STATLIT WORKSHOP
University of Connecticut
Homer Babbidge Library
August 24, 2006

Statistical Literacy Using a Learning Object

www.StatLit.org/GC

Presented By

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ANNOUNCEMENT:

We are very fortunate to have one of the leading voices in the area of statistical literacy, Dr. Milo Schield, coming to the Babbidge Library on **Thursday, August 24** to offer two workshops:

10:00 – 11:45 HBL LIC 2 - **Statistics, Tables, and Graphs**: A hands-on workshop illustrating the problems that professional data analysts and statistical educators have reading simple tables and graphs of percentages and the difficulties they have in describing and comparing these percentages in ordinary English. (Registration Required)

2:00 – 4:00 HBL Class of '47 Meeting Room - **Statistical Literacy: the study of statistics in the everyday media**: a presentation and discussion of statistical literacy.

Attached is a flyer for the workshop with imbedded links about the presenter and about statistical literacy.

Please reserve these times and plan to attend the two sessions as we begin our exploration the subtle, often deceiving, and yet always fascinating world of statistics and data.

Brought to you by the social science & geospatial data team:

Steve Batt, Shelley Cudiner, Sandy Gallup, Scott Kennedy, Jan Lambert, David Lowe, Sarah Mindel and Rick O'Toole

BACKGROUND:

The 2002 Statistical Literacy Survey found that students, data analysts, and college instructors need help in forming ordinary English descriptions and comparisons of the rates and percentages presented in tables and graphs. The W. M. Keck Statistical Literacy Project developed a Web-based drill program that decodes student's' descriptions and comparisons and gives users feedback on their errors. Students for whom English is not their native language may find this program very helpful. This statistical literacy learning object may be useful to students in the social sciences who need to be able to communicate statistical summaries involving rates and percentages. The goal of this workshop is to introduce users to the on-line program as a learning object.

PRESENTER:

Milo Schield is a professor of Business Administration at Augsburg College and the author of a Statistical Literacy textbook. In "*More Damned Lies and Statistics*," author Joel Best stated that "*A small educational movement advocating statistical literacy has emerged. Professor Milo Schield, Director of the W. M. Keck Statistical Literacy project at Augsburg College in Minneapolis, is the movement's leading voice*." The W. M. Keck Foundation started the W. M. Keck Statistical Literacy Project "*to develop statistical literacy as an interdisciplinary curriculum in the liberal arts*."

For an overview of statistical literacy, see www.StatLit.org/pdf/2004SchieldAACU.pdf
For other articles on statistical literacy, see www.StatLit.org/articles.htm.
For more on statistical literacy in general, see www.StatLit.org.
For more on Schield's textbook, see www.StatLit.org/Schield.htm.

LEARNING OBJECTS:

While there is no strong consensus on what a learning object is, suppose that a "good learning object" has these characteristics:

1. Self-contained (so it can be easily inserted/combined).
2. Cognitively independent (so it doesn't require much preparation or background)
3. Limited in breadth/scope (so it doesn't take on too broad a topic or procedure).
4. Limited in depth/conceptually (so it readily comprehensible).
5. Allows for repeated drill or practice – preferably on-line
6. Readily available for all users (it is not private and does not require a password)
7. Student-tested (so it has been found to be useful to students)
8. Documented (both program and student response).

The W. M. Keck Statistical Literacy Project has created a web-based program that is a "tested learning object." The task is to help students use ordinary English to accurately describe and compare percentages and rates as presented in tables. This "learning object" is:

1. Self-contained: Can be taught in high school, college or adult literacy classes.
2. Cognitively independent: requires just ordinary English and basic arithmetic.
3. Limited in scope: Focuses just on simple ratios: percentages and rates.
4. Limited in depth since it involves only the concepts of part and whole to form a ratio.
5. Allows for repeated drill by presenting new tables of rates and percentages.
6. Freely available on the web at www.StatLit.org/GC
7. Tested by over a hundred students; used in an on-line class with no teacher.
8. Documented: See "**An On-Line Grammar-Parsing Program that Decodes Ordinary English Descriptions and Comparisons of Percentages and Rates"** by Burnham and Schield at www.StatLit.org/pdf/2005BurnhamSchieldASA.pdf.

Developing this program has been a very ambitious programming project. Decoding ordinary English statements is not a simple task for a computer. This program required substantial funding from the W. M. Keck Statistical Literacy project.

