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ODYSSEY: A Journey to Lifelong Statistical Literacy

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 US Chair: International Statistical Literacy Project

17 July 2014 ICOTS-9
www.StatLit.org/pdf/2014-Schild-ICOTS-Slides.pdf

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Statistical Literacy: Teaching vs. Practicing


Statistical literacy (critical thinking with statistics) requires

- analytical skills: decoding statistical summaries, grammar and arguments
- communication skills: how the presentation influences the apparent strength of an argument

Students need lots of practice to develop these skills.

Students remember 90% of the subject matter if they do the task themselves even as a simulation, as opposed to 10%, 20% and 50% if they read, hear or watch someone else do the task respectively. Menn (1993)


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Forgetting; Group Learning

Learning without retention is a tremendous waste. Students in a traditional [statistics] course lost 48% of their course gain within 4 months after the course. Title et al. (2012).

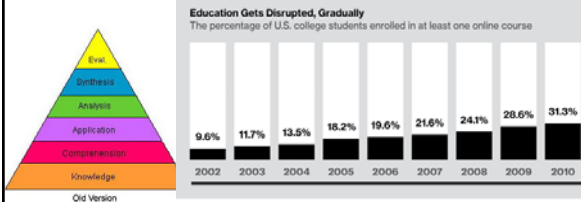
Group learning can be a powerful tool. Doing this online is almost impossible without some kind of forum.



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Writing/Speaking Online Forums

Demonstrating critical thinking (see Bloom's taxonomy) requires that students write or speak. Online forums are commonly used.



Year	Percentage
2002	9.6%
2003	11.7%
2004	13.5%
2005	18.2%
2006	19.6%
2007	21.6%
2008	24.1%
2009	28.6%
2010	31.3%


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Classifying Online Forums

Online forums can be grouped into five levels:

- L1: Basic. Quick feedback. Typical
- L2: L1 + no free-riders [Moodle Q&A]
- L3: L2 + all players are anonymous
- L4: L3 + everyone grades everyone
- L5: L4 + system scores players [Odyssey]



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Odyssey Forum

Odysseys™ is a unique online forum that is used by several colleges and universities.

Before they can see anything, players must

- submit their initial response to a challenge
- grade three or four responses by others.

The system updates each player's power based on:

- the grades received from others
- the power of those giving the grades.

For details, see Schield (2012a and 2012b).

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Good Forums

The key to good forums is the same as that for good discussions. The topics or challenges must:

- be open-ended (as opposed to right-wrong)
- encourage multiple approaches
- encourage discussion and reflection.

The following challenges have been used in teaching statistical literacy face-to-face and online.

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Over 40 "Challenges" in the last three years.

Challenges have been grouped as follows:

- Critical thinking exercises (7)
- Reading and interpreting tables and graphs (6)
- Reading and interpreting surveys (6)
- Explaining data patterns (5)
- Observational studies: Cross-sectional (7)
- Observational studies: Longitudinal (6)
- Evaluating randomized experiments (6)

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1) Critical Thinking

1. All Statistics are Facts
2. Can critical thinking be taught?
3. Is Sylvia Browne a real psychic?
4. How much math do we really need?
5. Damned Lies and Statistics: Joel Best
6. Gambler's Fallacy: Run at Monte Carlo
7. Coincidence or not? Canadian Lottery winner.

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2) Reading Tables and Graphs

TABLES:

- UK Bank-Raids data
- Pioneer-Press Circulation Statistics
- Per-Person Spending: Married vs. Single
- US Dropout-Rates by race, income, ESL, etc.
- AARP Insurance Savings: Mean, Median and Most

GRAPHS:
Libertarian/Tea-Party/Christian-Right Overlaps

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3) Surveys

1. 1 in 50 US Kids is homeless: study
2. Halloween Consumer Survey (2012)
3. Oregon has lowest rate of childhood obesity
4. 1 in 10 Chinese adults are diabetics, study finds
5. Students Consider Prostitution to Pay for Education
6. Third of U.S. teens with phones text 100 times a day
7. **95% Margin of Error**

