

Studying the Effectiveness of a Lesson on Regression Analyses

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Abstract

Sociology students enrolled in two sections of a required research methods course were observed while completing a lab assignment. This course is the second course in a three-course research-intensive sequence. The main objective of the assignment was to observe how students decide whether to conduct linear regression analysis or logistic regression analysis based upon the level of measurement of the dependent variable. There are three main findings from the study lesson observations and the completed work from students. First, instructors inconsistently instruct how to write null and research hypotheses. Second, students struggled to interpret the regression coefficients resulting from regression with dichotomous independent variables. Third, it was recognized that students need a lot more time to make decisions about how to complete the lab assignments. Each of these concerns can be addressed with practical changes to our teaching methods throughout the three-course sociology research sequence.

Learning Goals

Our primary learning goal was for students to be able to effectively report their findings in either logistic or linear regression when presented with an SPSS dataset and a question about finding statistical association among variables.

Determining which kind of regression to undertake, and then accurately conducting analysis was broken into a series of competencies that were part of the larger task:

1. State the null and alternative hypothesis for the relationship.
2. Determine the level of measurement of the variables.
3. Determine whether logistic or linear regression is to be used.
4. Run the appropriate regression in SPSS.
5. Report the appropriate statistics to make sense of: the statistical significance of the model, the statistical significance of the coefficients in the regression, the magnitude of the effect, and an interpretation of the effect based on the magnitude of the coefficients.

Our goal is for graduates of the sociology program to be capable of accurately conducting and interpreting both kinds of regressions. The lesson was designed so that students would first struggle with these issues on their own and then revisit them with the addition of the Regression Decision Tree Handout.

Methods

The lesson consisted of two lab handouts with two regression problems each, where the assignment specifies that these are regression problems, but not whether they are linear or logistic. The first lab handout also was given to students to work through with the information they had from the previous two labs (including the corrected labs they had received back). This handout was then collected and a second handout passed out along with the Regression Decision Tree handout. Our intention was to first see where students ran into problems in determining which kind of regression to use in the first two problems, and then see if the Regression Decision Tree was useful for students as they determined which type of regression to run on each of the problems of the second handout.

Results

We found three areas of concern that need to be considered as we teach regression analyses and interpretations in our research methods sequence.

1. We were not providing consistent instruction on how to write null and research hypotheses.

The two of us who teach Social Research Methods II corrected students' work when they wrote null and research hypotheses referring to "significant relationships" and directed students to simply write null hypotheses as "There is no relationship between X and Y," and research hypotheses as "There is a relationship..."

However, upon discussion with the instructor who teaches Social Research Methods I, we learned that "significant relationships" is consistently used in the textbooks and lessons in the first research course in the sequence (Levin and Fox 2014).

1. Students struggled to interpret the regression coefficients resulting from regression with dichotomous independent variables.

Of the 15 students observed during one lab class period, only five interpreted the dichotomous independent variables correctly on their completed lab assignments. For example, one student wrote, "For each additional female per male, respondents' incomes decreased by 2.40. For each additional non-white, respondents' incomes increased by .382." The correct interpretation should have been, "If a respondent was female..." or "If a respondent was non-white..."

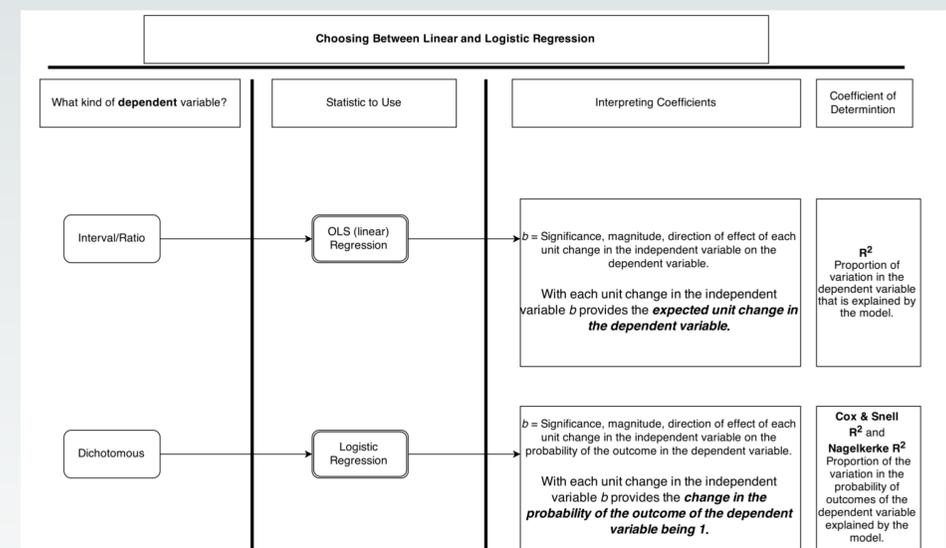
3. Students need a lot more time to make decisions about how to complete the lab assignments, but were able to apply previous knowledge with current information in the problem-solving process.

Approximately $\frac{1}{3}$ of the students were unable to complete two regression analyses within a 55 minute class period. Students were not as confident as we expected them to be, especially since these were students enrolled in the second research methods course in the sequence. Many of the students eventually got around to the correct regression analyses and interpretations, especially once they were provided a handout with a decision tree that led them to the correct choice. Students used the handouts we provided, as well as previous completed labs, as guides. For example, one pair of students working together were overheard discussing their choice to run a linear regression analysis. One student asked, "How do we know?" and the other replied, "It's very similar to one we did two weeks ago, but I don't know why."

Discussion

The lesson study demonstrated three main areas of concern. The first concern, inconsistent instruction of hypotheses writing will be addressed by open discussions on consistency among the research methods sequence instructors. The second concern, student struggle with interpreting dichotomous independent variables, will be addressed by ensuring that research sequence instructors provide ample examples and opportunities for students to practice with these types of variables. The last concern, lack of time, will require providing ample time in and out of class for contemplation and decision-making.

Regression Decision Tree



References

Levin, Jack and James L. Fox. 2014. Elementary Statistics in Social Research, 12th Edition. Allyn & Bacon: Boston.

Murray, James and Elizabeth Knowles. 2014. "Developing Students' Thought Processes for Choosing Appropriate Statistical Methods." Journal of Education for Business 89 (8) 389-395.

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