This program involves a core activity in data analysis -- the translation of rates and percentages into ordinary English statements. Reading tables of rates and percentages and then communicating the results in ordinary English is a basic activity in Statistical Literacy. This program may serve as a bridge between data literacy, statistical literacy and information literacy.

This workshop topic ties in with the results of an international survey on reading and interpreting tables and graphs of rates and percentages. The high error rates documented in this survey indicate the difficulties that students and teachers have in reading and interpreting tables and graphs of rates and percentages. The results and analysis are in these two papers:

Results: www.StatLit.org/pdf/2006SchieldIASSIST.pdf.
Analysis: www.StatLit.org/pdf/2006SchieldICOTS.pdf.

Goal: To introduce participants to a newly-developed learning object in the area of statistical literacy. This program is used by students at Augsburg College and at Capella University. It is available without charge on the web.

SCHEDULE:

1st period: 10:00 – 10:50 PM.

- Introduction to Statistical Literacy and reading ratios in tables and graphs.
- Survey on participants ability to read tables of rates and percentages (5 minutes)

- Study: "% of" grammar. Benefits of percentages. Focus on part vs. whole.
- Introduce web Statement Validator program at www.StatLit.org/GC
- *Use web program; Describe percentage in pie charts using "% of" grammar.* Enter name. Select Source = Pie Chart, Activity = Describe, Answer = "% of".
- *Use web program to translate statement from "percentage" to "% of" grammar.*

- Introduction to 100% tables. Note: A subgroup in a group is not always a part in a ratio. A title may involve a part, a whole or both.
- *Use web program; Describe percentages in 100% tables using "% of" grammar.*

- Introduction to half tables and percentage grammar.
- *Web: Describe percentages in fully margined tables using "% of" grammar.*
- *Web: Describe percentages in tables using "percentage" grammar.*

Break from 10:55 – 11:00 AM.

2nd period: 11:00 – 11:45 AM

- Describe comparisons using likely grammar.
- *Use web program: Compare slices of two pies using "likely" grammar.* Select Source = Pie Chart, Activity = Compare, Answer = "Likely."
- *Use web program: Compare statements of two percentages using "likely".* Select Source = Statement, Activity = Compare, Answer = "Likely."
- *Use web program; Compare percentages in 100% tables using "likely" grammar.* Select Source = Tables (100%), Activity = Compare, Answer = "Likely."
- Evaluation survey.

Materials:

1. Five table Survey
2. Introduction to the Web based Statement Validator for Percentages and Rates.
3. Participant survey

Q. WHY STUDY RATIOS?
A. Ratios are common and useful.

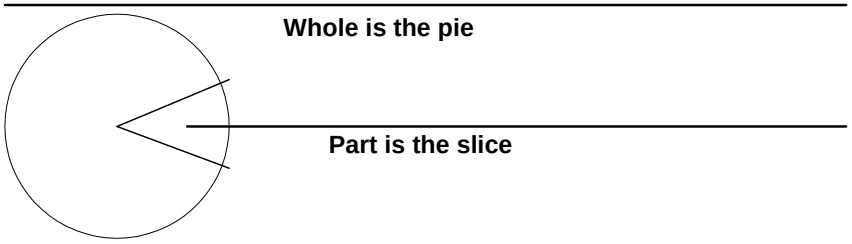
Consider this statistic:

- The number unemployed is greater in New York than in South Dakota.

Why is this a "no brainer"? New York has a lot more people.
Rates take into account the size of the group.

- The unemployment rate may be bigger in South Dakota than in New York.

Q. WHAT DO YOU NEED TO KNOW ABOUT RATIOS?
A. The simplest ratios are part-whole ratios.
The simplest graphic is a pie chart.



Q. HOW DO WE DESCRIBE PART-WHOLE RATIOS IN ENGLISH?
A. The simplest way is to use "% of" grammar.

All ratio statements must have at least one whole and one part.
The simplest and most common ratio statement involves percentages.
The simplest percentage grammar is "% of" grammar.

AMONG _____, ___ % OF _____ ARE _____
whole whole part

Example: whole is MALE COLLEGE STUDENTS, part is BUSINESS MAJOR.

1. 60% of male college students are business majors.
2. Among male college students, 60% are business majors.
3. Among college students, 60% of males are business majors.
4. Among males, 60% of college students are business majors.
5. Among college students who are males, 60% are business majors.
6. 60% of college students who are male are business majors.

