

- Please fill out a survey.
- You may add comments on the back.
- Keep the survey for reference during my talk.
- Return it to me at the end of the session.

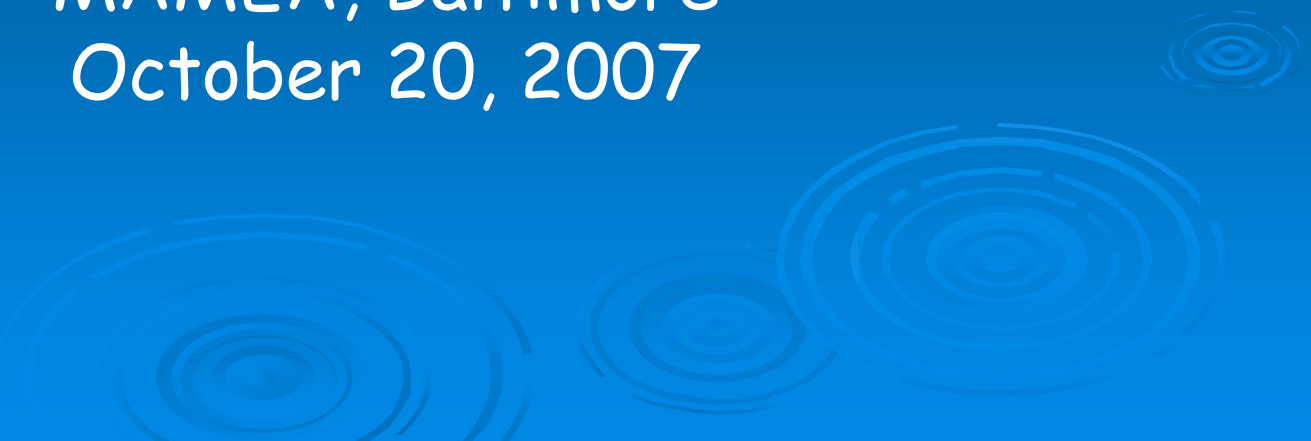
THANK YOU FOR YOUR HELP!!

Survey is posted online at:

http://www4.ncsu.edu/~cncudaba/Education/MySurveys/Fall07_pre.pdf


Measuring Ocean Literacy

C. Cudaback
North Carolina State University
at
MAMEA, Baltimore
October 20, 2007



What is Ocean Literacy?

Content-related definitions

- ocean/human interactions (COSEE)
 - 7 essential principles (COSEE)
 - 10 key points (Garrison)
 - 3 levels of understanding (NEETF)
 - 1) environmental awareness
 - 2) small personal steps
 - 3) environmental literacy
- 

Measuring Content Knowledge among Undergraduates

- open ended questions first
- Jan, 2005, pre-class survey
- thematic content analysis
- responses fell into 8 essential principles



What interests you about the ocean?

