AMA TYC 1999 — 11/99 — **C1**

Statistical Literacy Standards for Content

American Mathematical Association

of Two Year Colleges

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Contrary Opinion: Statistical Literacy is remedial.

Teaching rates and percentages *is remedial*.

Without a strong intellectual foundation, statistical literacy *is just like "check-book math"*.

Two-year colleges will be most susceptible:

• more of their students need remedial study.

• fewer of their students need statistical inference.

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Rebuttal on Rates and Percentages

Teaching rates and percentages is an excellent way of teaching these important topics:

* *conditional thinking,* $P(A|B) \neq P(B|A)$

* *relative frequency vs. risk,*

* s*purious associations,*

* *association vs. causation,*

* *interpreting regression and ANOVA models.*

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Understanding Confounding Simpson's Paradox

"White murderers more likely to receive the death penalty than black murders."   Disparate Impact!   Discrimination?

See *Simpson's Paradox* (Schield, 1999).

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Other topics: Describe and Interpret Graphs

Give a plausible explanation for this change

US: % of Population who are Female

Source: 1996 US Statistical Abstract 96S012

#1: Men die younger than women.

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Other topics: Association vs. Causation

Risk of death:

• *Washington DC. 12 per 1,000*

• *Alaska: 4 per 1,000*

1. "*The **risk** of death is three times as great in Washington DC as in Alaska.*"
   [Factual]

2. "*If an Alaskan <u>moves</u> to Washington DC they can **expect** to triple their chances of dying.*"
   [Disputable/inferential even if the data is true.]

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Other Topics: Association vs. Causation

Regress housing prices on number of bathrooms.

1. Houses with three baths sell for $20,000 more than houses with two baths.

2. For every additional bathroom, the price of a house increases by $20,000.

3. If you add a bathroom, you **can expect** to increase the price of your house by $20,000.

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Intellectual Goals of Statistical Literacy

To teach students about
- *numbers*: a way of summarizing data and associations
- *algebra*: a language that is simple, powerful & useful
- *functions*: useful devices to summarize relationships
- *conditionality*: an important aspect of human thought
- *induction*: the kind of reasoning most often used
- *spurious association*: a misleading association

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Conclusion

Students need to be literate about statistics as evidence for non-statistical conclusions.

The goal of Statistical Literacy is to help students learn the art of reasoning with statistics.

Statistical literacy is critical thinking about statistics.

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ACTIONS

1. *Divide C6 into two parts:*
   - Statistical Literacy: To be determined...
   - Statistical Inference: Most of C6; leave as is.

2. *Discuss content of a pre-stats stats course.* Take/return questionnaire from my web page.

3. *Develop support at your school for a statistical literacy requirement for graduation*

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BENEFITS

Perhaps students would say in your course,
"I really see the world differently now. I read the newspaper differently. I even think differently"

Perhaps other faculty would say,
"Students that take your course are better at thinking. Keep up the good work!"

Perhaps students would tell other students,
"You should take that Statistical Literacy."

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Recommended Reading

Twice As Less by Eleanor Wilson Orr
Black English and the Performance of Black Students in Mathematics and Science

Why Numbers Count, Lynn Steen, Editor
Heeding the Call for Change, Lynn Steen, Editor

Critical Thinking by Moore and Parker

The Art of Reasoning by David Kelley

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Why Not Four-Year Colleges? C13

Students at four year colleges are more likely

- to have completed calculus or finite math.
- to be required to take statistics by their major: business, economics, psychology, sociology, etc.
- to use statistical inference in graduate school or in research in a future job.
- to be taught in departments where statistical inference is the justification for the course.

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Why Two-Year Colleges? C14

Students at two-year colleges

- need more help with arithmetic and algebra
- need more work on reading and writing.
- need more work on distinguishing what is given from what is being asserted
- need more work on conditionality
- need to be taught mathematics in a context that clearly and readily relates to the 'real world'.