculator C |
<table>
<thead>
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<tbody>
<tr>
<td>LO</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>0.25</td>
<td>0.68</td>
<td>-3.04</td>
</tr>
<tr>
<td>σ</td>
<td>10.2</td>
<td>6.73</td>
</tr>
</tbody>
</table>

Further analyses will be conducted on the differences of the success rates of trailer and non-trailer students from semester to semester and over each exam in the course. A deep look into the success rates on exams might be apparent in both of these populations.

STATISTICAL ANALYSES

Examining of the line graph to the left and comparing learning outcomes, we observe that the trailer and non-trailer students are about equal for LO1 and LO2. However, as the course becomes more complex and we move into the higher learning objectives, the trailer students’ scores drop. LO3 has the lowest success rate for both groups. The p-value obtained from the hypothesis performed on LO3 is 0.058, so we fail to reject the null hypothesis. This indicates that there is no significant difference in the mean success rates. Focus needs to be placed on all students, regardless of classification, in the area of LO3.

In both diagrams, it is apparent that the trailer students are able to grasp the concepts in three of the four learning objectives, but the third learning objective seems to be where the trailer students begin to falter. Though the trailer students are as successful in LO3, their ability to set up an integral to solve a problem, they are unable to evaluate that integral, as seen in the results of LO2.

PLOT ANALYSES

Testing the hypothesis that there is no difference in the mean success rates of trailer and non-trailer students in Calculus B. The two samples seem to be able to grasp the concepts in three of the four learning objectives, but the third learning objective seems to be where the trailer students begin to falter. Though the trailer students are as successful in LO3, their ability to set up an integral to solve a problem, they are unable to evaluate that integral, as seen in the results of LO2.

THE LEARNING OBJECTIVES AND DATA COLLECTION

| LO1 | Define basic concepts and notations of calculus |
| LO2 | Demonstrate the manipulative skills required to solve problems in calculus |
| LO3 | Integrate algebraic and transcendental functions |
| LO4 | Examine, discuss, and apply definite integrals |

Exams administered in each course were designed with questions which could all be mapped to one or more of the learning objectives for that course. The students success in each learning objective were tested on was recorded (as a percentage) and used to determine the overall success in that learning objective, each exam, and the course in general.

CONCLUSIONS

The statistics course housed a very low number of trailer students each semester which leads to speculation about the strength of our analysis. What has been found is that the weaknesses lie in different subject areas than what we are discussing in this study. Further analysis may be conducted to determine if this is in fact the case. Calculus B seems to be a course worth continued examination. In the case of the sections analyzed during this academic year, the performance of trailer students in a non-trailer section, was higher than desired. This may account for some of the interesting differences in expectation for the success of students in the Spring semester versus the Fall semester. However, it is still evident that the trailer student sample has not performed to the level of the non-trailer student in this course for three of the four learning objectives. The course that stands out the most with reasonable differences in means is the Calculus B course. There are several reasons why this may be, but most significant is the students who are considered trailer in this course have more possible reasons for being classified as such. These students could be choosing the Calculus C course, but if a weaker trailer student may have had to repeat prerequisite courses, may have gone a semester without a mathematics course from their sequence, or may have begun in an algebra or pre-calculus course, indicating their preliminary skills were lower than should have been.

RECOMMENDATIONS

If we are able to determine, prior to the beginning of a semester, what the proportion of trailer-to-non-trailer students in any given course, preliminary action (course design, presentation, academic resources, etc.) could be taken in order to ensure the students that are targeted as weaker get the best chance at succeeding in the course. The academic resources and program provided on campus are well designed and implemented to assist struggling students of all backgrounds, but most are not mandatory for students in this group.

Suggested programs in existence to make mandatory for credit:

• Weekly visits to the Bates Study Center or the Academic Support Center
• Weekly standing appointment to review materials, exams, quizzes, etc. with professor or TA
• Suggested programs to be designed, revised, or implemented:
  • TAs hold office hours a week in Calculus C.
  • LAs introduced into lower level courses deemed "at risk" due to proportion of trailer students
  • Online supplemental, remedial, work to be completed for credit in the course
  • Implementation of group work (with mixed abilities) in the Statistics courses

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References: