Statistical Literacy at Augsburg

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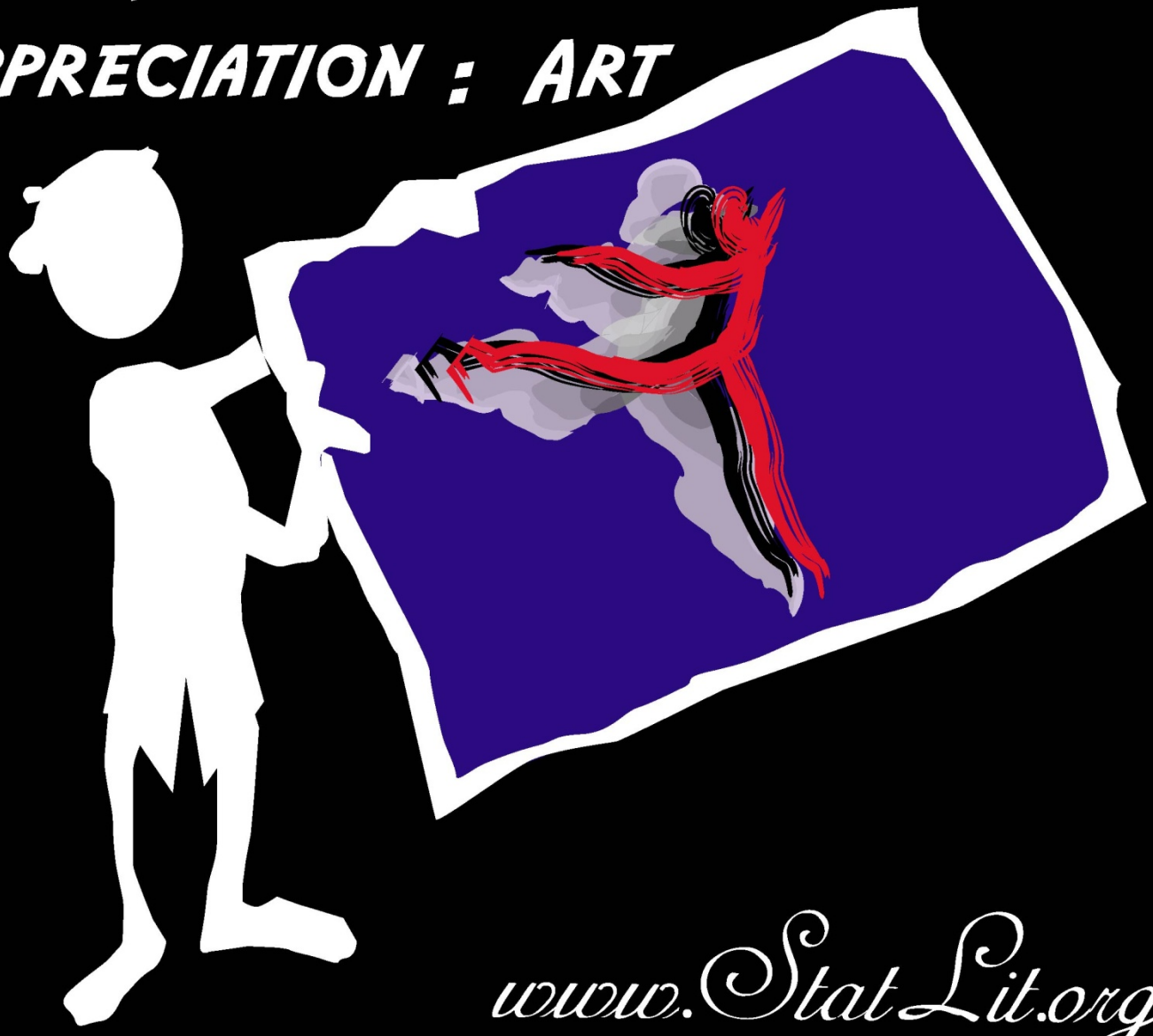
Feb 24, 2012

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

Statistical Literacy : Statistics
As
Art Appreciation : Art



SL

www.StatLit.org

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.