EP1: big ocean, many features

EP2: shapes features of earth

EP3: weather and climate

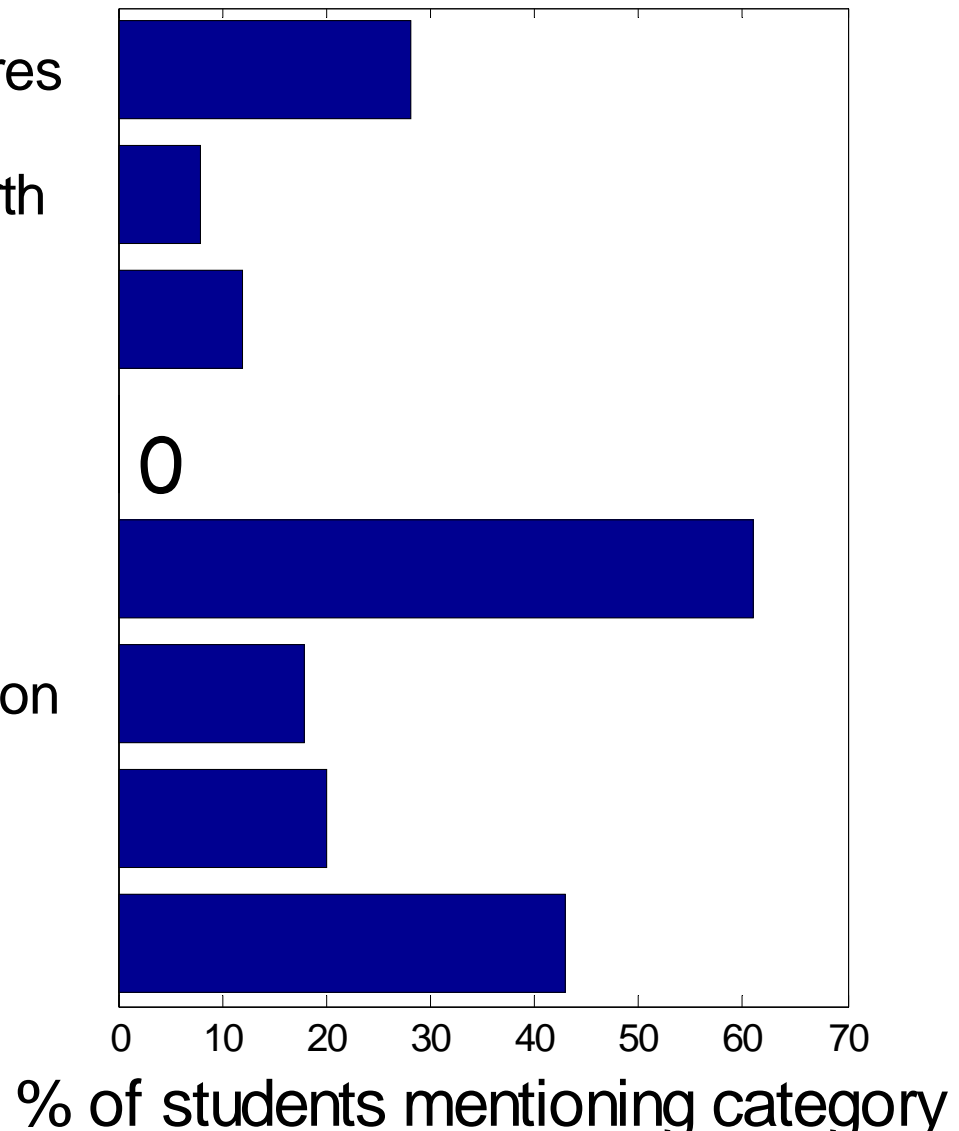
EP4: makes earth habitable

EP5: life and ecosystems

EP6: ocean/human connection

EP7: largely unexplored

personal connection



Beyond Content

COSEE (2005)

understanding

communication

policy decisions

Attitudes

- nature & relevance of science
- environmental ethics



Pre-class essay:

What interests you about the ocean?

"There is so much that we don't know, and that's very intriguing. We probably know more about outer space than we do about deep-sea ecosystems,"

"It makes my imagination go wild."

"Every moment brings something new."

"I feel a type of completeness
I don't feel anywhere else."

"I like the power, energy, motion,
and sounds of the waves."

"Mysterious and scary...
beautiful and intriguing."

"The ocean is the last semi-sacred place on Earth,
where humans haven't colonized and totally
demolished the place."



Can teachers channel this passion?

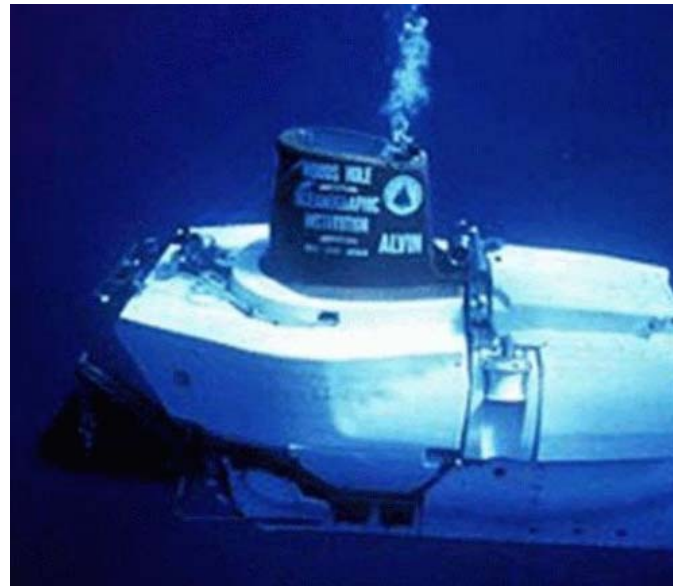
The role of conversation in Ocean Literacy

Pre-class:

"[I want to] impress girls at the beach with my knowledge of why the ocean does what it does."

Post-class:

"It seems like now anytime I hear someone... speak about the ocean, I just want to jump in and explain everything I know."



Learning Objectives: 2 x 2 Matrix

	Ocean Science	Ocean Stewardship
Content	understand ocean science	understand human impacts on the ocean
Attitudes	perceive science as a useful tool	feel responsible for ocean conservation



A Valid Survey Instrument measures what students are thinking ... it's hard to do

1) Content Validity

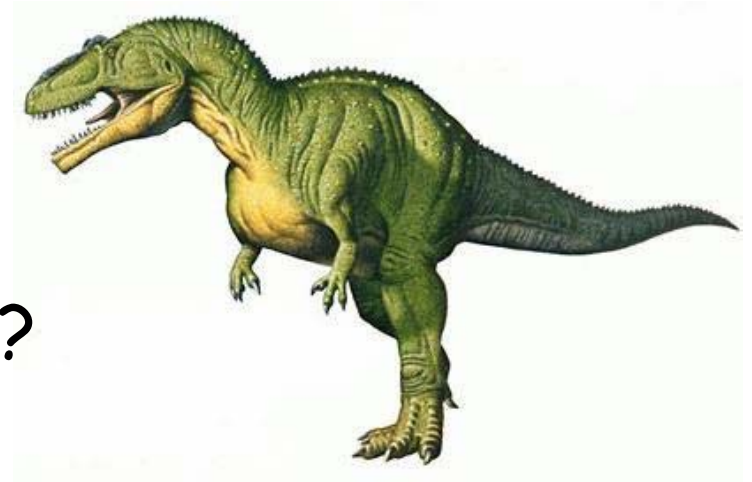
Asking correct questions?

