Quantitative Literacy: Core Concepts

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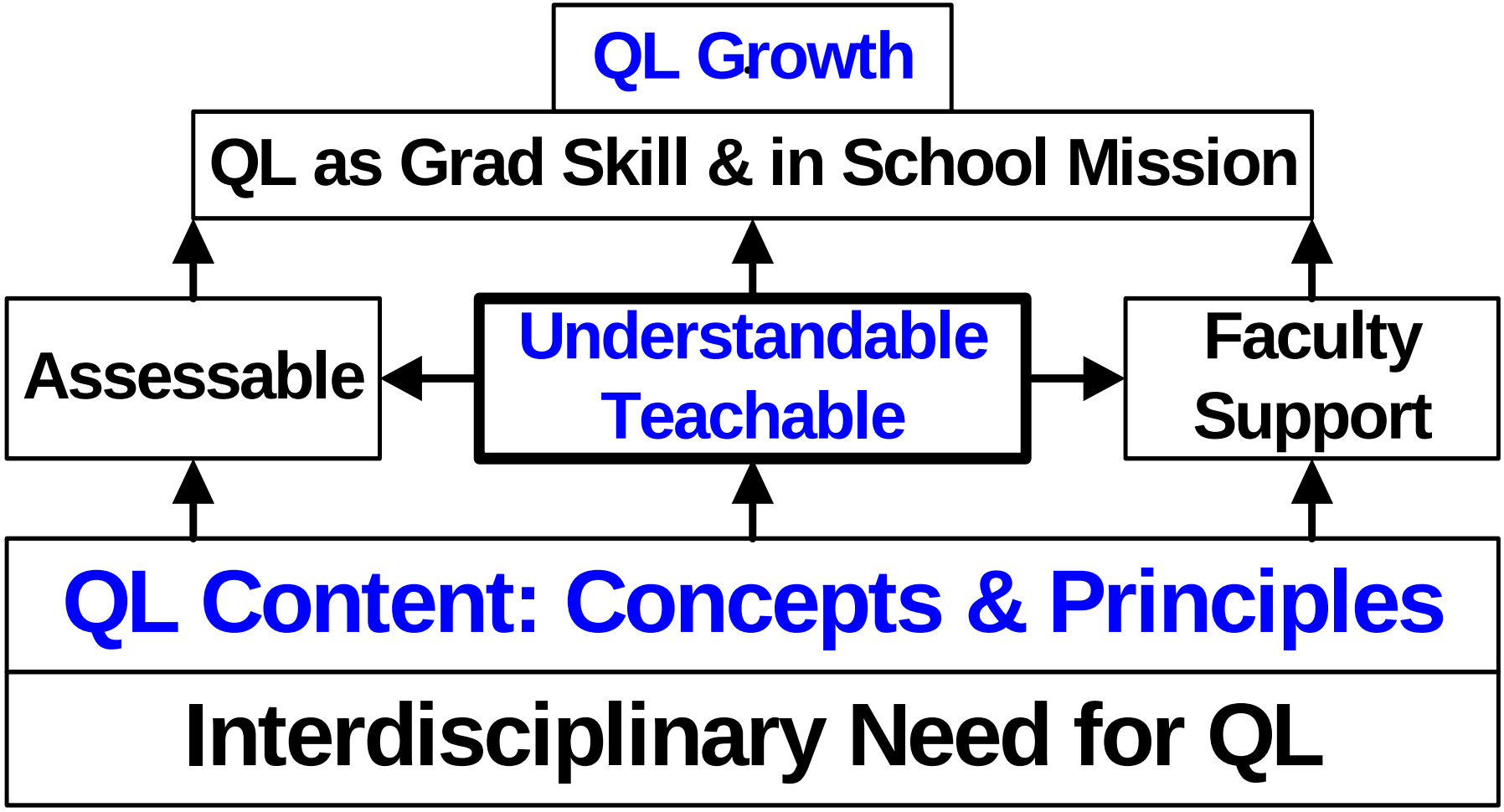
Slides at www.StatLit.org/pdf/2007SchieldCarleton6up.pdf

Core Content: Keystone to Growth in QL



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.

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)**

#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!**

Simple Arithmetic Comparisons

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

#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?