Augsburg's Statistical Literacy Course

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

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

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

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).

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*.

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.

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.

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

Loudest Animal on Earth

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.

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 8g	

Vitamin A 9% • Vitamin C 1%

Fat by Calories

$$\frac{43}{122} = 35\%$$

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

Textbook

Introduction

Ch. 1: Story behind the Statistics

Ch. 2: Take CARE

Ch. 3: Understanding Measurements

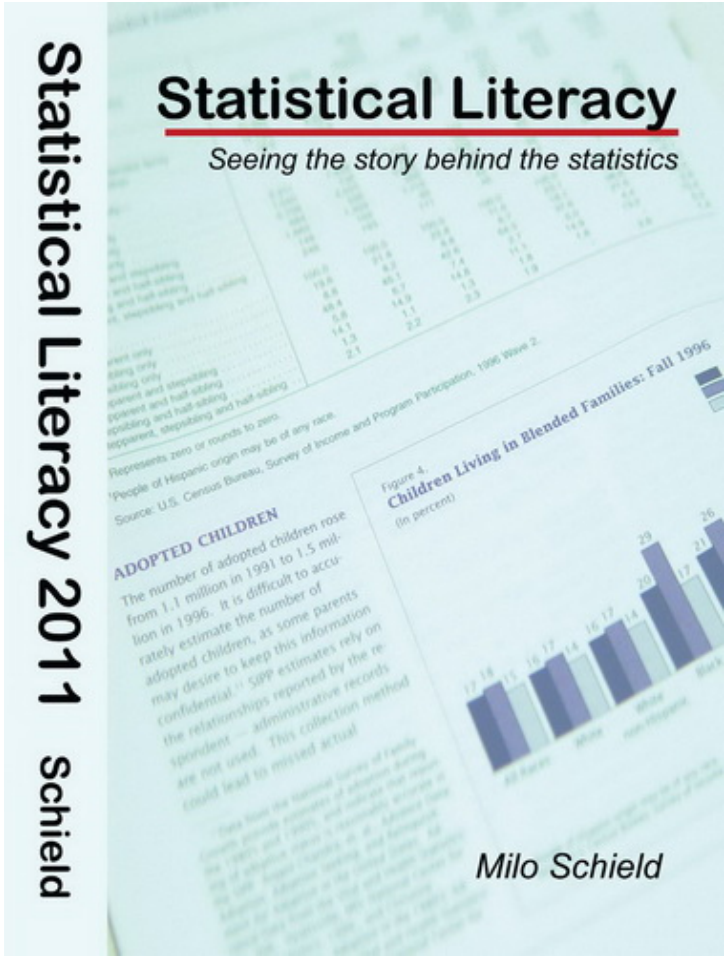
Ch. 4: Describing Ratios

Ch. 5: Comparing Ratios

Ch. 6: Understanding Ratios

Ch. 7: Chance and Confidence

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



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

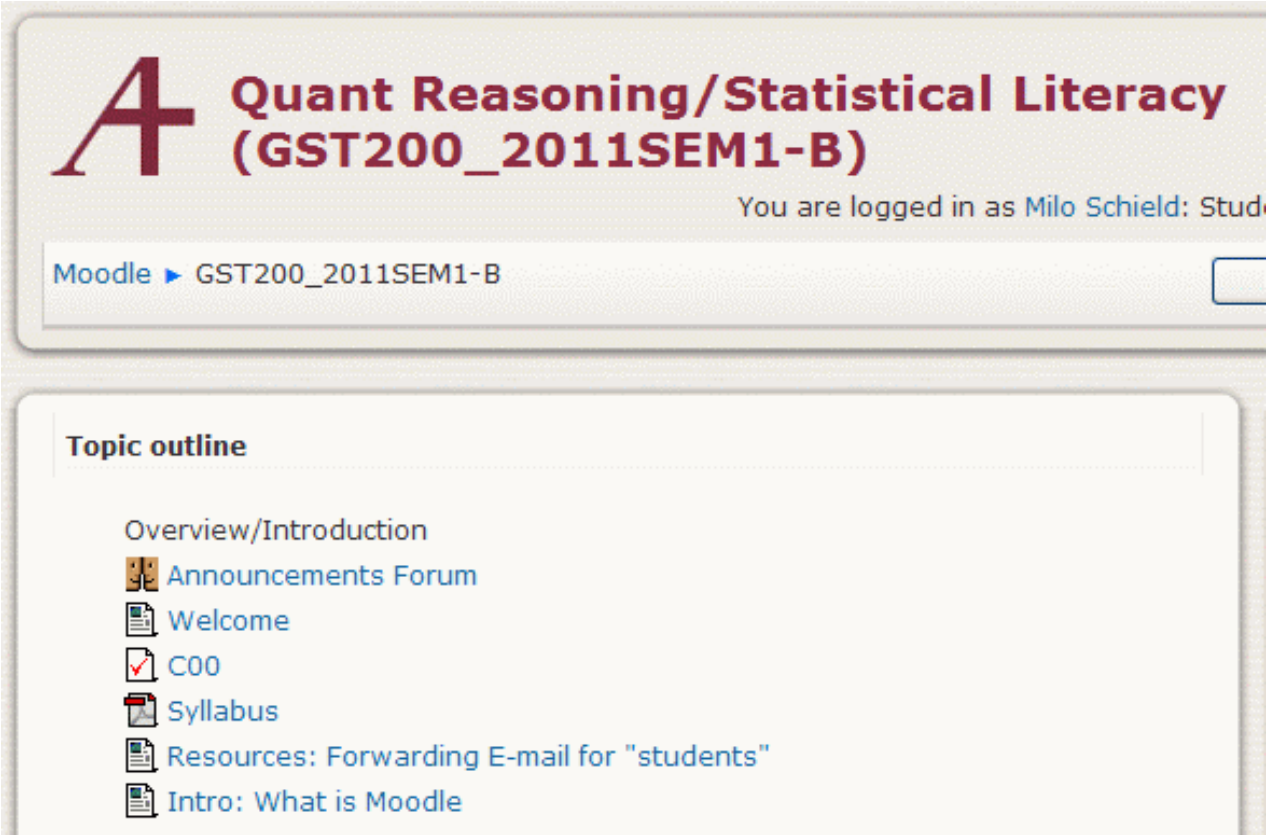
Completed 73 Moodle exercises; worked 730 problems

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

Course Management

Moodle: 130 Exercises (~10 questions each)

Student-tested by over a thousand students.