2) Construct Validity

Asking questions correctly?

3) Criterion - Related Validity

My results match others?



Science Content Quadrant (scientists teaching)

Objectives

Teaching



Learning



Research

1. cover material
2. students understand concepts
3. students pass exams
4. Bloom's taxonomy
5. Geoscience Concept Inventory

Stewardship Content Quadrant

Academia

- last chapter of many texts

Other Sources

- public surveys ~3/150 questions
- conservation organizations
- media - LA Times, Nat. Geographic, Discovery

... inquiry guided learning!

Science Attitudes Quadrant (science is relevant and useful)

- implicit in many science courses
- good attitude => good content learning

Formal educational research

- language: domains, validation, reliability
- instruments: VNOS, VASS, CLASS

Stewardship Attitudes Quadrant (I should look after the ocean)


Public opinion surveys by polling firms

- for education/conservation
- large samples: *e.g.*, 1500 phone surveys
- instrument validation rarely reported
- no teaching/learning

Educational surveys

- SOAK, R. Fortner
- MASTS, J. Lambert

Questions about Student Attitudes Regarding Ocean Science and Ocean Stewardship

1. How are different attitudes related?
 2. Does an introductory course improve attitudes?
 3. Do attitudes predict class performance?
 4. What does it mean to be an expert?
- 

Attitude Data Collection

Fall, 2006 NCSU

- honors, 12 students, pre & post

Spring, 2007, NCSU and Orange Coast College

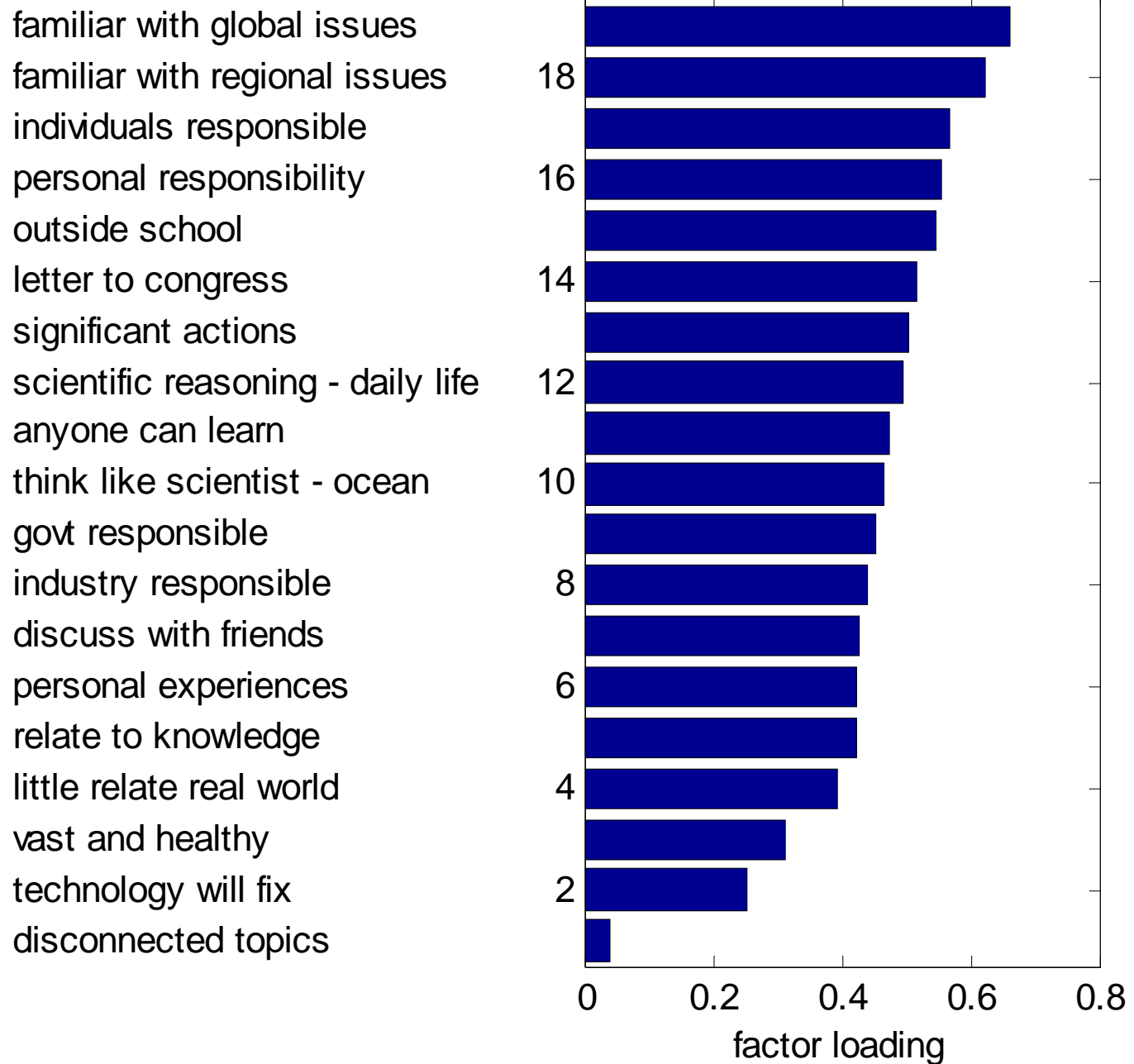
- First Year Inquiry, 16 students
- E. Knowles distance, 16 students
- T. Garrison, 280 students, post only

