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Statistical Literacy at Augsburg

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Slides at www.StatLit.org/pdf/2011Schield-Lehman-Class-6up.pdf



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2009 Survey Results from US Four-year Colleges

87% have college-wide quantitative requirement
68% have a quantitative support center
43% can satisfy QR requirement outside math

19% offer a course described as “statistical literacy”
17% offer a course described as QL or QR.

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Augsburg's Statistical Literacy Course

1. Course goals
2. Course content (textbook)
3. Course delivery for student teachers
4. Feedback from student teachers

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1: Goals of QL

The content and the form of delivery for quantitative literacy (QL) depend on the choice of the goal.

The Augsburg Statistical Literacy course is based on:

- AACU Quantitative Literacy rubric (General Education)
- ASA GAISE College Guidelines for Statistical Literacy
- MAA QL publications

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AACU Gen-Ed QL Goals

Individuals with strong QL skills:

1. possess the ability **to reason and solve quantitative problems** from a wide array of authentic contexts and everyday life situations.
2. **understand and can create sophisticated arguments** supported by quantitative evidence ...
3. **can clearly communicate those arguments** in a variety of formats (using words, tables, graphs, mathematical equations, etc., as appropriate).

www.aacu.org/value/rubrics/pdf/QuantitativeLiteracy.pdf

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ASA GAISE College Guidelines

The guidelines state that “students should recognize:

- Common sources of bias in surveys and experiments
- How to determine the population to which the results of statistical inference can be extended, if any, based on how the data were collected
- How to determine when a cause-and-effect inference can be drawn from an association based on how the data were collected (e.g., the design of the study).

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ASA GAISE College Guidelines

The ASA GAISE report defines statistical literacy as *understanding the basic language of statistics (e.g., knowing what statistical terms and symbols mean and being able to read statistical graphs), and understanding some fundamental ideas of statistics.*

This report noted that *students should develop statistical literacy and the ability to think statistically.*

The college report suggests assessing statistical literacy by students *interpreting or critiquing articles in the news and graphs in media.*

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MAA QL Documents

The MAA document (Steen, 2003) notes that

“Quantitative literacy empowers people by giving them tools to think for themselves, to ask intelligent questions of experts, and to confront authority confidently. These are skills required to thrive in the modern world.”

Meeting the goals of all three groups (AACU, ASA and MAA) is very demanding.

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2) Statistical Literacy as Found in Arguments


Non-Math Content:

1. Distinction between association, causation and confounding.
2. Statistics are numbers in context.
3. All statistics are socially constructed. [Joel Best]

Argument-Driven Math Content:

Admonition: When dealing with statistics, “Take CARE”!

- Influence of **Context**: What is controlled for (taken into account) by study design, comparison, ratio, ratio comparison and models.
- Influence of **Assembly** in defining groups and measures.
- Influence of **Randomness** in small and large samples.
- Influence of **Error** (bias) in subjects, measurement and sampling



Where Do Statistics Come From?

Setting the Table for Introductory Statistics


Marc Isaacson
Dept. of Business Admin.
Augsburg College

Where do statistics come from?

Why not say “Statistics come from data”?

- This is a common answer from students. What is wrong with this answer?
- Saying that “Statistics come from data” is like saying “Babies come from hospitals”. Both are true. Both leave out a whole lot of the story.

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Assembly on “bullying”

1. *Almost all* students are involved in bullying
2. *Very few* students are involved in bullying

How could both claims be true?

Source: <http://www.kare11.com/rss/article/922571/14/Study-Half-of-Minn-students-bullied-or-bullies>



Dealing With Bullying

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Loudest Animal on Earth




Adult = *Corixidae*
Photo Source: College of Natural Resources, U of CA - Berkeley

Pond insect 'loudest animal on Earth'

A tiny 'water boatman' insect is the world's loudest animal relative to its body size, according to a new study.

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Two Per Cent Milk

Fat by Weight

2% = $\frac{5}{244}$



Nutrition Facts	
Serving Size 244 g	
Amount Per Serving	
Calories 122	Calories from Fat 43
% Daily Value*	
Total Fat 5g	7%
Saturated Fat 3g	15%
Trans Fat	
Cholesterol 20mg	7%
Sodium 100mg	4%
Total Carbohydrate 12g	4%
Dietary Fiber 0g	0%
Sugars 12g	
Protein 5g	
*Percent Daily Values are based on a diet of other people's misdeeds.	

Fat by Calories

43
----- = 35%
122

Fat by Daily Value

7% = $\frac{43}{65 \times 9}$

Divide 43 calories from fat by daily fat calories allowed = 65 grams of fat times 9 calories per gram of fat

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Textbook

Introduction

Ch. 1: Story behind the Statistics

Ch. 2: Take CARE

Ch. 3: Understanding Measurements


Ch. 4: Describing Ratios

Ch. 5: Comparing Ratios

Ch. 6: Understanding Ratios

Ch. 7: Chance and Confidence

- Appendix: Additional Tables
- Tables of Figures, Tables and Stories



Statistical Literacy 2011 Schield

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3) Teacher Training Online

Six weeks: May 19 – June 30, 2011.

Entirely on-line. No face-to-face.

Materials presented via textbook, PowerPoint & audio.