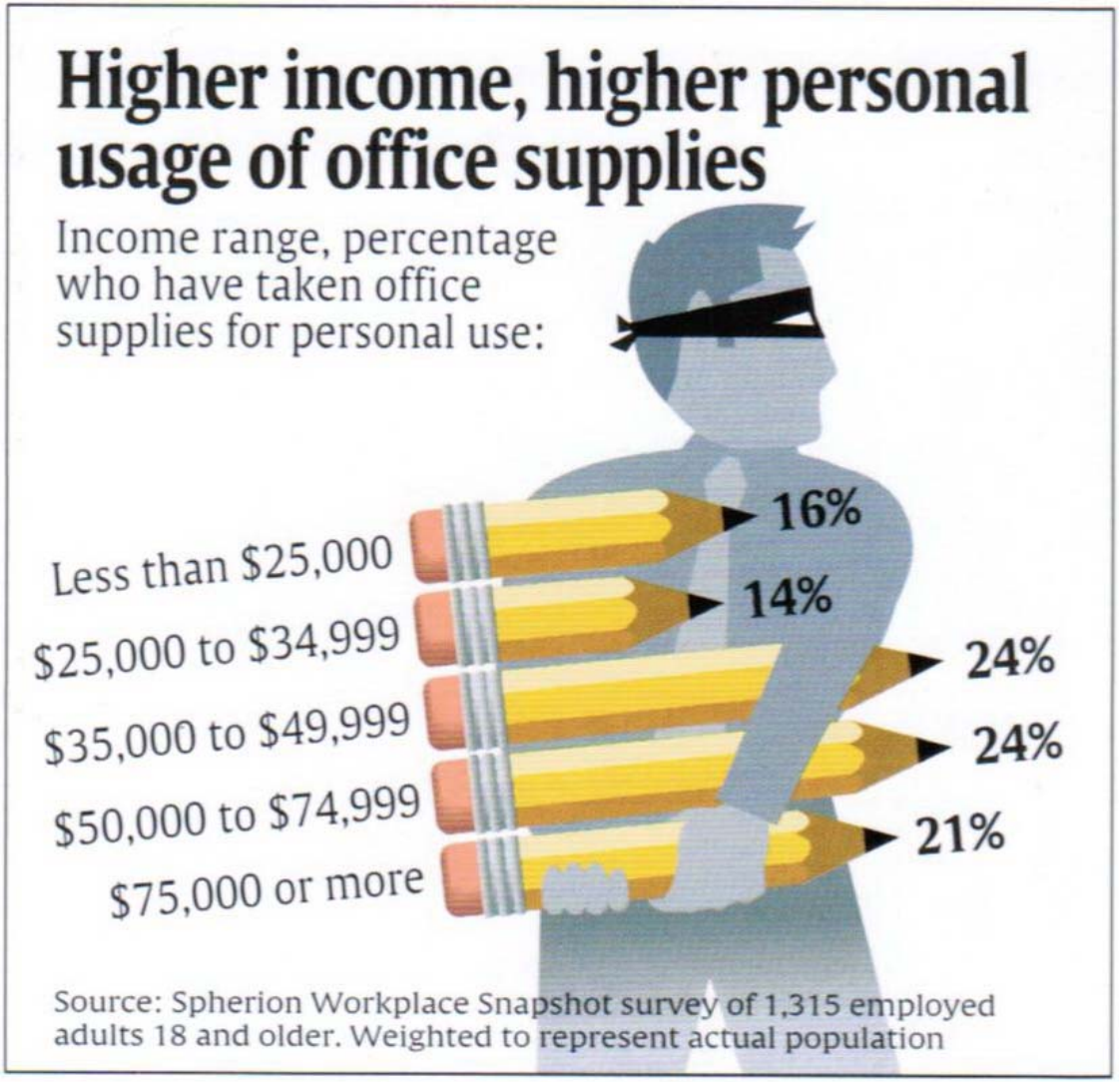
Reading Graphs

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.



Odysseys: Teach Critical Thinking

Milo Schield: Dept. of Business Admin. Augsburg College

Larry Copes: Educational consultant, editor, software developer

General Problem

The most comprehensive assessment of learning among college students found that "45 percent of students show **no significant improvement** in the key measures of critical thinking, complex reasoning and writing by the end of their sophomore years." Arum and Roska (2011)

A "Solution": Q&A Forum

Default Moodle Q & A forum "requires students to post their perspectives before viewing others students' postings. This allows equal initial-posting opportunity among all students, thus encouraging original and independent thinking."

Advantages

Facilitates out-of-class student discussions.
Allows teacher monitoring of student interactions.

Disadvantages

Knowing who writes what can bias peer reviews.
Students hesitate to critique their peers.
Students are reluctant to admit ignorance to peers.
Grading each student takes lots of teacher time.

Conclusion

Q&A online forums don't promote deep critical thinking: they don't facilitate immediate grading, don't allow for dialog on grades received and don't provide anonymity to the participants.