Are Different Attitudes Related?

- 19 survey items x 281 undergrads
- 2 universities, 3 teachers
- Spring, 2007, post course

- Cronbach's alpha = 0.86 (out of 1)
- good inter-item reliability

- factor analysis
- some questions more correlated than others



Items that dominate Factor Loading

I am **familiar** with the environmental issues facing the coastal areas in my home state.

I am **familiar** with the issues facing the global ocean.

Individual citizens should be **responsible** for protecting marine environments.

I have a personal **responsibility** to work for the health of the oceans and coastal areas.

Empowerment and responsibility

Does introductory course improve attitudes?

- 15 survey items x 43 undergrads
- not including item about global issues
- 1 university, 2 teachers
- Fall 2006 & Spring 2007, pre & post course
- paired-sample t-test: mean score improves
- individual items: some improved more than others
- **empowerment and responsibility**

5 Items Show Significant Improvement

My actions can have a **significant effect** on the health of oceans and coastal areas.

I have a personal **responsibility** to work for the health of the oceans and coastal areas.

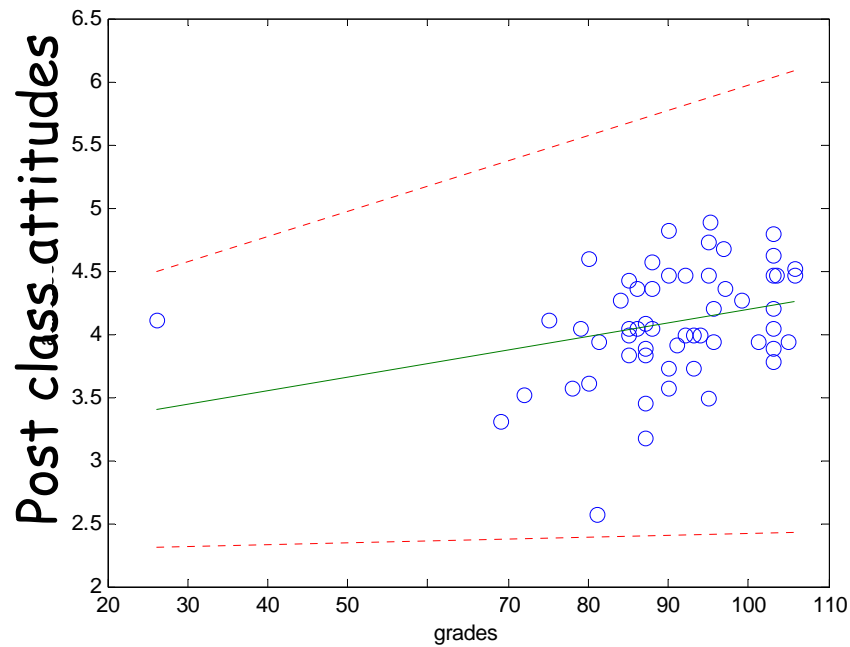
I am **familiar** with the environmental issues facing the coastal areas in my home state

I have **enough background knowledge** to write a substantive letter to my congressional representative about an issue affecting the ocean.

When studying oceanography, I relate the important information to what I already know rather than just memorizing it the way it is presented.