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4) Explaining Data

1. Excess of Males in the SAT tails
2. Are heights normally-distributed?
3. Overweight Increases over Time
4. Low Graduation Rates: Minnesota Schools
5. 25,000 U.S. Deaths Linked to Sugary Drinks

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5) Evaluating Observational Studies: Cross-sectional

1. Spanking Lowers IQ
2. ADHD Leads to Weight Gain
3. TV Ownership Linked to Well-Being
4. College students: Later classes, lower grades
5. Study: Women Who Drink Tend to Be Thinner
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6) Evaluating Observational Studies: Longitudinal

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4. High gas prices drive down traffic fatalities
5. US Income Mobility Study: Ten Year Comparison
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7) Evaluating Randomized Experiments

1. Comparing training programs
2. "Booze + diet soda = bigger buzz?"
3. Bigger Tableware Helps Widen Waistlines
4. Giving Criminals \$\$ after Release Cuts Recidivism?
5. **Not statistically significant = no difference?**

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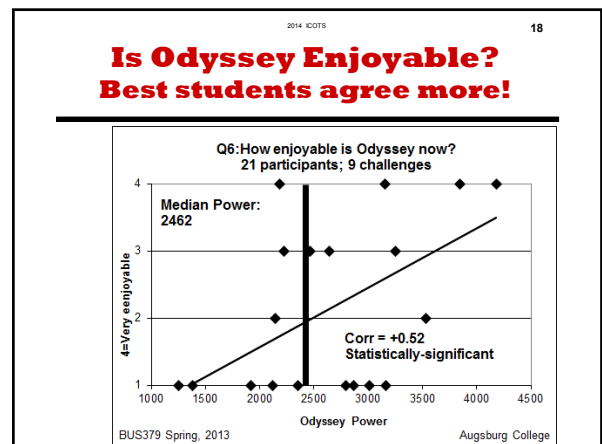
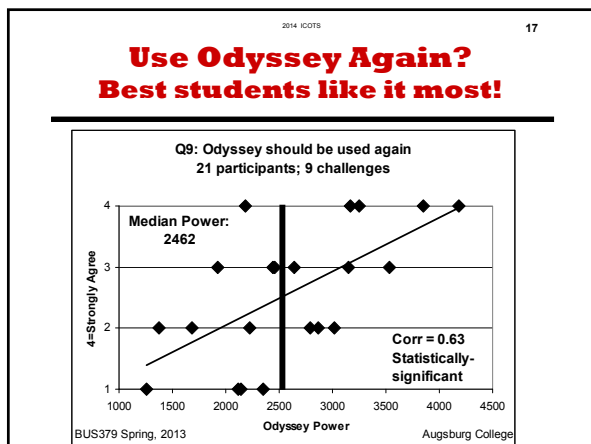
Student Responses

I like being anonymous to review others work.

The best quality was the immediate feedback I received.

I liked creating a response to the questions before having the opportunity to read what others had replied. I felt my initial response was independent.

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Conclusion

Students need to practice in class what they should be doing after the class is finished.

Most students will encounter statistics in their personal lives via the everyday media.

They need practice analyzing statistics in the media.

Odyssey is one way of doing this online.

See the associated paper for details.

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Bibliography

Menn, D. (1993, Oct). Multimedia in education. *PC World*, M52-M60.

Schield, M. (2012a) Odysseys User Guide. Copy at www.statlit.org/pdf/2012-Odysseys-Guide-6up.pdf

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Survey

How many of you are in or are connected with

1. business or economics? 5/72
2. epidemiology, sociology, education, history, journalism or political-science? 13/72

How many cover ANY of these in Intro Stat? 18/72

- confounding in problems or on exams,
- coincidence in big data, effect size OR
- effect of confounding on stat. significance

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Statistics Education Problem

When teaching Intro Stats, how many discuss:

- different kinds of observational studies?
- using observational associations to find causes?