Contacts

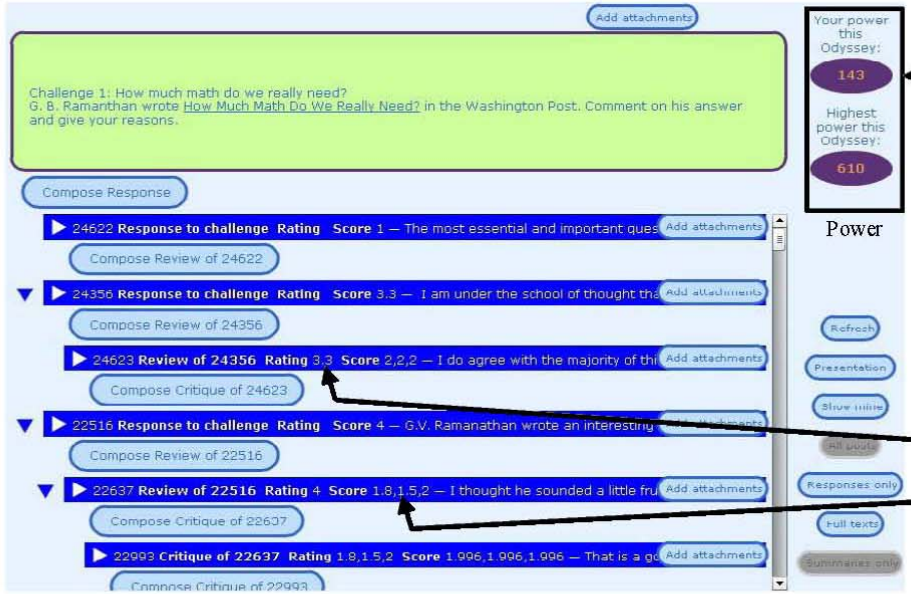
Larry Copes <Copes@Edmath.org> or Milo Schield <Schield@Augsburg.edu>

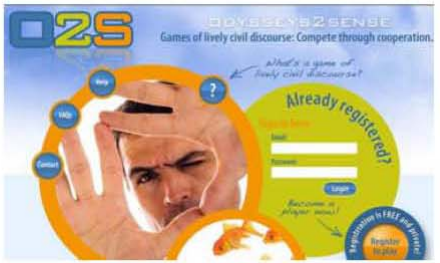
Odysseys™ is owned by Independent Learning, LLP.
www.facebook.com/pages/Odysseys2sense/195689806136

References

Arum, R. and J. Roksa (2011). *Academically Adrift: Limited Learning on College Campuses*. Univ. of Chicago Press.

Schield, M. (2011). Teaching Statistical Literacy Using Odysseys2Sense: A Unique Web-Discussion Forum. MAA www.statlit.org/pdf/2011SchieldMAA.pdf





Real Solution: Odysseys

a web forum that promotes critical discourse:

- ❖ All posts are **anonymous**.
- ❖ Real-time **computer-generated** student power.
- ❖ Each post **computer-scored** based on ratings.
- ❖ Ratings **computer-weighted** by student power.
- ❖ Students can rate and comment on all posts.

Odysseys2sense™ at www.odysseys2sense.com

Audience: Teachers teaching critical thinking in large courses, online courses or accelerated courses

Word Mosaic (below): Taken from student comments. Larger font means more frequent comments.

Other Benefits

- ❖ Risk-taking in thinking.
- ❖ Peer learning and teaching.
- ❖ Immediate feedback, even in large classes.
- ❖ Dialog about evaluation.
- ❖ Diminished instructor time.

Student Responses

73 students in 7 classes (Fall 2010):

- ❖ 63% found it "valuable"
- ❖ 70% said it improved their critical thinking
- ❖ 75% preferred *Odysseys* to written papers

Positive student comments:

- ❖ Something new, fun and engaging
- ❖ Instant feedback/scoring
- ❖ Convenient, straight-forward, anonymous
- ❖ Thought-provoking arguments
- ❖ Involved critical thinking, learn from others
- ❖ Able to critique others

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!!!