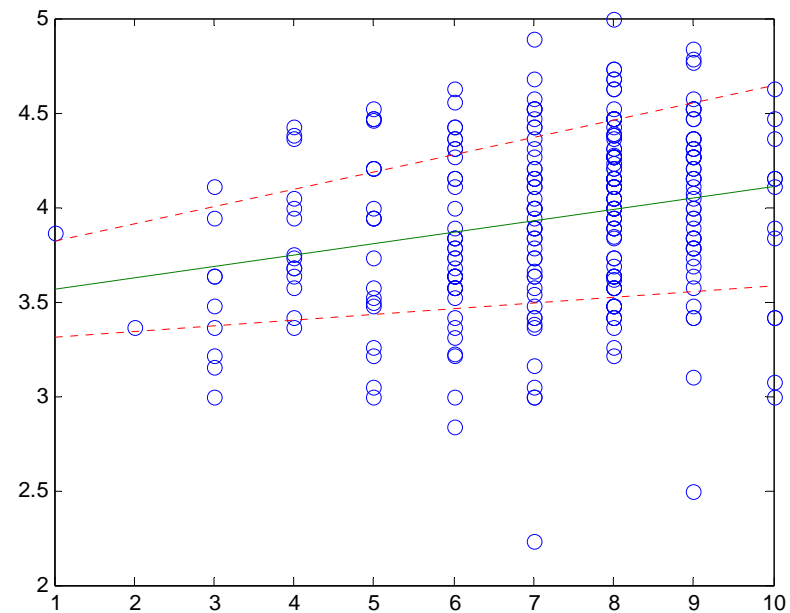
Attitudes Correlate with Content Knowledge

$n = 56, r = 0.3, p = 0.025$



NCSU Grades

$n = 276, r = 0.23, p = 10^{-4}$



Orange Coast Impact Quiz

Experts **What does it mean to be an expert?**

- NMEA educators (32 + yours)
- Sea Grant scientists & other colleagues

Students

(Thanks to Rachel Bergren and Beth Biegler Hines)

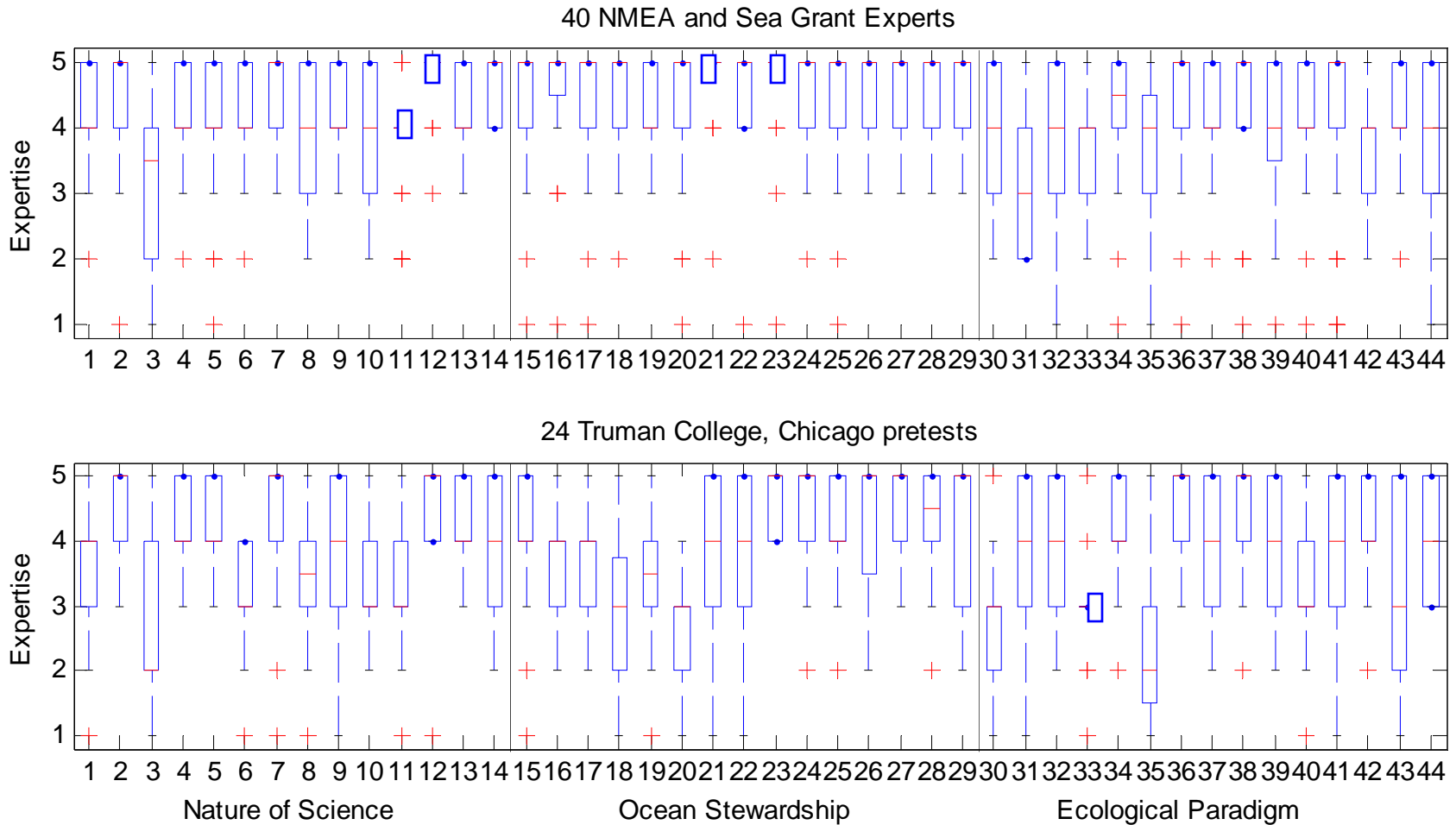
- 120 NCSU, ages 18-25, ethnic mix
- 24 Truman College, older, street smart
- 100 High School students, rich & white

