

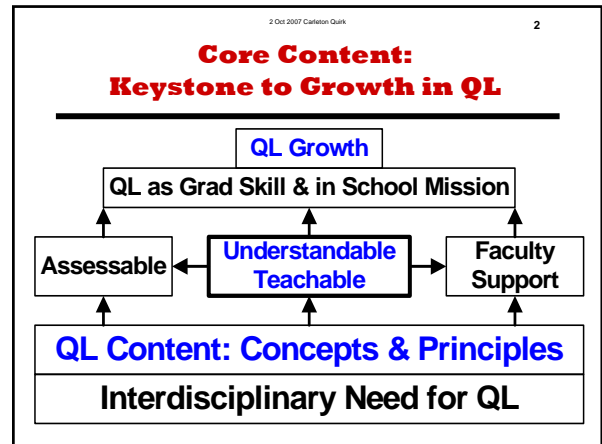
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Quantitative Literacy: Core Concepts

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Quantitative Inquiry, Reasoning & Knowledge
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Slides at www.StatLit.org/pdf/2007SchieldCarleton6up.pdf



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QL Numbers in Context

“The essence of QL is to use mathematical and logical thinking in context.” Lynn Steen 2004

QL must have defining core concepts that are

- argument based (control for context)
- mathematically sound
- **understandable** by students and faculty
- **useful** to students in their everyday lives
- **teachable** by non-math faculty.

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QL: Four Core Concepts

Here are 4 math tools that control for context and are English or graph based:

1. Arithmetic comparisons (% more than)
2. Ratios (percentages, rates, probability)
3. Comparisons of ratios (likely, prevalent)
4. **Standardizing (compare apples w. apples)**

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#1: Numeric Comparisons Control For Context

Qualitative vs. quantitative

- Napoleon was shorter than many French soldiers
- Napoleon 4" shorter than average French soldier

- Women live longer than men
- Women live 7 years longer than men

If interest rates increase from 1% to 2%.

- Double (two times as much as)
- 100% increase (100% more; 1 times more than)
- 1 percentage point increase **Not a 1% increase!**

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Simple Arithmetic Comparisons

Three is 2 times [200%] more than One.

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**#2: Rates and Percentages
Control For Context**

Q1. Can both be true, same time/place/group?

1. Unemployment is up Number is up
2. Unemployment is down Rate is down

Q2. Are these percentages the same?

1. The percentage of men **WHO ARE** runners
2. The percentage of men **AMONG** runners

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**Percentages in Tables
Describe in Ordinary English**


Percentage who are Females			
	Non-Smoker	Smoker	ALL
Non-Runner	48%	24%	40%
Runner	30%	33%	32%
ALL	42%	29%	36%

1. 33% of female smokers are runners.
2. 33% of females are runner smokers.
3. 33% of runner smokers are female Correct
4. 33% of female runners are smokers

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**Medical Tests:
99.9% Accurate!**

- Greater Than 99.9% Accurate
Reliable as Tests Used by Doctors and Hospitals
- Confidential and Anonymous
- Results 24 Hours a Day
- One Spot™ Technology



99.9% of positives have disease

99.9% of diseased test positive.

HIV-1 TEST SYSTEM
for the Detection of Antibodies to HIV-1

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**#3: Comparisons of Ratios
Control For Context Two Ways**

Is marijuana a gateway drug to heroin?

1. 90% of heroin addicts first used marijuana
2. 99% of heroin addicts first used milk

Are men psychologically stronger than women?

3. Widows are more likely **AMONG** suicides than widowers [are].
4. Widows are *less* likely **TO** commit suicide than widowers [are].

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**#4: Standardizing Ratios
Controls For Context**

Once you have ratios (percentages, rates or averages) or comparisons of ratios, many students mistakenly think no more can be done.

Standardizing takes into account the influence of confounders on ratios.

Standardizing links mathematics, confounding and context in ways that everyone should know.

Standardizing involves multivariate thinking.

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**#4: Numbers in Context:
Multivariate Thinking**

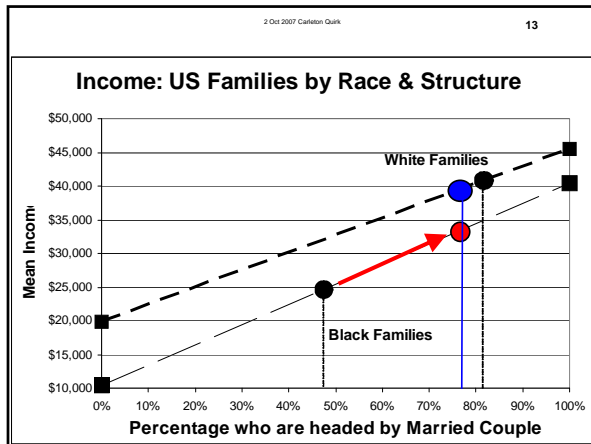
Mexico has better medical care than the US.

- Death rate in Mexico: 5 per 1,000 population
- Death rate in US: 8.7 per 1,000 population

US: Average incomes in 1994:

- \$41,000 for white families
- \$25,000 for black families
- **\$16,000 is the black-white income gap**

Is this evidence of structural racism in America?



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QL Has a Bright Future

Educators need to agree on core QL ideas that:

- are common across the curriculum,
- focus on arguments in everyday life,
- relate to context, and
- enhance students' critical thinking

so Quantitative Literacy will be

valued, respected and accepted in academia.

Working together, we can make it happen!

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Separate Course Statistical Literacy

W. M. Keck Statistical Literacy Project developed a course that studies the influence of context on numbers found in the news reports, press releases and studies:

1. Arithmetic Comparisons (% more than)
2. Ratios: percentages, rates, probability
3. Comparisons of ratios (likely, prevalent)
4. Standardizing (comparing apples & apples).

Course overview at www.StatLit.org/pdf/2007SchieldGST200a.pdf

Grammar program at www.StatLit.org/GC/P2

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References at www.StatLit.org

Schild, Milo (2004). *Statistical Literacy and Liberal Education at Augsburg College*. AAC&U Peer Review See www.StatLit.org/pdf/2004SchieldAACU.pdf

Schild, Milo (2005). *Statistical Prevarication: Telling Half Truths without Lying*. IASE conference Sydney See www.StatLit.org/pdf/2005SchieldIASE.pdf

Schild, Milo (2006). *Beware the Lurking Variable*. American Statistical Association STATS Magazine. See www.StatLit.org/pdf/2006SchieldStats.pdf.