

A Statistical Analysis of the Effect of R on Student Learning in Probability

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Introduction

- Probability is considered a difficult subject for students to understand.
- R is a free software available that is a powerful tool for statistical computing, and can solve long statistical problems with a few lines of code.
- The question of the research is whether teaching students R and allowing them to use R on homework improves scores and confidence.

Methods: Data Collection

- One section of MATH 346: Introduction to Probability at UW-Eau Claire
- 12 students and 11 homework assignments.
- Each assignment contained 2 related problems at the end, one problem using R and one without R.
- Assessed student performance in two areas, confidence and score.
- Scores graded on a scale of 1 to 5
- Confidence rated on a scale of 0 to 3 with 0 meaning "Not at all confident" and 3 meaning "Very confident"
- Students were asked to make a conjecture and then were asked to grade their confidence in the conjecture.

Methods: Analysis

- Student scores and confidences analyzed using tests of proportions and using linear and logistic regression.
 - Residual plots of linear models were reasonable, despite discrete nature of the responses.
 - Results were robust to type of analysis.
- Student scores and confidence analyzed using linear regression (Figure 1)

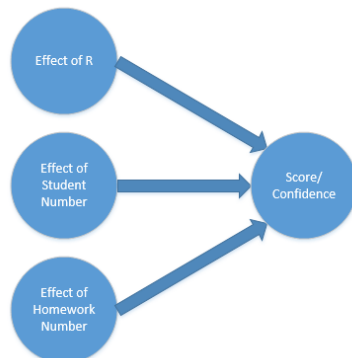


Figure 1: Linear model used to analyze student performance.

Results: Scores

- Evidence that using R is associated with higher scores (R vs No R coefficient = 0.300, p-value = .033).
- Average scores of students on problems not using R was 4.063 and average when using R was 4.334 (7% increase).
- Some problems were worth more or less than 5 points, these were all adjusted to a 5 point scale.

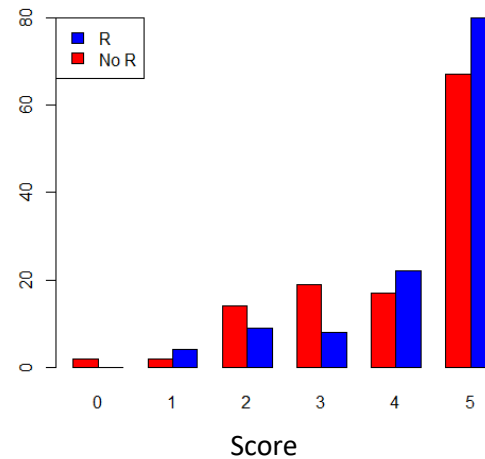


Figure 2: Students scored 7% higher on the problems involving R than the problems without R.

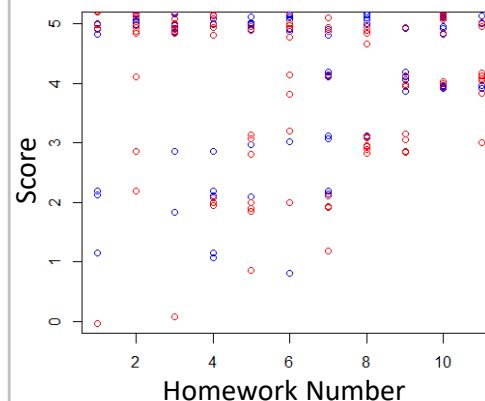


Figure 3: R scores, represented in blue, are consistently above No R scores, represented in red.

Results: Confidence

- Students rated their confidence 5% higher on problems involving R than they did on problems without R.
- Linear regression did not show conclusive evidence of an effect of R on confidence. (p value of .36)
- Results were also simplified down to "confident" or "not confident" and significance was still not found
- Students were asked to make a conjecture and then were asked to grade their confidence in the conjecture.
- Students were also asked to rate their confidence in their final scores, these results were also inconclusive.

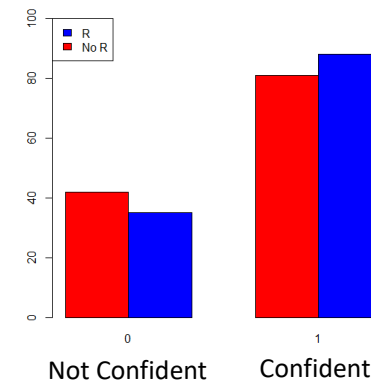


Figure 4: No conclusive evidence of difference of proportion of confidence scores equal to 2 or 3 for R vs No R.

Conclusion

- Students seem to score better when using R.
- No conclusive evidence of relationship between confidence and the usage of R.
- R has potential to be a valuable learning tool more observations are required to get more conclusive results.
- In the future better clarification of difference between confidence in conjecture and confidence in final answer could be beneficial.
- Also in the future it could be helpful to survey students on how they think R affects learning.
- Suggestions? brisbia@uwec.edu or larsonnd@uwec.edu

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