Most teachers don't teach these; most teach an *abstinence-based course*. [Only 1% of the 300+ ICOTS abstracts mention *cause*]

Most college students will encounter *causation* repeatedly both professionally (social sciences, law, medicine) and personally (health/politics).

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**New Course & Textbook:
Statistical Literacy for Managers**

First half: **Traditional Descriptive & Inferential**

1. Tables & graphs in ordinary English
2. Models and distributions
3. Sampling, bias, confidence intervals & overlap

Second half: **Big Data (Association/Causation)**

1. Coincidence & Law of Very Large Numbers
2. Confounding: Influence on stat. significance
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**Need Focus/Support Group
to Change Statistical Education**

Need feedback/support from statistical educators

- who deal with observational studies (business, sociology, education, social work, law, health),
- who focus on general education and the humanities (political-science, history, journalism), OR
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If interested, e-mail Schield@Augsburg.edu

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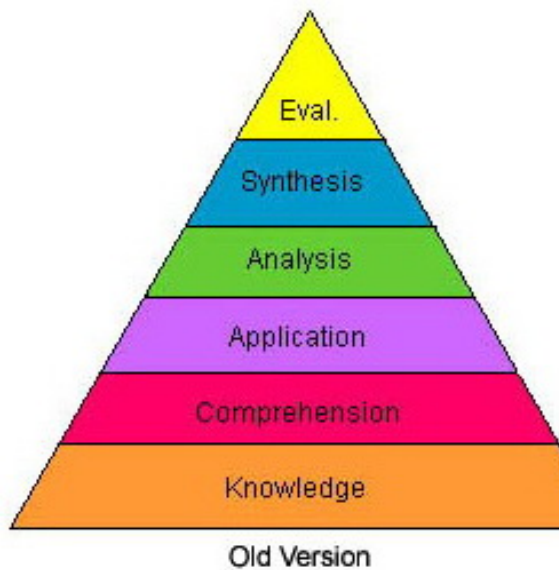
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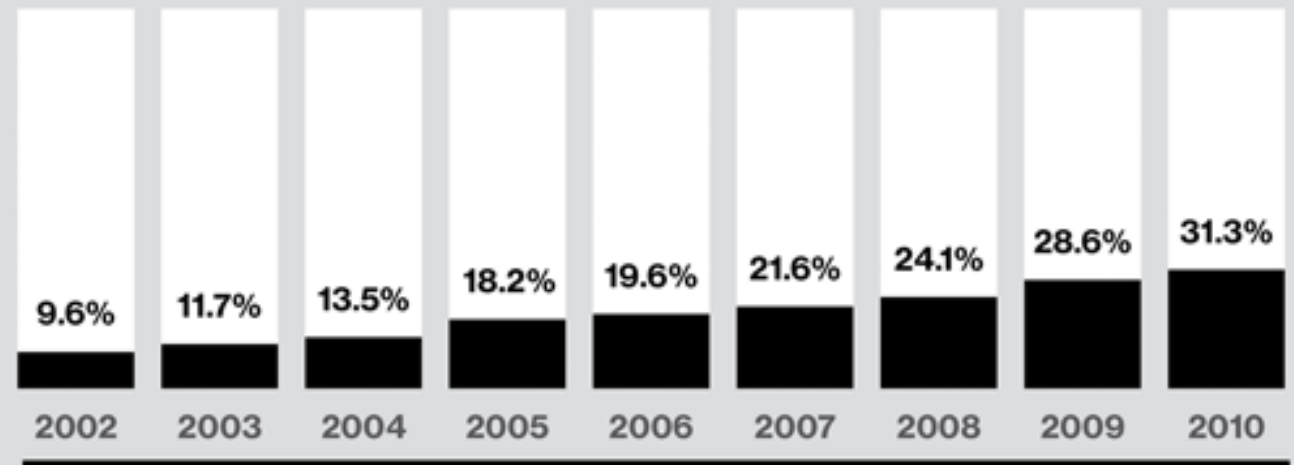
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Education Gets Disrupted, Gradually