Q. HOW DO WE READ 100% TABLES OF PERCENTAGES?
A. 100% SUM: GROUP IS WHOLE, COMPONENTS ARE PARTS.

Example: Assume that these majors are primary majors – no double majors are possible.

Table 1

College Students	---------- SEX ----------		
Major	Male	Female	TOTAL
Business	60%	20%	40%
Economics	10%	50%	30%
MIS	30%	30%	30%
TOTAL	**100%**	**100%**	**100%**

Table 2

College Students	---------- SEX ----------		
Major	Male	Female	TOTAL
Business	75%	25%	**100%**
Economics	17%	83%	**100%**
MIS	50%	50%	**100%**
TOTAL	50%	50%	**100%**

Table 3

College Students	---------- SEX ----------		
Major	Male	Female	TOTAL
Business	30%	10%	40%
Economics	5%	25%	30%
MIS	15%	15%	30%
TOTAL	50%	50%	**100%**

→**USE TABLES 1-3.** Select the table that is appropriate for the question being asked.

1. What percentage of these females are majoring in business?
   a. 20% b. 25% c. 50% d. 75% e. none of these
2. Among these business majors what percentage are females?
   a. 20% b. 25% c. 50% d. 75% e. none of these
3. In Table 1, what is the part-whole status of "Female"?
   a. Whole b. Part c. Neither or can't say.
4. In Table 2, what is the part-whole status of "Female"?
   a. Whole b. Part c. Neither or can't say.
5. In Table 3, what is the part-whole status of "Female"?
   a. Whole b. Part c. Neither or can't say.

A1 Describe the 20% in the center column, top row of Table 1. Use "% of/are" grammar.

_____

A2 Describe the 75% in the left column, top row of Table 2. Use "% of is/are " grammar.

_____

A3 Describe the 30% in the left column, top row of Table 3. Use "% of is/are " grammar.

_____

Q. Why use PERCENTAGE GRAMMAR?
A. Percentage grammar is commonly used in titles for tables and graphs.

Percentage **grammar can be used to describe percentage part-whole ratios**

P1	Among _____	the percentage of_____	who/that are _____	is/are ___ %
	{whole}	{whole}	{part}	## .

P2	Among _____	the percentage of_____	is/are ___ %
	{whole}	{part}	## .

Writing descriptions of percentages in percentage grammar is harder than reading such descriptions.

Reading statement in percentage grammar is necessary to decode percentage tables which typically use percentage grammar in their titles. .

Q. HOW CAN WE TRANSLATE FROM "PERCENTAGE" GRAMMAR (SOURCE) TO "% OF" GRAMMAR (TRANSLATION)?
A. Identify part & whole in "percentage" statement.

Example #1.
Given: Among college students, the percentage of males who are business majors is 75%.
Translation: 75% of male college students are business majors.

Example #2.
Given: Among college students, the percentage of business majors who are males is 75%.
Translation: Among _____, __% of _____ are _____.

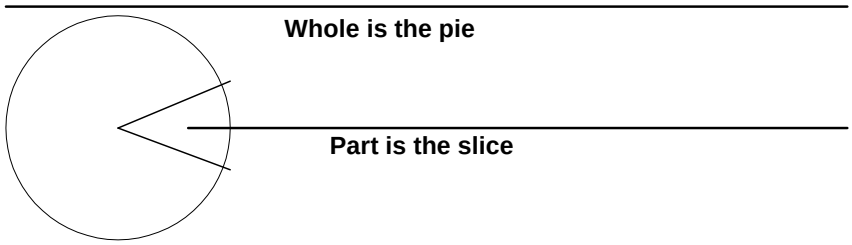
Example #3.
Given: Among college students, the percentage who are male business majors is 25%.
Translation: Among _____, ___% of _____ are _____.

Q. ARE PEOPLE CONFUSED READING PERCENTAGE TABLES?
A. Absolutely!

Table 6: Percentage overweight or obese

	Men	Women	Total
ALL	53.5	40.5	48.0
Whites	52.9	39.7	46.1
Blacks	59.3	49.6	54.4
Other	51.4	40.8	46.0

Using the following pie chart, describe the part(s) and whole(s) for the 59.3 in the lower left.
[3 points: 1 point for each part, part-delimiter, whole and whole delimiter]



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Q. HOW CAN WE USE "LIKELY" GRAMMAR?
A. Identify part & whole in "percentage" statement.

LIKELY GRAMMAR IS COMMONLY USED TO COMPARE PERCENTAGES.

