Activity Title: International Education Statistics

Unit: Dealing With Data and Uncertainty

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Description and Purpose: The objective of this lab is to use statistics to compare performance of students from various countries on the math portion of an international standardized test. Students will use descriptive statistics, normal distribution, percentiles, and z-scores, to make comparisons. Students will examine data from the PISA and TIMMS international tests and then explore educational and cultural systems of countries that participate in these tests.

Time Needed: 1-3 hours of class time depending upon how much material is assigned outside of class. Students may read preliminary information prior to class and complete follow-up research after the class period has ended.

Materials For Activity:

- ❖ Statistics and International Education handout
- ❖ Internet Access
- ❖ Access to spreadsheet or calculator

Procedure: Students should research the PISA and TIMMS international education assessments before using the assessment results to calculate and interpret statistics. Students may use a spreadsheet, calculator, or other method indicated by the instructor to compute standard deviation, z-scores, and percentiles. Students then use results to compare the standing of the U.S. to other countries. After numerical data is compared, students explore the educational structures of the countries they've been tracking in the data.

Assessment:

Part	Recommended Points
I: PISA and TIMMS	10 points
II: Statistics	50 points
III: Singapore	20 points
IV: Other Country	20 points
Total Score	**100 points**

Resources:

- www.oecd.org/pisa/aboutpisa/
- www.oecd.org/pisa/keyfindings/PISA-2012-results-snapshot-Volume-I-ENG.pdf
- http://www.ncee.org/programs-affiliates/center-on-international-education-benchmarking/top-performing-countries/singapore-overview/4136-2/
- http://www.oecd.org/pisa/keyfindings/pisa-2012-results-volume-i.htm
- www.moe.gov.sg/education/syllabuses/sciences/files/maths-secondary.pdf
- http://www.oph.fi/english/education_system
- http://www.uaecd.org/education-introduction
- http://online.culturegrams.com/
- http://nces.ed.gov/timss/

MAT 143 Lab: Dealing With Data and Uncertainty – International Education Statistics

I. The PISA Assessment:

       Visit the website: www.oecd.org/pisa/aboutpisa/ to learn about this international education assessment. Watch the video on the page. Briefly describe the PISA assessment and state three things that stood out to you from the video.

2. Computing Statistics:

Use the first column of data from the 2012 PISA Assessment:
 www.oecd.org/pisa/keyfindings/PISA-2012-results-snapshot-Volume-I-ENG.pdf OR column H from the downloadable data set found at http://www.oecd.org/pisa/keyfindings/pisa-2012-results-volume-i.htm

       a. Create a histogram using 6 classes with a lower class limit of 350 and a class width of 50.

       b. Do the test scores appear to be normally distributed? Why or why not?

       c. Find the standard deviation of the test scores.

       d. According to the 68-95-99.7 Rule, 95% of the test scores are between which two values?

       e. Find the z-score and percentile value for each of the following countries:

              i. The United States

              ii. Singapore

              iii. Finland

              iv. The United Arab Emirates

       f. Compare the results of the 4 countries. What factors do you think attribute to any discrepancies?

3. The TIMMS Assessment:

       Visit the website http://nces.ed.gov/timss/ to learn about this international education assessment. How does the TIMMS assessment differ from the PISA assessment? Describe at least three differences.

4. Computing Statistics:

Go to the website http://nces.ed.gov/surveys/international/reports/2011-timss-g8-math.asp#mathematics8table and look at the Math G8 Percentiles table. You can also download an Excel copy of the table using the link in the upper right corner. Recall that the mean is the 50th percentile. Do the following:

       a. Create a histogram using 6 classes with a lower class limit of 350 and a class width of 50.

       b. Do the test scores appear to be normally distributed? Why or why not?

       c. Find the standard deviation of the test scores.

       d. According to the 68-95-99.7 Rule, 95% of the test scores are between which two values?

       e. Find the z-score and percentile value for each of the following countries:

              i. The United States

              ii. Singapore

              iii. Finland

              iv. The United Arab Emirates

       f. Compare the results of the 4 countries with their own results on the PISA assessment. Which countries stayed at about the same percentile? Which countries changed percentiles? What factors do you think contributed to any changes you observed?

5. Exploring Singapore, Finland, and the UAE:
There are many factors that affect educational outcome in any country: population size, population homogeneity, educational system, and relative wealth are just a few.

> a. The United Nations Development Program publishes a Human Development Index, which includes an Education Index. Read http://en.wikipedia.org/wiki/Education_Index to get a brief overview of the education index.
> b. Next, we will look at the actual data published through Google's public data explorer: http://www.google.com/publicdata/explore?ds=bqed7l430i2r6_&ctype=b&strail=false&bcs=d&nselm=s&met_x=indicator_137506&scale_x=lin&ind_x=false&met_y=indicator_103606&scale_y=lin&ind_y=false&idim=country:15503:10303:2403:3803&ifdim=country&tunit=Y&pit=333777600000&hl=en_US&dl=en_US&ind=false&icfg#!ctype=b&strail=false&bcs=d&nselm=s&met_x=indicator_103706&scale_x=lin&ind_x=false&met_y=indicator_63206&scale_y=lin&ind_y=false&idim=country:6703:18803:21903:22103&ifdim=country&pit=1315454400000&hl=en_US&dl=en_US&ind=false

> Make sure that under Compare by Country, there are check marks beside the United States, the United Arab Emirates, Finland, and Singapore. You can choose from the selections on the left column to change the values represented on the x- and y-axes. Compare the Education Index of the Countries on one axis with other factors such as GDP, life expectancy, and poverty indices. Plot the Education Index against two other factors you think may affect the PISA and TIMMS scores.

> - How are the four countries you've been tracking similar to each other on your charts?
> - How are the four countries you've been tracking different from each other your charts?
> - Do the charts you see in the data explorer help confirm or deny any of your hypotheses in questions 2f and 4f?

6. Read the following overview of Singapore's education system:
http://www.ncee.org/programs-affiliates/center-on-international-education-benchmarking/top-performing-countries/singapore-overview/4136-2/
> a. Briefly explain the shifts that have occurred in the Singapore education system since the 1970s.

Read pages 3-7 of the following article from the Ministry of Education in Singapore:
www.moe.gov.sg/education/syllabuses/sciences/files/maths-secondary.pdf
> b. Briefly discuss Singapore's approach to mathematics education. How does this approach compare to what you have experienced in the U.S.?

7. Further Research:
> Research the mathematics education system in Finland or the UAE. Discuss the emphasis your chosen country places on mathematics and whether or not this emphasis reflects in the PISA and TIMMs score. How does this country compare to the United States? To Singapore?
> Here are some links to get you started:

- For brief cultural and societal overviews look at http://online.culturegrams.com/
- Here is the official website about the Finnish education system: http://www.oph.fi/english/education_system
- Here is an official website about education in the United Arab Emirates: http://www.uaecd.org/education-introduction