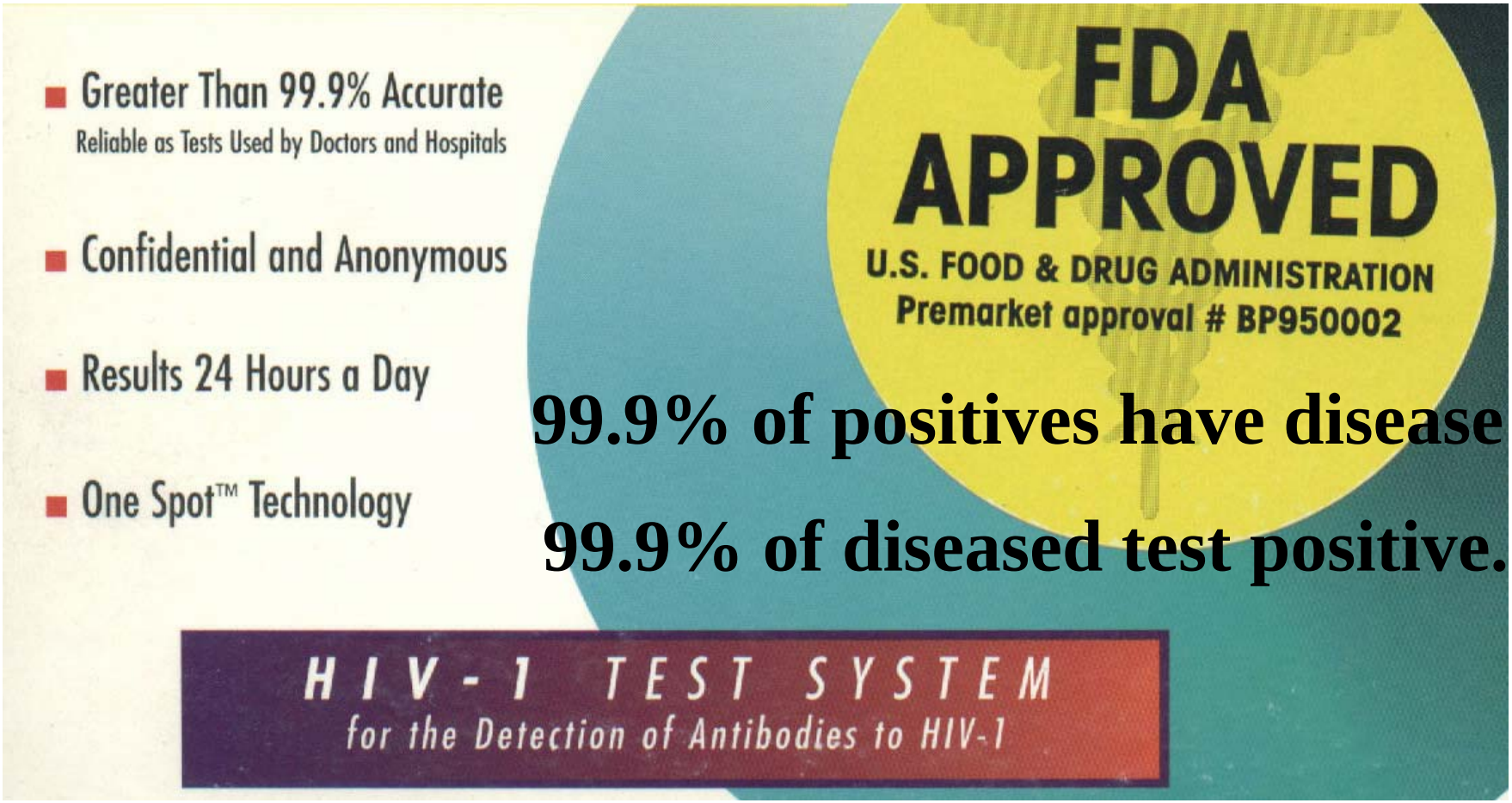
1. The percentage of men **WHO ARE** runners
2. The percentage of men **AMONG** runners

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

Medical Tests: 99.9% Accurate!



#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].

#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.