Short-form Common-Part Comparisons of Ratios using LIKELY/PREVALENT:

Likely or Prevalent Among: Part as subject

Top row for "simple ratio" compare, center row for "percent compare". Bottom row for "times compare"

			times as likely/prevalent		as	
Among _____	_____ is	__	% more/less likely/prevalent	among/in ____	than	among/in _____
			times more/less likely/prevalent		than	
{whole}	{part}	##.		{test whole}		{base whole}

Example with wholes:

Among men, suicide is __% more likely/prevalent among whites than among blacks.

Example with whole delimiters:

Among men, suicide is __% more likely/prevalent in 1970 than in 2000.

**Prevalent, risky,* or *probable* can be used in place of *likely among* but not in place of *likely to.*

Likely To: Test whole as subject

Top row for "simple ratio" compare, center row for "percent compare". Bottom row for "times compare"

			times as likely		as	
Among _____	_____ is/are	__	% more/less likely	to _____	than	is/are _____
			times more/less likely		than	
{whole}	{test whole}	##..		{common part}		{base whole}

Example with wholes:

Among men, whites are __% more likely to commit suicide than are blacks.

Example with whole delimiters:

Men were __% more likely to commit suicide in 1970 than in 2000.

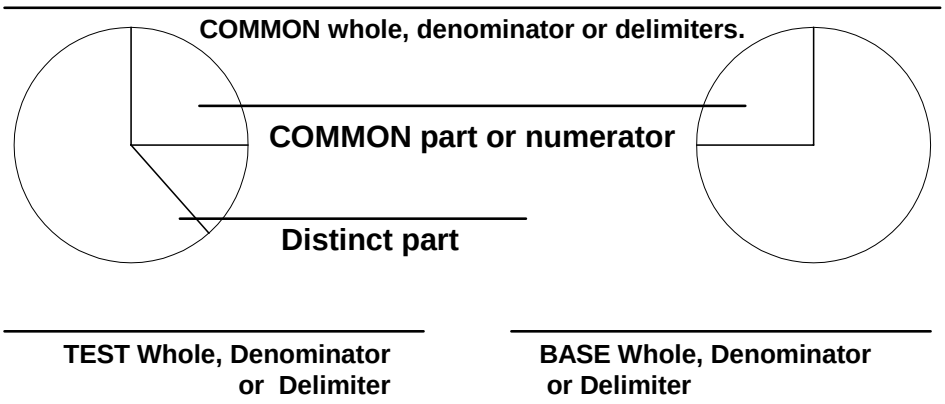
CREATING A LIKELY COMPARISON FROM TWO PERCENTAGES.
Example: 60% of men are business majors; 20% of women are business majors.
Compare as a simple ratio comparison using the smaller as the base.

Analysis:

> Common part is "business major", Men is test whole and Women is base whole.

Result:

> Men are three times as likely to be business majors as are women.
> Being a business majors is three times as likely among men as among women.



TRANSLATE THE FOLLOWING COMPARISONS INTO LIKELY GRAMMAR

B1. Among smokers, the percentage of men who are runners is 50% more than the percentage of women who are runners.

7 points: 1 for keyword, 1 for part, 1 for wholes, 1 for test/base, and 3 for compare (number, grammar and base indicator).]

B2. For college graduates, the unemployment rate of men is 50% more than that of women.

7 points: 1 for keyword, 1 for part, 1 for wholes, 1 for test/base, and 3 for compare (number, grammar and base indicator).]

TRANSLATE THE FOLLOWING COMPARISON INTO PERCENTAGE GRAMMAR.

B3. Among girls in grades 9-12, girls in Wyoming are 10.8 times as likely to use smokeless tobacco as those in New York.

7 points: 1 for keyword, 1 for part, 1 for wholes, 1 for test/base, and 3 for compare (number, grammar and base indicator)

Q. HOW DO WE COMPARE PERCENTAGES IN 100% TABLES? A.

Example: Assume that these majors are primary majors – no double majors are possible.

Table 1

College Students	---------- SEX ----------		
Major	Male	Female	TOTAL
Business	60%	20%	40%
Economics	10%	50%	30%
MIS	30%	30%	30%
TOTAL	**100%**	**100%**	**100%**

Compare the two numbers in the top row as a simple ratio. Use the larger as the base.

> Males are 3 times as likely as females to be business majors.
> Business majors are 3 times as likely among males as among females.

