



## The Nightmare

"Surely you were aware when you accepted the position, Professor, that it was publish or perish"



Research Vs Teaching ...

Research About Teaching!



## Goal:

### Measure impact of my teaching

- Teach better => Ocean Literacy
- Write papers => get tenure

### Ocean Literacy

- What is it?
- Can I measure it?
- Can I teach it?



## Defining Ocean Literacy

([oceanliteracy.org](http://oceanliteracy.org))

An ocean literate person

- **understands** ... the functioning of the ocean
- can **communicate** about the ocean in a meaningful way, and
- is able to make informed and responsible **decisions** regarding the ocean and its resources

## Seven Essential Principles (EPs)

1. The Earth has one big ocean with many features
2. The ocean and life in the ocean shape the features of earth
3. The ocean is a major influence on weather and climate
4. The ocean makes the Earth habitable.
5. The ocean supports a great diversity of life and ecosystems
6. The ocean and humans are inextricably interconnected
7. The ocean is largely unexplored

## Measuring Ocean Literacy

- survey based on Essential Principles
- 12 open format questions
- administer at start of intro class
- required but *not graded*
- 119 surveys, Jan, 2006
- revised survey as post test, May, 2006
- pre and post test for future classes
- other intro classes, NOSB, teaching teachers

## What I set out to learn

1. Can I measure how well students understand the ocean? (develop a survey instrument)
2. How well do students understand the ocean, before the start of class? (administer a pre test)
3. Does the class improve their understanding of the ocean? (compare pre and post tests)

## What I set out to learn

4. Does initial ocean literacy predict class grade? (compare pre test with quiz scores)
5. Does ocean literacy correlate with college, year? (collect demographic information)

## What I learned

1. Test development and validation are tricky. The survey instrument is a work in progress.
2. It's easy to find out what topics interest students, harder to measure understanding.
3. Preliminary analysis suggests that *a priori* ocean literacy is weakly correlated with class grade