Survey

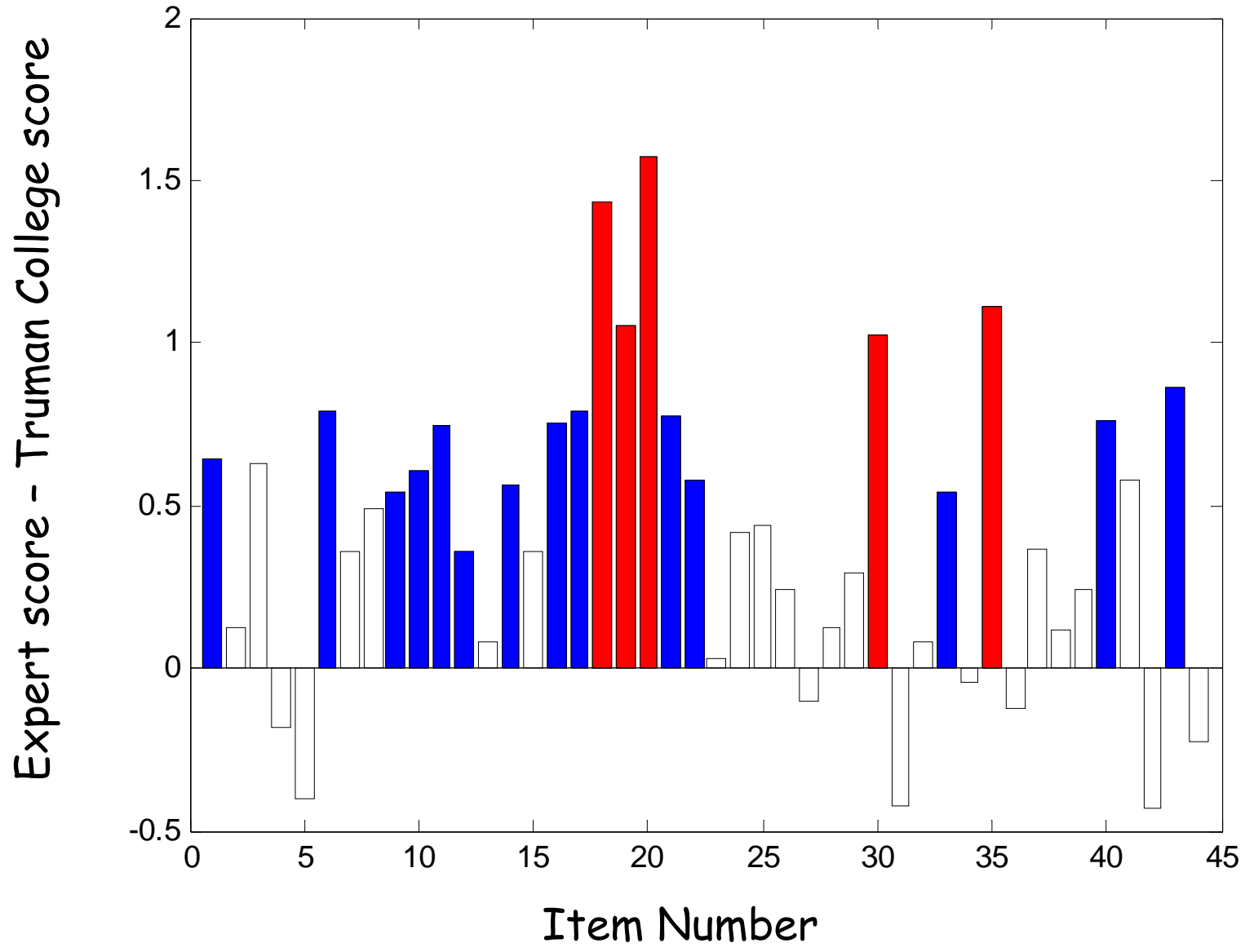
- Nature of Ocean Science, Ocean Stewardship
- New Ecological Paradigm

