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GAISEing into the NEW Guidelines

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GAISEing into the NEW Guidelines

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GAISEing into the NEW Guidelines

- Original Report
- March Webinar Recording
- Completed Report

http://www.amstat.org/education/gaise/

USCOTS '15
making connections

CAUSE

ASA
AMERICAN STATISTICAL ASSOCIATION
Promoting the Practice and Profession of Statistics®
Everything is the same… but everything has changed!

<table>
<thead>
<tr>
<th>Original GAISE College Report</th>
<th>GAISE 2016 Report</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total:</strong> 61 pages</td>
<td><strong>Total:</strong> 139 pages</td>
</tr>
<tr>
<td><strong>Main Report:</strong> 25 pages</td>
<td><strong>Main Report:</strong> 26 pages</td>
</tr>
<tr>
<td>- Five groups of Goals for Students</td>
<td>- Nine Goals for Students</td>
</tr>
<tr>
<td>- Six Recommendations for Teaching</td>
<td>- Six Recommendations for Teaching</td>
</tr>
<tr>
<td><strong>Supporting Appendices:</strong> 38 pages</td>
<td><strong>Supporting Appendices:</strong> 113 pages</td>
</tr>
<tr>
<td>- Examples of Activities and Projects</td>
<td>- Evolution of Intro Stats &amp; Emergence of Statistics Education Resources</td>
</tr>
<tr>
<td>- Examples of Assessment Items</td>
<td>- Multivariable Thinking</td>
</tr>
<tr>
<td>- Example of Using Technology</td>
<td>- Activities, Projects, and Datasets</td>
</tr>
<tr>
<td>- Examples of Naked, Realistic, and Real Data</td>
<td>- Examples of Using Technology</td>
</tr>
<tr>
<td></td>
<td>- Examples of Assessment Items</td>
</tr>
<tr>
<td></td>
<td>- Learning Environments</td>
</tr>
</tbody>
</table>
Two new emphases

a. **Teach statistics as an investigative process of problem-solving and decision-making.**
   Statistics is a problem-solving and decision-making process, not a collection of formulas and methods.

b. **Give students experience with multivariable thinking.**
   The world is a tangle of complex problems with inter-related factors. Let’s show students how to explore relationships among many variables.
What is your comfort level with multivariable thinking?

a) Very comfortable – Ready to teach it today!

b) Somewhat comfortable – Considering adding it as a new topic soon.

c) Not comfortable – Not Ready to Teach it Yet
Your assignment!

- As we go through the next example, think about how this activity can be used in different learning environments.
  - Face to Face
  - Distance Learning (Online)
  - Flipped (Inverted)
  - Large Classes
  - Cooperative Learning
- If you think of something, go ahead and send it as a chat message.

- Touches on 5 of the 6 recommendations (no Assessment today!)
- Statistical thinking experience
- Key **concept** in the lesson: Confounding/ lurking variable
  - *Limits of observational studies*
  - *Multivariable thinking via stratification*
- **Real data** relevant to student experience – engagement
- Interactive discussion – active learning
- Technology to convey the concept
States vary widely…

What impact might we expect salaries to have on SAT scores?
What’s next?

- So, we have now set the stage for our investigation.
- We are now going to go through how to do work this out using four different technology packages.
  - R
  - JMP
  - Minitab Express
  - Excel
R commands to make a first scatterplot with fitted line.