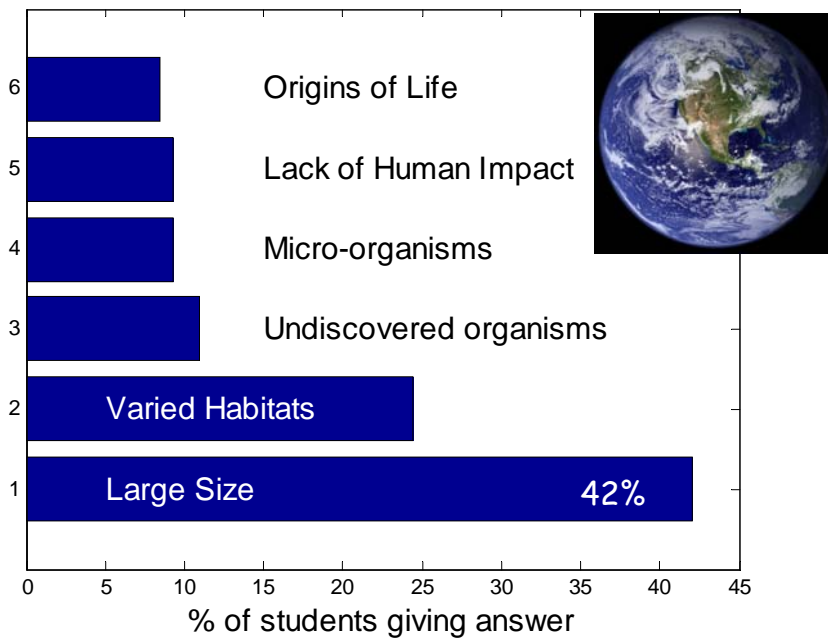


## EP5: The ocean supports a great diversity of life and ecosystems

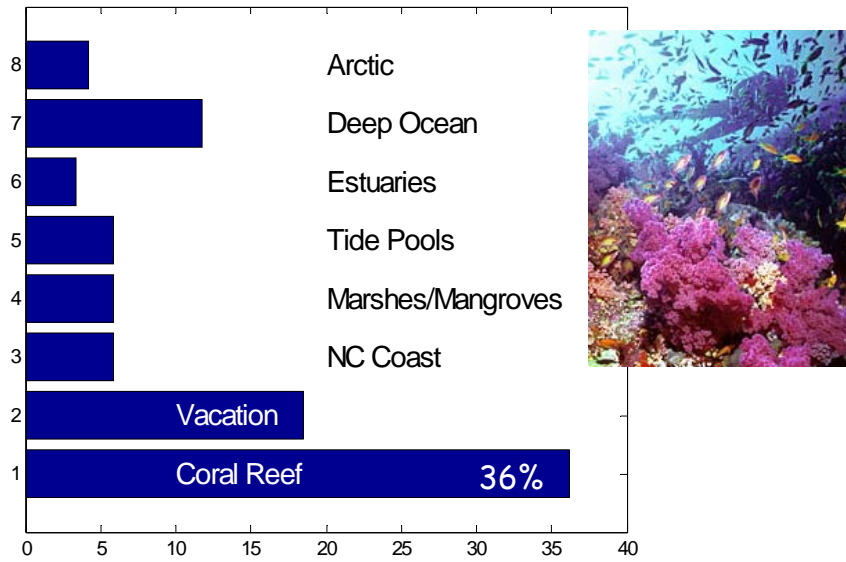
### Questions:

- Is there a greater variety of living organisms on land or in the ocean?
- Why?
- Describe an oceanic environment you find interesting, and the ecosystem in that environment.

### Why is life more diverse in ocean than on land?



### Describe an oceanic environment and its ecosystem



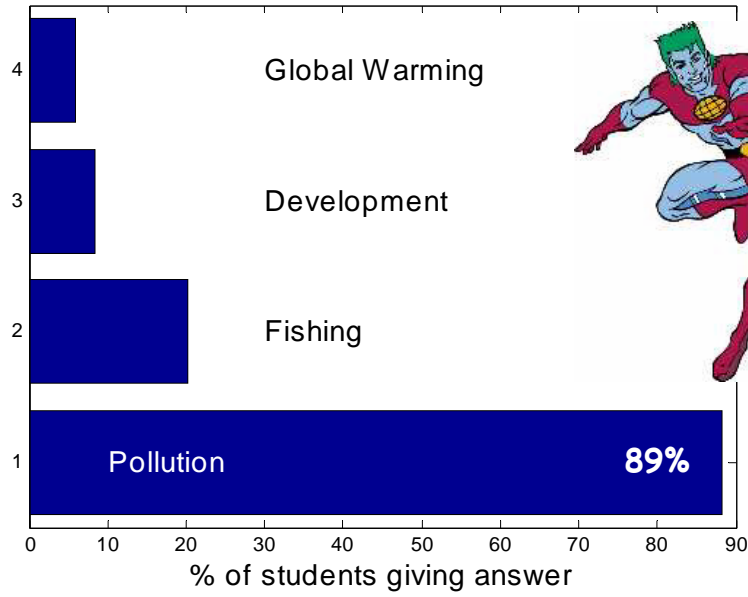
## EP6: The ocean and humans are inextricably interconnected

### Questions:

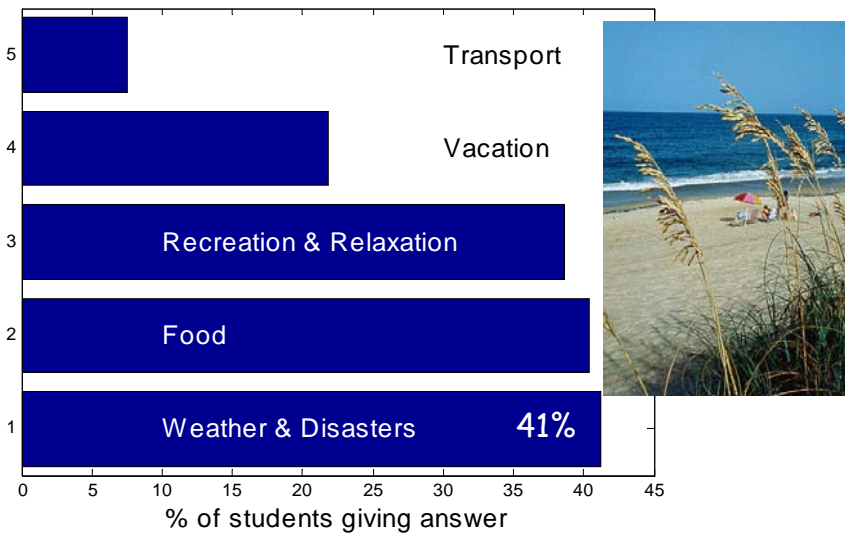
- Discuss some ways your actions affect the ocean.
- Discuss some ways the ocean affects you.