All 44 items: Compare 40 Experts & 24 Truman College Students

Some Patterns are Visible



Mean Score Difference: Experts - Truman College, Chicago

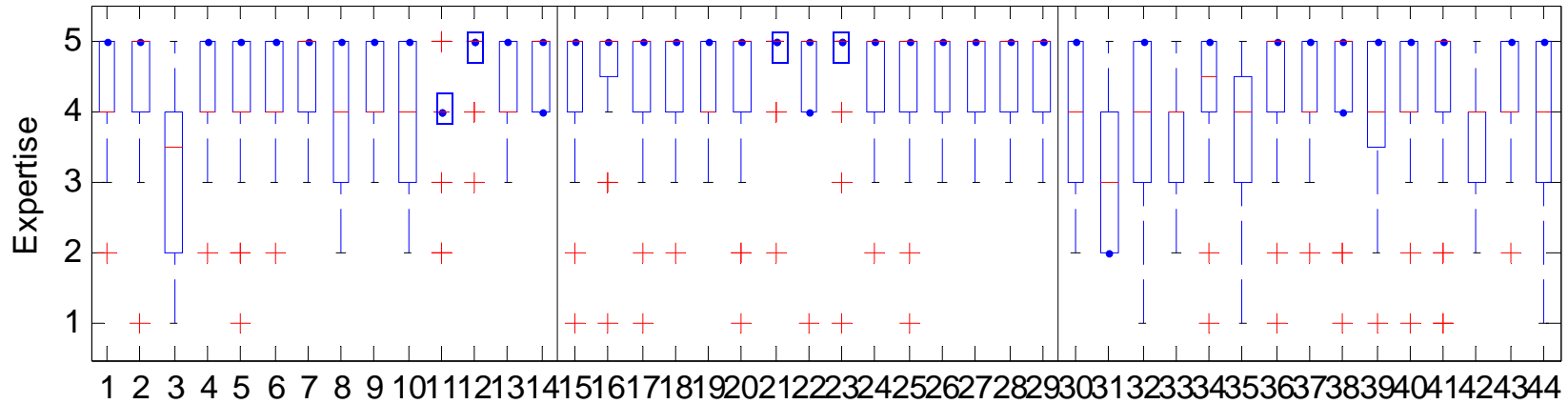


Experts know they are experts

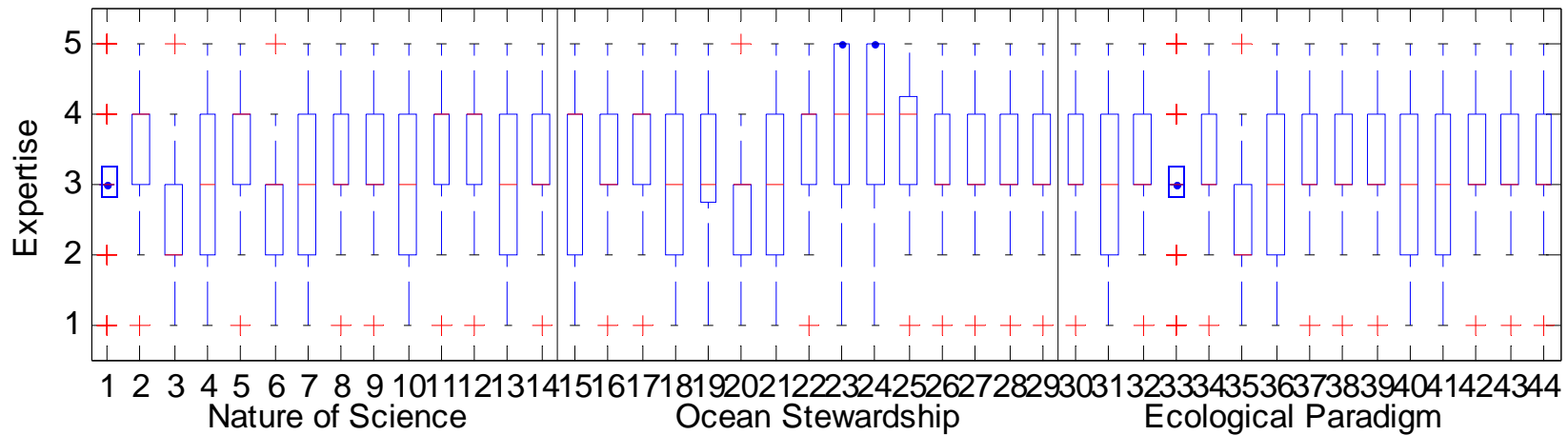
18. I am **familiar** with the environmental issues facing the coastal areas in my home state.
19. I am **familiar** with the issues facing the global ocean.
20. I have **enough background knowledge** to write a substantive letter to my congressional representative about an issue affecting the ocean.
30. We are approaching the limit of the number of people the earth can support.
35. The earth has plenty of natural resources if we just learn how to develop them. (**Disagree**)