> plot(Mean.Total~Est.Mean.Salary, data=Guber, pch=16, ylab="State average SAT score", xlab="Average teacher salary")
> mod1=lm(Mean.Total~Est.Mean.Salary, data=Guber)
> summary(mod1)
> abline(mod1)
WHAT THE HECK

AM I LOOKING AT ???
R commands for the breakdown by Level

> #Using mosaic and lattice
> library(mosaic)
> mPlot(Guber) #then choose Selection: 2
> #then choose x and y, then color by Level, then choose Model as linear, then add a Key to the top
> #Here is what Show Expression gives:
> xyplot( Mean.Total ~ Est.Mean.Salary, data=Guber,
> groups=Level, main="", type=c("p","r"),
> auto.key=list(space="top", columns=3))
An R screenshot, using the mosaic package and mPlot()
### JMP Video

![Image of JMP software interface](image.png)

<table>
<thead>
<tr>
<th>State</th>
<th>Expend per pupil</th>
<th>Avg PT Ratio</th>
<th>Est Mean Salary</th>
<th>%taking SAT</th>
<th>Level Taking</th>
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</thead>
<tbody>
<tr>
<td>Alabama</td>
<td>4.405</td>
<td>17.2</td>
<td>31.144</td>
<td>8</td>
<td>low</td>
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<tr>
<td>Alaska</td>
<td>8.963</td>
<td>17.6</td>
<td>47.951</td>
<td>47</td>
<td>middle</td>
</tr>
<tr>
<td>Arizona</td>
<td>4.778</td>
<td>19.3</td>
<td>32.175</td>
<td>27</td>
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<tr>
<td>Arkansas</td>
<td>4.459</td>
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<td>28.934</td>
<td>6</td>
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<tr>
<td>California</td>
<td>4.992</td>
<td>24</td>
<td>41.078</td>
<td>45</td>
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<tr>
<td>Colorado</td>
<td>5.443</td>
<td>18.4</td>
<td>34.571</td>
<td>29</td>
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<tr>
<td>Connecticut</td>
<td>8.817</td>
<td>14.4</td>
<td>50.045</td>
<td>81</td>
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<tr>
<td>Delaware</td>
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<td>16.6</td>
<td>39.076</td>
<td>68</td>
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<tr>
<td>Florida</td>
<td>5.718</td>
<td>19.1</td>
<td>32.588</td>
<td>48</td>
<td>middle</td>
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<tr>
<td>Georgia</td>
<td>5.193</td>
<td>16.3</td>
<td>32.291</td>
<td>65</td>
<td>high</td>
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<tr>
<td>Hawaii</td>
<td>6.078</td>
<td>17.9</td>
<td>38.518</td>
<td>57</td>
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<tr>
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<td>29.783</td>
<td>15</td>
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<tr>
<td>Illinois</td>
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<td>39.431</td>
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<tr>
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<td>26.461</td>
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</tbody>
</table>
JMP: Bivariate

SAT Total vs. Mean State Salary (000)

- SAT Total
- Mean State Salary (000)
JMP (By Level)
Minitab Express - Video
Excel

Plate 20. UNIVAC digital computer in the U.S.A., showing a bank of magnetic-tape storage units on the right

http://worldpowersystems.com/archives/lvall/
## Excel (data grouping)

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>State</td>
<td>Per Pupil</td>
<td>Salary</td>
<td>% eligible</td>
<td>Group</td>
<td>avg verbal</td>
<td>avg math</td>
<td>avg total</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>$</td>
<td></td>
<td></td>
<td></td>
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<td>47.951</td>
<td>47</td>
<td>445</td>
<td>489</td>
<td>934</td>
</tr>
</tbody>
</table>

=IF(E2<22,"low",IF(E2>49,"high","medium"))
Excel (side-by-side display)
Excel (all-in-one display)

Teacher Salary v. Avg SAT Total grouped by % eligible
Let’s Discuss

- So, how can we use this same example in different learning environments?
  - Face to Face
  - Distance Learning (Online)
  - Flipped (Inverted)
  - Large Classes
  - Cooperative Learning

- Please enter your thoughts into the chat room.
Interested in Learning More about GAISE 2016

• Watch the ASA webinar from March

• To read the current draft
  – http://www.amstat.org/education/gaise/

• Any questions or comments, please feel free to contact the co-chairs, Michelle Everson (everson.50@osu.edu) or Megan Mocko (mmeece@ufl.edu)