discuss some ways your actions affect the ocean



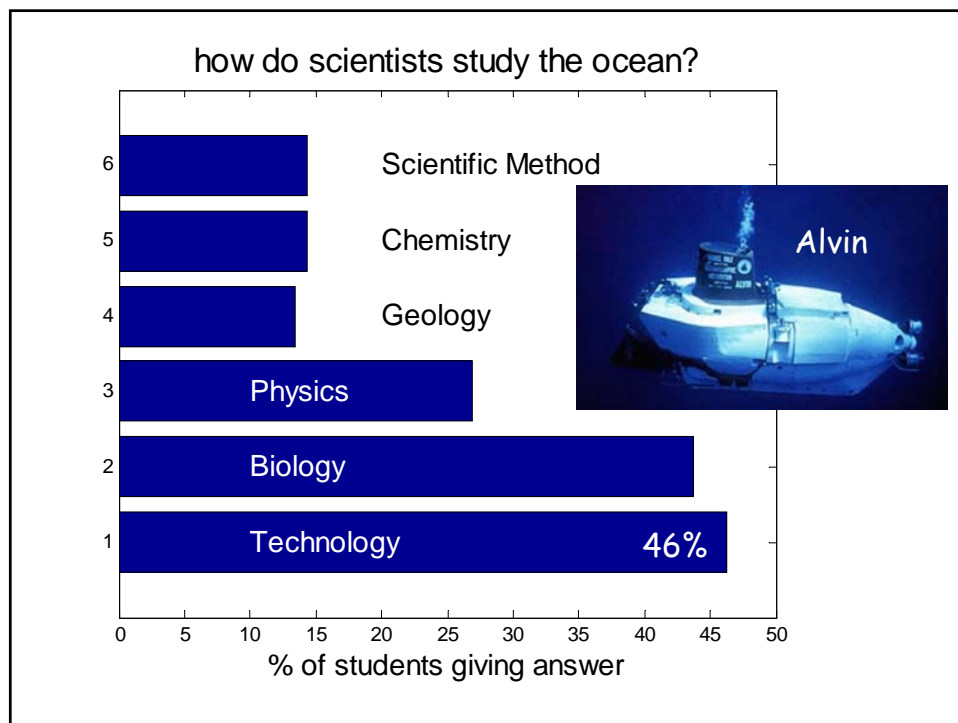
discuss some ways the oceans affect you

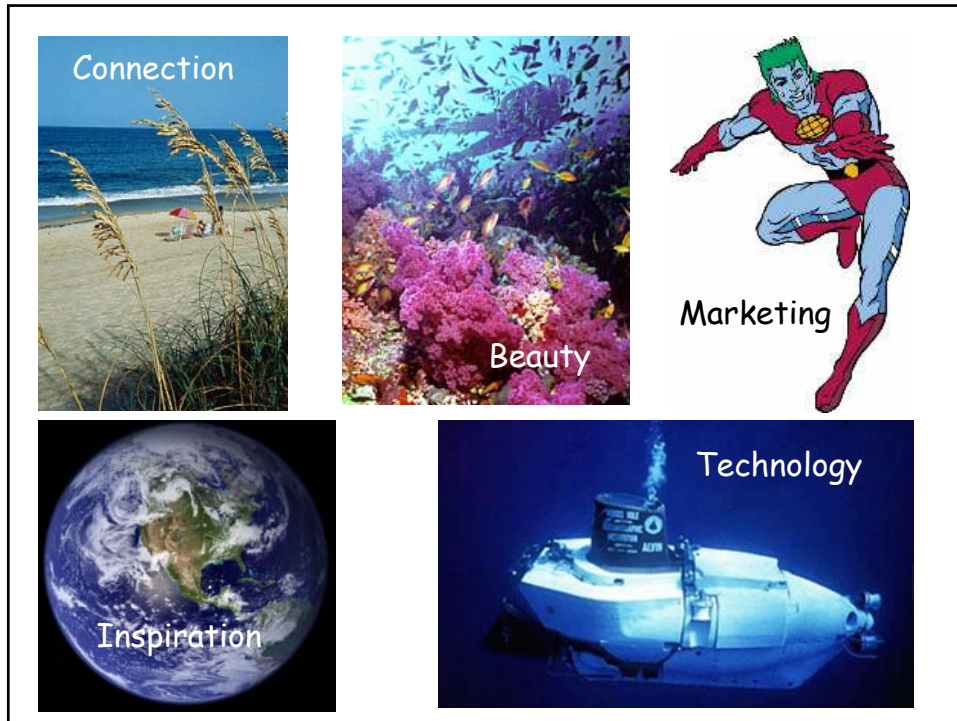


## EP7: The ocean is largely unexplored

### Questions:

- Do we know all there is to know about the ocean?
- Describe a few ways scientists study the ocean.



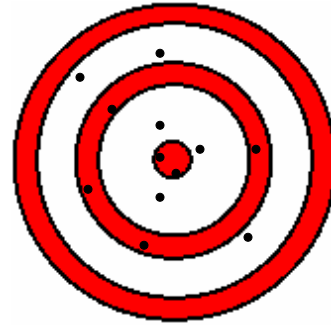


Attitudes, Awareness .... Whatever!

What do the students actually know?



Reliable but Invalid  
Test by Statistics!



Valid but Unreliable  
No Statistical Tests

Reliable test helps predict future results.

Valid test measures what you really mean it to measure.  
Need to define objectives clearly!

**There are no stupid questions,  
only stupid answers**

... but questions can be

- invalid: too easy to guess
- unreliable: getting it right doesn't correlate with a high overall score.

## EP1:

The earth has one big ocean  
with many features.

### Questions:

87%

- Can water from the Mediterranean Sea travel to the Arctic Ocean?
- How?

## Preliminary Scoring

How can water travel Mediterranean to Arctic?

### Semi-literate:

54%

- evaporation & rain
- currents are always in motion

### Literate:

18%

- Evaporation by sun then atmospheric current pushes to destination and released by precipitation.
- The water would flow south then transatlantic to the Gulf Stream. The Gulf stream would then carry it North to the Arctic