The percentage of U.S. college students enrolled in at least one online course



Source: Babson Survey Research Group



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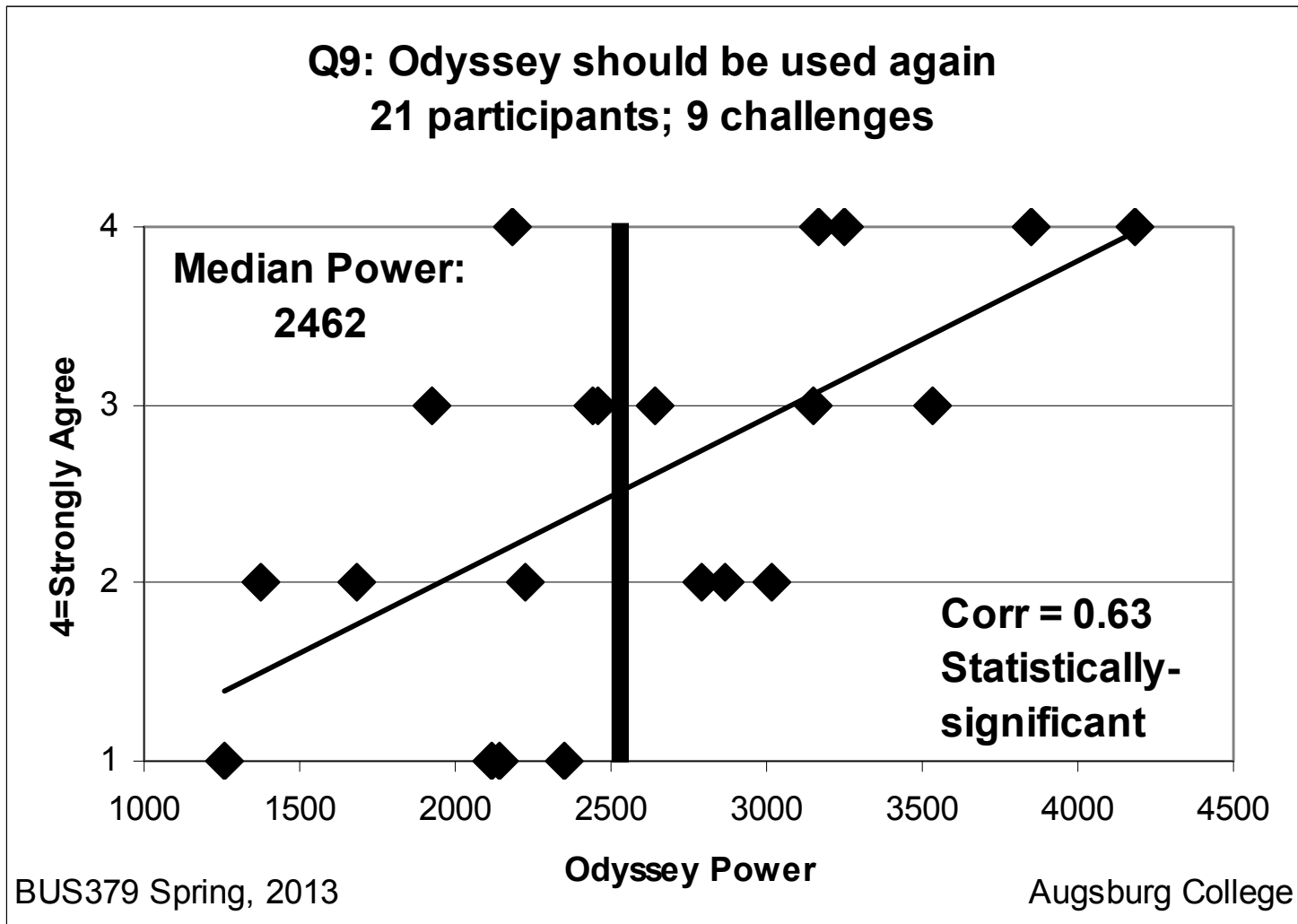
