STATISTICAL LITERACY
and
STATISTICAL COMPETENCE
in the
21ST CENTURY

David S. Moore
Purdue University

- **THE ENVIRONMENT**
- **THE NEW LITERACY**
- **THE NEW COMPETENCE**
- **THE NEW PROFESSIONALISM**

THE ENVIRONMENT

- **The intellectualizing of work**

  $\Rightarrow$ Need analytical, quantitative, computing skills

  $\Rightarrow$ Need interpretive, communication skills

  $\Rightarrow$ Multiple jobs, multiple careers

  $\Rightarrow$ Need statistical skills?

- **The democritization of education**

  $\Rightarrow$ More in college, more taking statistics

  $\Rightarrow$ Often employed, career focus

  $\Rightarrow$ Want visible utility

THE ENVIRONMENT

- **Pressures on education**

  $\Rightarrow$ We cost too much

  $\Rightarrow$ Room for competition

  $\Rightarrow$ Technology-based learning

  $\Rightarrow$ Student background and motivation?

- **A changing discipline**

  $\Rightarrow$ Technology

  $\Rightarrow$ Back to data, back to science

  $\Rightarrow$ Interdisciplinary emphasis

THE ENVIRONMENT

- **Technology**

  $\Rightarrow$ Drives demand for quantitative skills

  $\Rightarrow$ The young are fluent

  $\Rightarrow$ New content emphases

  $\Rightarrow$ New learning tools: The next big change?

  $\Rightarrow$ Enables competition

  $\Rightarrow$ The information flood: No global village

THE NEW STATISTICAL LITERACY

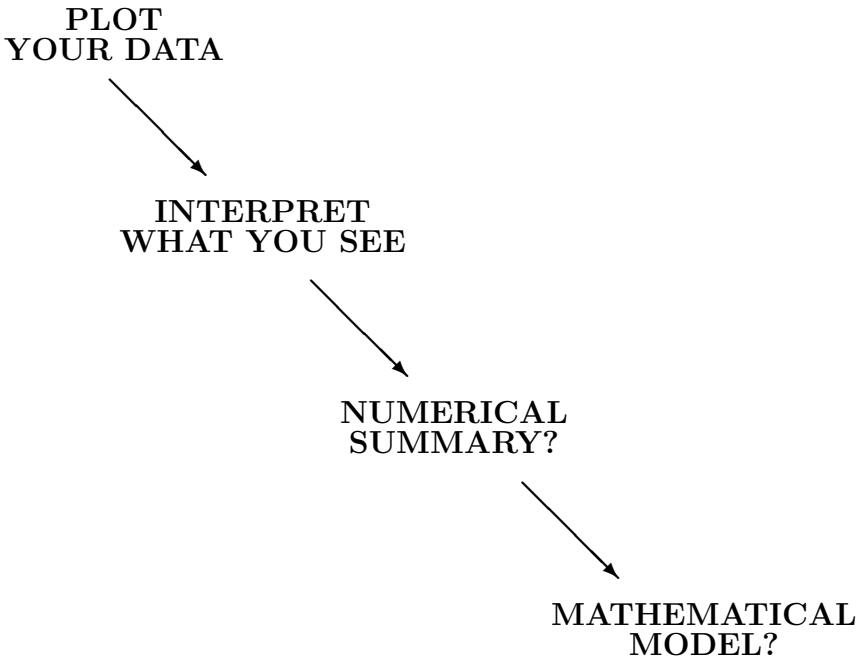
- **Think broadly**

  $\Rightarrow$ Strategies and big ideas (details automated)

  $\Rightarrow$ Communication and problem-solving

  $\Rightarrow$ Filters for nonsense

- **Strategies: an example**



- **Big ideas: some examples**

  $\Rightarrow$ Data beat anecdotes

  $\Rightarrow$ Is this the right question?

  $\Rightarrow$ Beware the lurking variable

  $\Rightarrow$ Association is not causation

  $\Rightarrow$ Observation versus experiment

  $\Rightarrow$ The importance of study design

  $\Rightarrow$ The omnipresence of variation

  $\Rightarrow$ Conclusions are uncertain

- **Is this a stat course?**

THE NEW STATISTICAL COMPETENCE

- **Use sophisticated tools gracefully**
- **Keep thinking broadly**
- **What can't be automated?**
- **Statistical thinking (ASA/MAA)**

  $\Rightarrow$ The need for data

  $\Rightarrow$ The importance of data production

  $\Rightarrow$ The omnipresence of variability

  and ...

$\Rightarrow$ The quantification and explanation of variability

$\rightarrow$ Randomness and distributions

$\rightarrow$ Patterns and deviations (fit and residual)

$\rightarrow$ Mathematical models for patterns

$\rightarrow$ Model-data dialog (diagnostics)

- **This is serious stuff**

  $\Rightarrow$ One pass through software isn't enough

  $\Rightarrow$ Understanding chance variation

  $\Rightarrow$ Models as interpretive tools

- **But you can choose the details to fit your context**

SOME HESITATIONS

- **Is this utopian?**

  ⇒ No one ever went broke by underestimating the motivation of The American Freshman

  ⇒ Costs, competition, ...

- **Does statistics retain a core?**

  ⇒ Is quantitative literacy our turf?

  ⇒ Is any **specific** competence shared?

  ⇒ Why instruction separate from a context in another field?

  ⇒ Why instruction separate from broader information science?