## EP1: The earth has one big ocean with many features.

### Questions:

- How deep is the ocean, on average?
- What familiar size or distance is similar to the depth of the ocean?

### Answers:

- 2-6 km 28%
- mountains or miles 34%
- football fields 9%

### Interpretation:

- Appalachians (too short) Himalayans (too tall)
- need to express in personal terms - e.g. running

## EP1: The earth has one big ocean with many features.

### Questions:

- How much of the Earth is covered with ocean?
- What fraction of the water on Earth is in the ocean?

### Answers:

- coverage: 70-80% 78%
- fraction: 90-99% 48%

### Interpretation:

- educators mention the size of the ocean often
- "3/4" is easy to visualize, "97%" is not
- class exercise!

## EP2. The ocean and life in the ocean shape the features of earth

### Questions:

Describe one or two processes that affect the shape of the coast.

Not yet scored

## EP3. The ocean is a major influence on weather and climate

## EP4. The ocean makes the Earth habitable.

### Question:

Our earth system runs on heat, water, carbon and oxygen, all of which cycle through the earth, ocean, atmosphere and biosphere. For any of these cycles, discuss the importance of the ocean.

Not yet scored

## EP5: The ocean supports a great diversity of life and ecosystems

### Questions:

93%

- ~~• Is there a greater variety of living organisms on land or in the ocean?~~
- ~~• Why?~~
- Describe an oceanic environment you find interesting, and the ecosystem in that environment.