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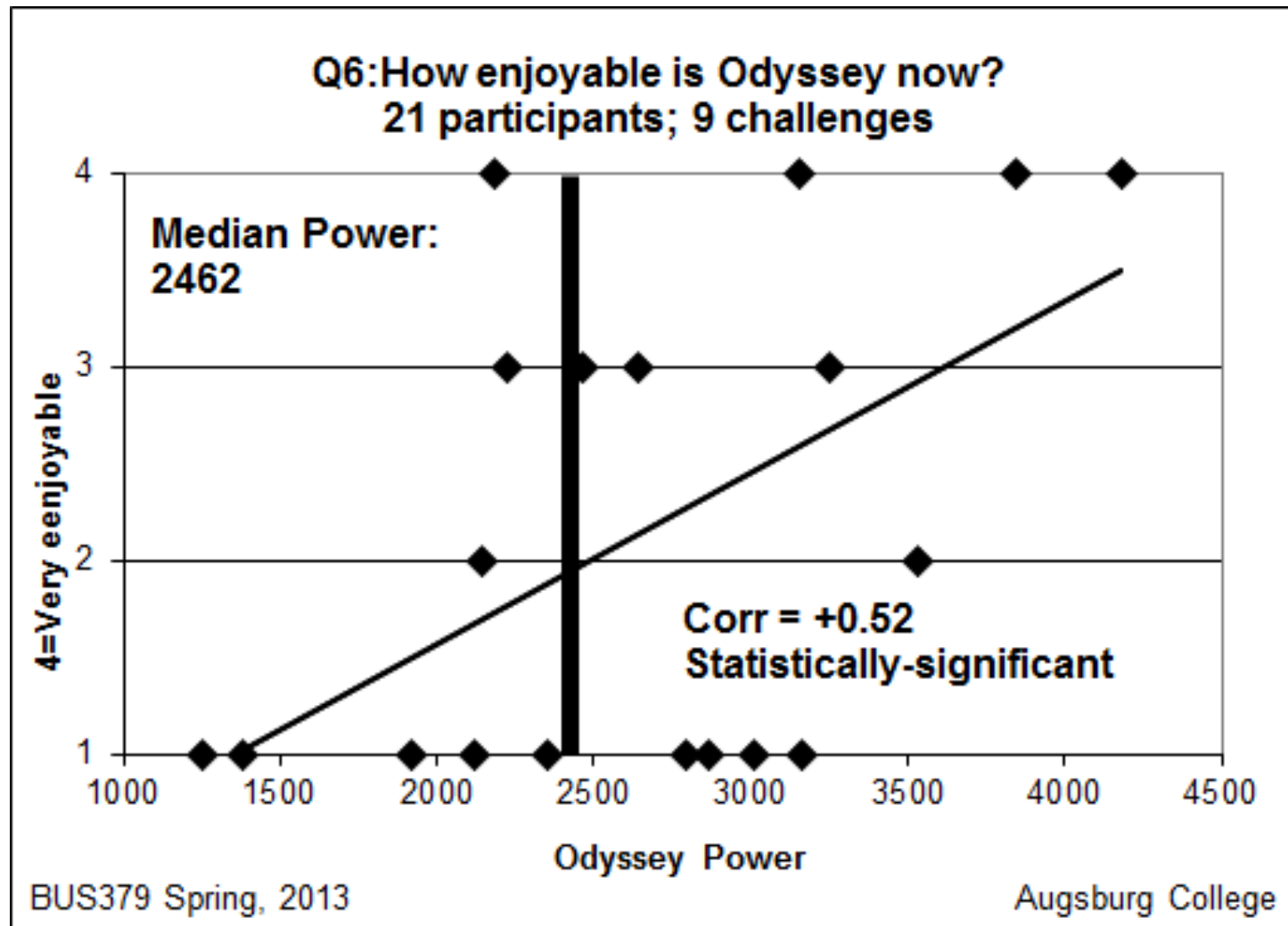
Use Odyssey Again?

Best students like it most!



Is Odyssey Enjoyable?

Best students agree more!



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