Keene College (VT): 8 Teachers

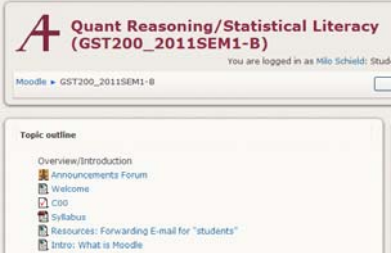
Completed 73 Moodle exercises; worked 730 problems

Completed 14 news-based challenges in Odyssey: an online anonymous forum with peer-review.

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Course Management

Moodle: 130 Exercises (~10 questions each)
Student-tested by over a thousand students.



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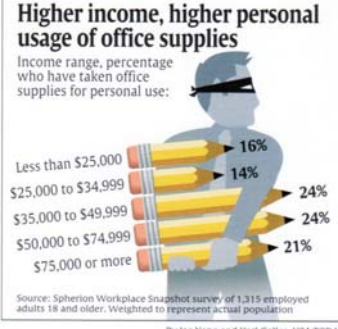
Reading Graphs

a) 16% of employees who have taken office supplies for personal use earn less than \$25,000.

b) 16% of employees who earn less than \$25,000 have taken office supplies for personal use.

c) Graph is ambiguous.

d) I can't tell.



Higher income, higher personal usage of office supplies

Income range, percentage who have taken office supplies for personal use:

Less than \$25,000	16%
\$25,000 to \$34,999	14%
\$35,000 to \$49,999	24%
\$50,000 to \$74,999	24%
\$75,000 or more	21%

Source: Spherion Workplace Snapshot survey of 1,315 employed adults 18 and older. Weighted to represent actual population

By Lee Yano and Kurt Gelles, USA TODAY

Odysseys: Teach Critical Thinking

Milo Schield: Dept. of Business Admin., Augsburg College | Larry Cooper: Educational consultant, editor, software developer

General Problem
The most comprehensive assessment of learning among college students found that 40 percent of students do not see significant improvement in the key measures of critical thinking, complex reasoning, and writing by the end of their sophomore years. (Arora and Patten 2011)

A "Solution": Q&A Forum
David Heston, U.S. Marine, "regretted not having that perspective before leaving others' behind" postwar. This online Q&A forum provides opportunity among all students. See www.aug.edu/~lcooper/odyssey

Advantages
• Addresses use of class material discussion
• Offers teacher monitoring of student interaction

Disadvantages
• Knowing who writes often on large open sections
• Students hesitant to engage live posts
• Students are reluctant to admit ignorance or pass
• Getting each student takes lots of teacher time

Conclusion
Q&A online forum has proven deep critical thinking, but also a valuable assessment platform. Don't allow the ability to grade received and that provides monitoring in the participant.

Contacts
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References
Arora, R. and Patten, C. Assessment of critical thinking and complex reasoning among college students. *Journal of Management Education*, 45(1), 1-15 (2011)

Real Solution: Odysseys
• A web forum that provides critical discussion
• 200 posts are comments
• 1000+ comments generated student posts
• Ask your computer scientist about an online
• Faculty response generated by teacher panel
• Students can use and comment on all posts
• <http://www.aug.edu/~lcooper/odyssey>

Other Benefits
• 24/7 self help in thinking
• Peer learning and teaching
• Personalized feedback, even in large classes
• Making about problems
• 200+ student responses

Student Responses
73 students in "Odyssey" (2 of 2010)
• 67% found it "valuable"
• 70% said it improved their critical thinking
• 70% preferred it to other online pages
Positive student comments:
• Inspiring peers, but not mapping
• Personal feedback learning
• Connections, insight forward, everywhere
• Strongly motivated agreement
• Depth of critical thinking, from time often
• Like a culture, often

Audience: Students needing critical thinking to help careers, self-construct in nontraditional careers
Word Mosaic: students, critical thinking, large classes, self-construct in nontraditional careers

4) Teacher Training Feedback

To improve students' critical thinking the most, which would you recommend? **Odyssey forum** (5/7); Regular online forum (2/7); Written assignments (0/7).

In learning the material, the Moodle exercises had **moderate value** (4/7).

Split on which course is most useful to math-phobic students in understanding numbers in everyday media: Quantitative Reasoning (3/6), Statistical Literacy (3/6).

Teacher Training Feedback #2

The focus on Context (choice in comparisons, ratios, study design) had **high value**. (4/7)

The focus on Assembly (choice in defining and presenting statistics) had **high value**. (4/7)

The focus on Randomness had **moderate value** (3/7).

The focus on Error/bias had **high value**. (4/7)

Agreed (4/7): text is suitable as a reference for QL course.

Teacher Training Feedback #3

The use of and emphasis on math in this course in understanding numbers in the media is **very adequate** (4/7).

This course is **extremely valuable** (4/7) in reading and interpreting statistics in the media?

Take CARE approach had **moderate to high value** (6/7).

Very likely that students need the skills from this course as citizens in a data world. (5/7)

Strongly agreed (5/7) that statistical literacy should be required of all college students for graduation.

SUMMARY
Peter Holmes

W. M. Keck Statistical Literacy course

- "is *different*": "different emphasis", "different background", "a different package"
- "goes beyond Numeracy"
- is more in line with the statistical literacy "needed by most people in everyday life to read the news, by those in business commerce or management, and by policy makers."

Invitation

Check out www.StatLit.org

Check out some Statistical Literacy papers.

- *Statistical Literacy and Liberal Education at Augsburg*
- *Epidemiological Models and Spotty Statistics*
- *Teaching Statistical Literacy as a Quantitative Rhetoric Course*
- *The Social Construction of Rankings*

Sign up for information on teacher-training courses. It will expand your view of QL!!!