Not yet scored  
Coral Reefs

## Preliminary Scoring

Why ... a greater variety of life in the ocean?

### Semi-literate:

55%

- because it is so big and diverse
- there are much smaller organisms in the ocean

### Literate:

26%

- not as polluted and it's deeper & wider
- far more space (and food) for organisms, and a greater variety of selective pressures



## EP6: The ocean and humans are inextricably interconnected

### Questions:

- Discuss some ways your actions affect the ocean.
- Discuss some ways the ocean affects you.

Not yet scored

### Preliminary Scoring

Discuss some ways your actions affect the ocean

**Semi-Literate: mention pollution only** 59%

- Runoff from your yard can pollute the oceans.  
Pollution can kill the animals of the ocean
- pollution, littering harsh chemicals

**Literate: mention two impacts** 41%

- Vacationing-> encourages development-> can adversely affect wetlands and shore;  
Petroleum-> tanker wrecks (Exxon Valdez)
- Pollution-> changes content of ocean, Voting->  
... policy affecting ocean, Fishing-> wildlife

## EP7: The ocean is largely unexplored

Questions:

100%

- ~~Do we know all there is to know about the ocean?~~
- Describe a few ways scientists study the ocean.

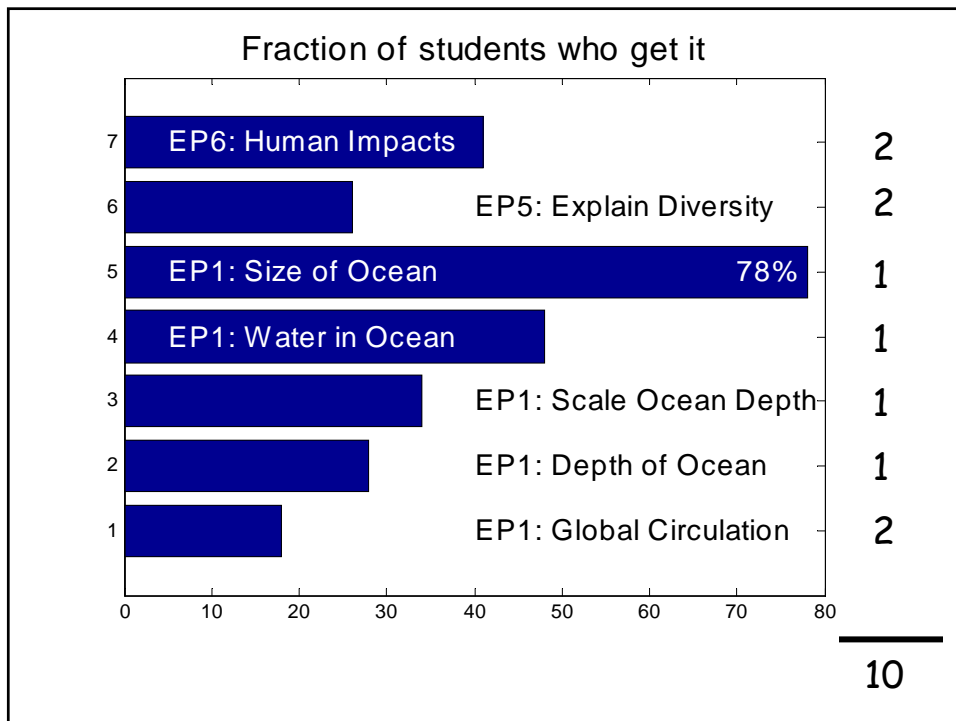
Not yet scored  
Technology & Biology

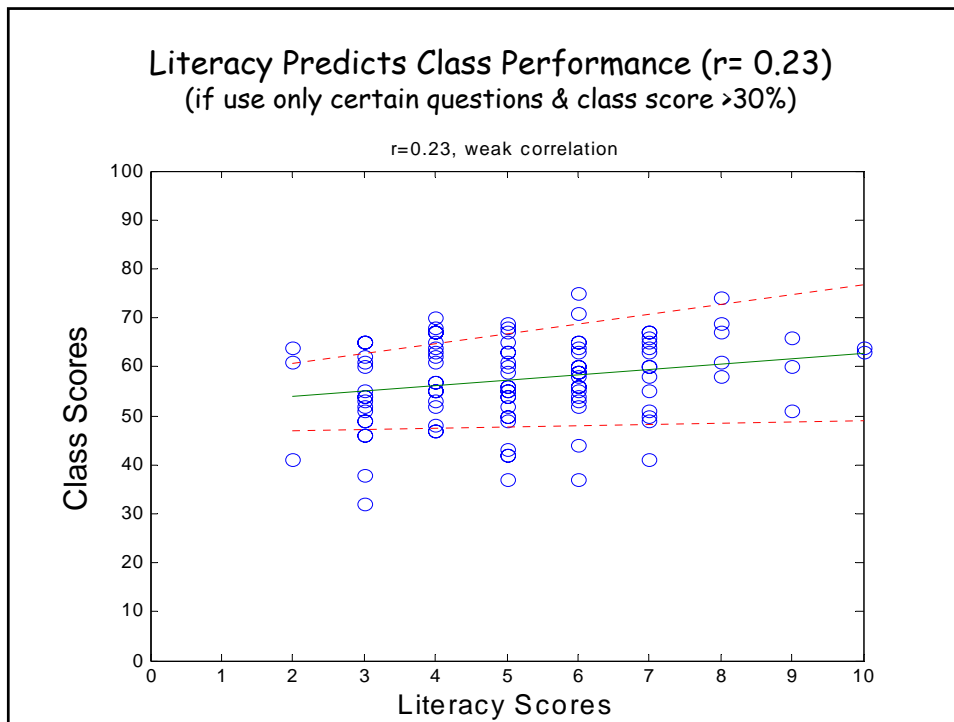
## Nature of Science

Question:

What is science, anyway? Please elaborate.

Tell me what interests you about the ocean, and what you would like to learn about in this class. You may use your latest trip to the ocean as a starting point.





## Compare with general public

### The Ocean Project

5 questions, telephone survey, 1500 adults, 1999

- More plant and animal life is found in the oceans than on land: 39%
- Average score, all questions: 3.8/10

### My students, pretest in oceanography class

- There is a greater variety of life in ocean than on land 93%
- Average score, some questions 5.3/10

## Summary & Discussion

- literacy survey is a work in progress
- probably reliable measure of student interest
- blue marble, beach, coral, Capt Planet, Alvin
- total score on valid questions, average 5.3/10
- student literacy higher than general public
- literacy score predicts class grade ( $r=0.23$ )
- NOSB competitors are as literate as students

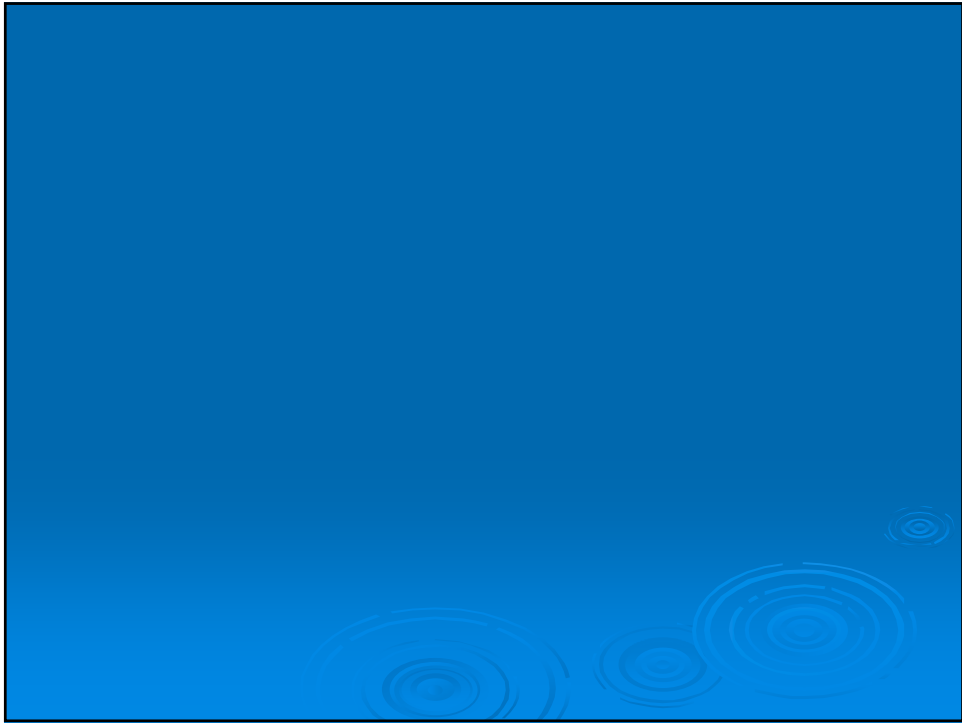
Until I saw the sea  
I did not know  
that wind  
could wrinkle water so.

