Lesson Study in Economics:
Developing Students' Thought Processes For Choosing Appropriate Statistical Methods
Authors: Betsy Knowles and James Murray, University of Wisconsin - La Crosse

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<th>BACKGROUND</th>
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<td><strong>Course:</strong> BUS 230 - Business and Economics Communication and Research</td>
<td><strong>Background on the Statistics Unit:</strong> Students (re)introduced to a number of statistical tests, how to implement them, how to interpret result, and how to identify appropriate statistical tests to answer research questions.</td>
<td><strong>Classroom Observation:</strong> - Students’ written work, observed students’ discussions - Did students reflect on four key questions? - Did students get it right? - Did they have irrelevant considerations? - Did they have well-articulated reasons for their decisions?</td>
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<td><strong>About the Course:</strong> - Students conduct a statistical analysis appropriate for their own research project. - Students write a significant research paper. - MTH 145 (Elementary Stats) is a prerequisite</td>
<td><strong>Our Knowledge Organization - Decision Tree:</strong> - Jointly developed a lesson on how to organize knowledge about statistical tests. - Based on the four key questions to the left.</td>
<td><strong>Findings in Fall 2011:</strong> - Improved performance after the decision tree intervention. - Decision trees drawn from memory reveal students did not yet completely understand decision-making process.</td>
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<td><strong>Learning Goals:</strong> Help students develop a way to organize statistical results that is conducive to applying this knowledge to answer research questions.</td>
<td><strong>Four In-class Exercises:</strong> - Challenged students to: (a) Pick statistical test for a research question (b) State reasons for the choice - Focused on four statistical tests: (A) One-sample T-test (B) Independent Samples T-test (C) Paired Samples T-test (D) Chi-Squared Test of Independence.</td>
<td><strong>Findings in Spring 2012:</strong> - Students’ overall performance same or worse than those in Fall 2011 who had not been exposed to decision tree. - Excellent use of key questions - Excellent retention of the decision tree.</td>
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<td><strong>Challenge:</strong> - Students are competent in computation and implementation procedures for statistical tests. - Students have not yet organized this knowledge in a way that is effective to apply it.</td>
<td><strong>Fall 2011:</strong> Two exercises - Decision Tree - Two exercises</td>
<td><strong>Surprising Findings / Remaining Challenges:</strong> - Statistical and colloquial vocabulary caused significant confusion (eg: independence, relationship) - Confusion on what constitutes a variable and what is the scale of measurement.</td>
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<td><strong>We want students to consider key questions:</strong> 1) Number of variables? 2) Scale of Measurement? 3) Intent of test (Differences or Co-movement)? 4) Independent or Paired Samples?</td>
<td><strong>Spring 2012:</strong> Decision tree thru unit - Four exercises</td>
<td><strong>Week Later Pop-Quiz:</strong> Recreate Decision Tree from Memory</td>
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Decision Tree

#1. How many variables did you measure?
- One
- Two or more

#2. What is the scale of measurement?
- Nominal
- Ordinal
- Interval / Ratio

#3. Difference or other Relationship?
- Chi-Squared Test of Frequencies (Single Variable)
- Sign Test for a Median (Nonparametric)
- Single Variable T-Test
- Chi-Squared Test of Independence

#4. Are the measurements independent or paired?
- Relationship
- Difference
- Spearman Correlation (Nonparametric)
- Mann Whitney U-Test (Nonparametric)
- Independent
- Paired
- Wilcoxon Signed Rank Test (Nonparametric)

- Pearson Correlation
- Independent Samples T-Test for Two Categories
- ANOVA for Three or More Categories
- Paired Samples T-Test
- Paired