78 High School Students in Birmingham are very clearly not experts

40 NMEA and Sea Grant Experts

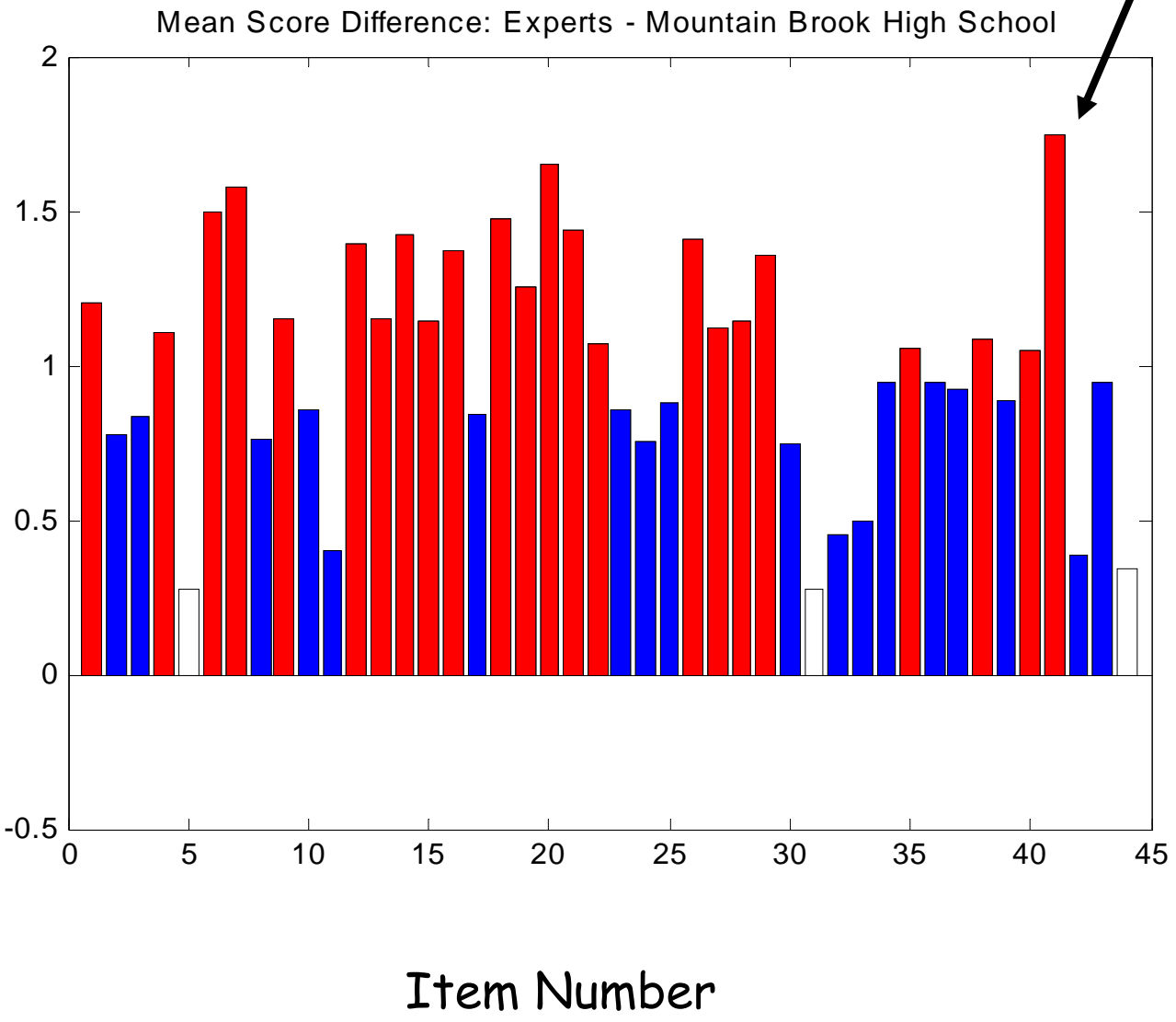


78 Mountain Brook High School pretests



Humans were meant to rule over the rest of nature.

Expert score - HS student score



Attitude Conclusions

Most people are concerned about the ocean.

Empowerment and responsibility are crucial.

- a) Education improves
- b) Experts are empowered
- c) Highly correlated with other attitudes
- d) Predict attitudes about science

Can we improve attitudes about science by teaching about human impacts?

Acknowledgements

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Andrew Newell, Dave Eggleston, Gayle Plaia

Mike Kimberly, Ernie Knowles, Tom Garrison

A photograph of a beach with waves crashing onto the shore under a clear blue sky. The water is a vibrant turquoise color, and the sand is a light beige. The sky is a deep, clear blue. The overall scene is bright and sunny.

Until I Saw the Sea by Lillian Moore

Until I saw the sea
I did not know
that wind
could wrinkle water so.

I never knew
that sun
could splinter a whole sea of blue.

Nor
did I know before,
a sea breathes in and out
upon a shore.