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

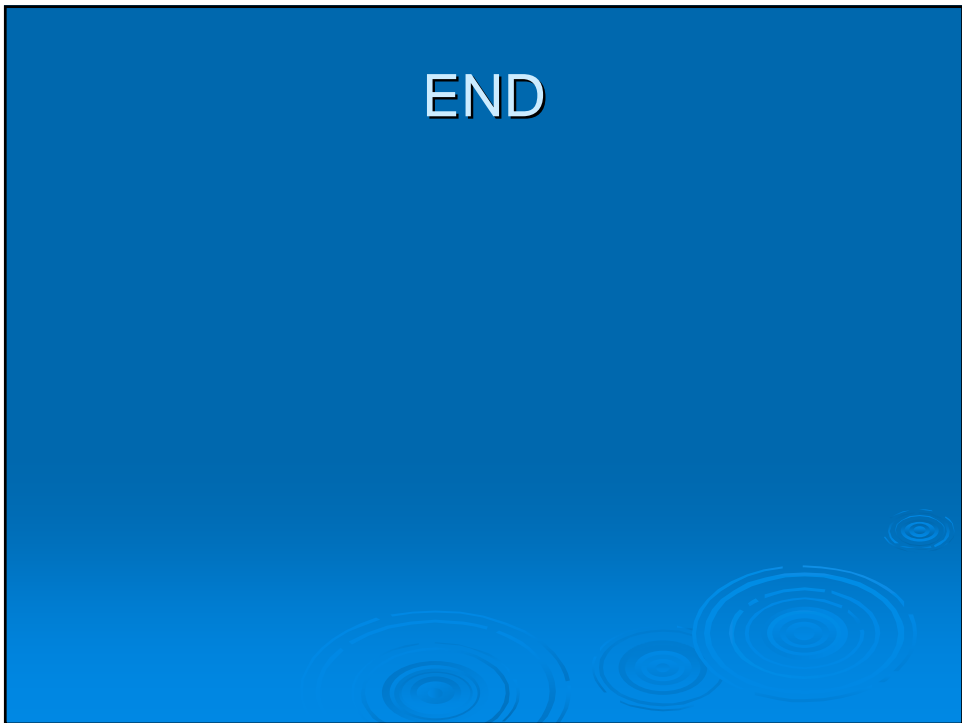
Nor  
did I know before,  
a sea breathes in and out  
upon a shore.

**Until I Saw the Sea**  
by Lillian Moore

<http://nessus.gunslingers.org>



END



' O see not ye yon narrow road,  
So thick beset wi thorns and briers?  
That is the path of righteousness,  
Tho after it but few enquires.

' And see not ye that braid braid road,  
That lies across yon lillie leven?  
That is the path of wickedness,  
Tho some call it the road to heaven.

' And see not ye that bonny road,  
Which winds about the fernie brae?  
That is the road to fair Elfland,  
Whe[re] you and I this night maun gae.