Compare the two numbers in the top row as a percentage difference.

> Males are 200% more likely as females than to be business majors.
> Business majors are 3 times as likely among males as among females.

> Males are 3 times as likely as females to be business majors.
> Business majors are 3 times as likely among males as among females.

Related topics not covered:

Several table types have not been covered.
1. Half tables
2. Fully-margined tables without any 100% totals
3. Tables with missing margins
4. Bar graphs of percentages

Several activities have not been covered.
1. Translating a "% of" statement into a "percentage" grammar statement.
2. Describing and comparing percentage pie-charts using "percentage" grammar.
3. Describing and comparing percentages in 100% tables using "percentage" grammar.
4. Describing and comparing percentages in fully-margined percentage tables.
5. Describing and comparing percentages in percentage tables with missing margins.
6. Describing and comparing percentages presented in bar graphs.

Several grammars have not been covered.
1. Describing and comparing percentages using percentage grammar.
2. Describing and comparing rates using rate grammar.

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Take Aways:

D1. Part-whole ratios are extremely common.

D2. Part-whole ratios are valuable because they take into account the size of a group.

D3. Among the most common part-whole ratios are 100% percentages.

D4. The simplest 100% diagrams are pie charts.

D5. There are two grammars for describing percentages: "% of" and "percentage."

D6. The group in the title may be all whole, all part or a combination of whole and part.

D7. Percentage grammar is commonly used in table titles.

D8. In "percentage" grammar, "Percentage of" can introduce either a part or a whole.

C1. Comparisons are valuable because they relate to a relevant basis.

C2. Comparisons of ratios are extremely valuable: they can control for the size of the groups and provide a relevant basis for comparison.

C3. Common-part comparisons are most valuable: they always control for the size of the groups.

C4. Part-whole percentages can be compared using "likely" grammar.

Bottom Line: Practice is required to use part-whole grammars properly.

Statistical Literacy Using a Learning Object

Circle your answers for questions 1 through 14.
Write out your answers for questions 15 through 21.

1. The web-based program is a good learning object.
   a. strongly disagree b. disagree c. neutral d. agree e. strongly agree
2. Using ordinary English to describing percentages can be difficult.
   a. strongly disagree b. disagree c. neutral d. agree e. strongly agree
3. Using ordinary English to compare percentages can be difficult.
   a. strongly disagree b. disagree c. neutral d. agree e. strongly agree
4. Describing and comparing percentages in tables and graphs is valuable for citizens.
   a. strongly disagree b. disagree c. neutral d. agree e. strongly agree
5. Describing and comparing percentages in tables and graphs is valuable in business.
   a. strongly disagree b. disagree c. neutral d. agree e. strongly agree
6. Describing & comparing rates in tables & graphs is valuable for social science majors.
   a. strongly disagree b. disagree c. neutral d. agree e. strongly agree
6. *Mathematics* teachers are likely to teach this material.
   a. strongly disagree b. disagree c. neutral d. agree e. strongly agree
7. *English* teachers are likely to teach this material.
   a. strongly disagree b. disagree c. neutral d. agree e. strongly agree
8. *Business communications* teachers are likely to teach this material.
   a. strongly disagree b. disagree c. neutral d. agree e. strongly agree
9. *Statistics* teachers are likely to teach this material.
   a. strongly disagree b. disagree c. neutral d. agree e. strongly agree
10. *Social Science* teachers are likely to teach this material.
    a. strongly disagree b. disagree c. neutral d. agree e. strongly agree
11. Instruction staff should support teaching this material to social science majors.
    a. strongly disagree b. disagree c. neutral d. agree e. strongly agree
12. Instruction staff should support teaching this material to all college students.
    a. strongly disagree b. disagree c. neutral d. agree e. strongly agree
13. This was a good workshop for instruction support staff who support the social sciences.
    a. strongly disagree b. disagree c. neutral d. agree e. strongly agree
14. We should have more workshops on statistical literacy.
    a. strongly disagree b. disagree c. neutral d. agree e. strongly agree

15. What is the most interesting or important aspect of this learning object?

_____

_____

_____

16. What is the least interesting or important aspect of this learning object?

_____

_____

_____

17. Why should instruction support staff teach this material **to social science majors**?

18. Why should staff ***NOT*** take on teaching this material **to social science majors**?

19. How ready is this learning object for wide-spread deployment?

20. How could this learning object be improved?

21. How could this workshop be improved?