#4: Numbers in Context: Multivariate Thinking

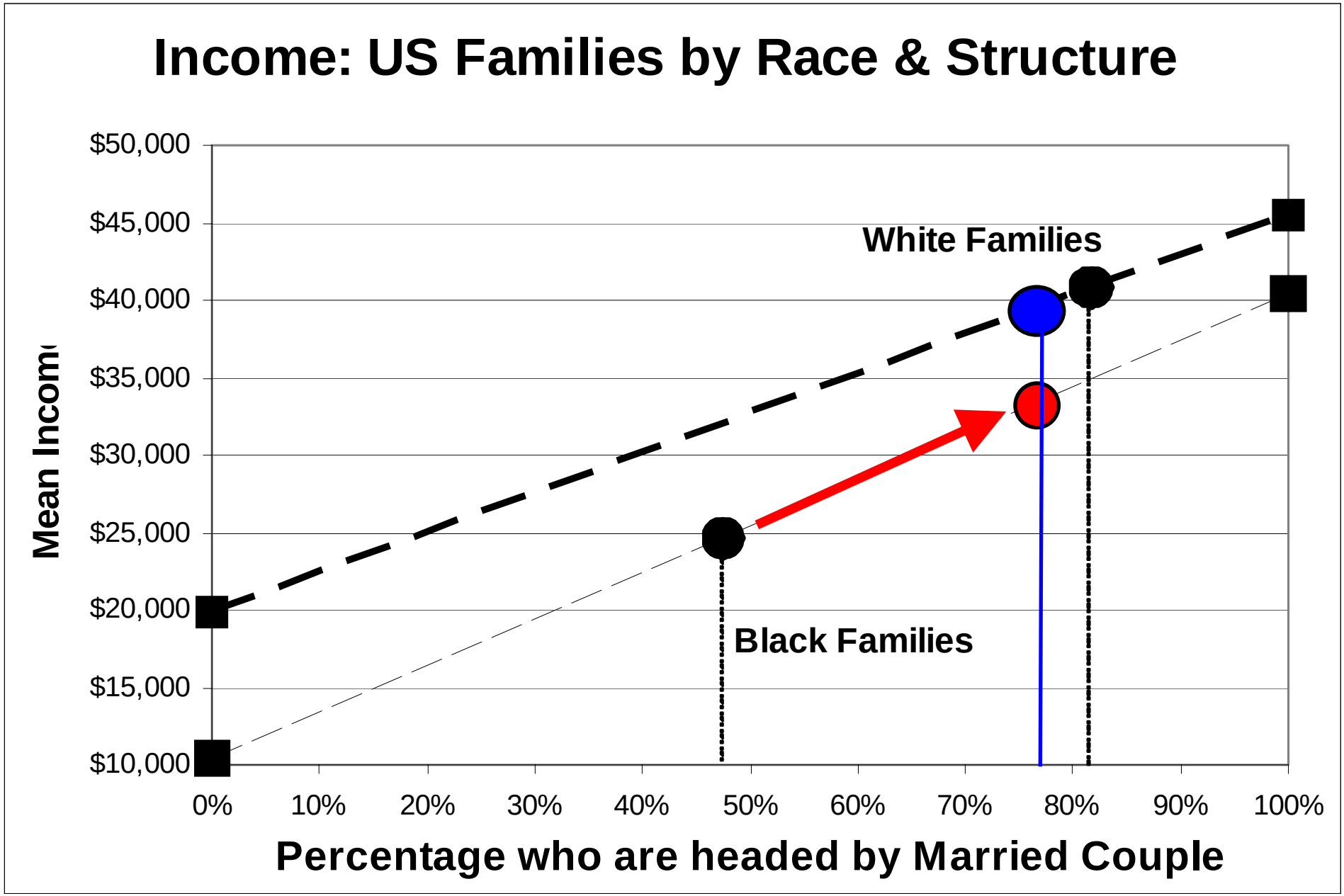
Mexico has better medical care than the US.

- 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?


Income: US Families by Race & Structure
Mean Income
$50,000
$45,000
$40,000
$35,000
$30,000
$25,000
$20,000
$15,000
$10,000
White Families
Black Families
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percentage who are headed by Married Couple

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!

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

References at www.StatLit.org

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