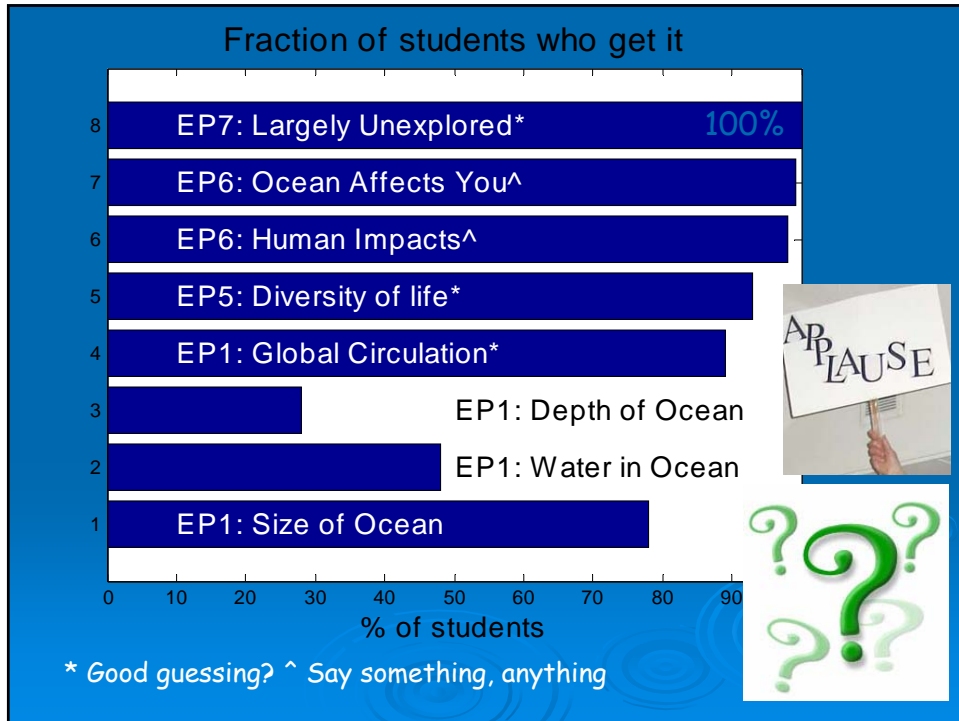
The Ballad of True Thomas

### "How wide", "how deep", "how much?"

- better differentiation - not everyone gets them right
- can score consistently

### "Why?", "How?", "Explain", "Discuss"

- very important - communication aspect of literacy
- good differentiation
- hard to grade - highly qualitative



## EP1:

The earth has one big ocean with many features.

### Questions:

- Can water from the Mediterranean Sea travel to the Arctic Ocean?
- How?

### Answers:

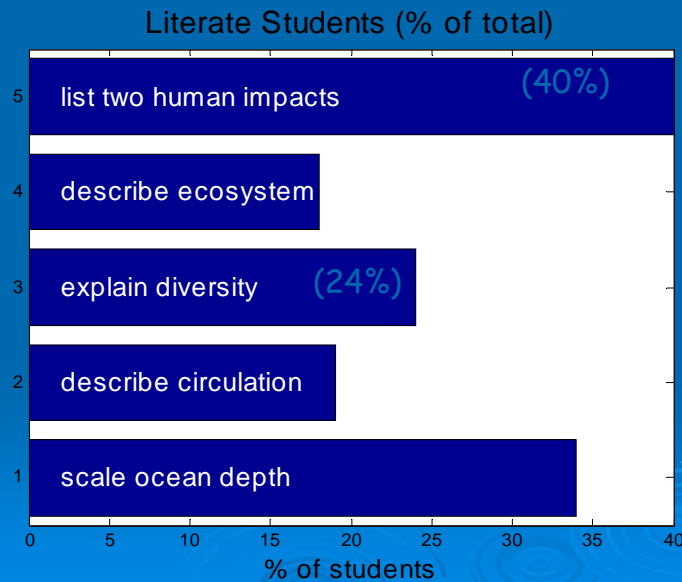
- "yes" 87%
- simple explanation ("currents") 52%
- detailed explanation 19%

### Interpretation:

- Knowledge Vs Communication
- Knowledge Vs Good Guessing



## Preliminary Scoring: qualitative questions



## Conclusions & Discussion

- students appear to know about ocean 79%
- (public knows about ocean 39%)
- students express themselves literately 50%
- literacy predicts class performance  $r = 0.32$
- literacy predicts action? unknown