Measurement of Student Perceptions and Attitudes in Mathematics

Carl Wieman Science Education Initiative, UBC Mathematics

Science Teaching and Learning Fellows: Warren Code, Joseph Lo, Sandra Merchant

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Overview

1. History of the CLASS (pronounce “C-LASS”) surveys.


3. Results from our first version.

4. Lessons from our validation (student, expert)
Goals of this survey

• Sample attitudes, beliefs, perceptions and general dispositions with respect to a discipline.

• Compare student attitudes with typical expert responses.

• Be able to give the same survey at a variety of levels to track attitude shifts.

• Quick: ~35 Likert scale questions, ~8 mins.

• Measure of populations, not individuals.
History of C-LASS

• Original, targeted at Physics: **Colorado Learning Attitudes about Science Survey**

• Later, adapted to Biology and Chemistry.

• [http://www.colorado.edu/sei/class/](http://www.colorado.edu/sei/class/)

• Lots of data, fairly consistent results . . .
Adaptation to Mathematics

Three steps, process is iterative:

1. Identify questions and expert attitudes by surveying experts.
2. Validate questions via student interviews.
3. Categorize questions based on response data.
Categories

- Exploratory and confirmatory factor analysis.
- Some questions load on multiple categories.
- Not every question lives in a category, but we can keep them around for information.
**Relations to real world**
- Reasoning skills used to understand math can be helpful to me in my everyday life. (Q.25)

**Need to understand formulas or procedures**
- It is a waste of time to understand where math formulas come from. (Q.27)

**Dependence on procedures**
- To learn math, I only need to memorize solutions to sample problems. (Q.24)

**Confidence**
- If I get stuck on a math problem, there is no chance that I will figure it out on my own. (Q.36)
**Exploration in problem solving**
- There are times I solve a math problem more than one way to help my understanding. (Q.31)

**Independence in learning**
- I cannot learn math if the teacher does not explain things well in class. (Q.10)

**Uncategorized items**
- Being good at math requires talent. (Q.32)
- I find that reading the text in detail is a helpful way for me to learn math. (Q.7)
Scoring

• Survey “experts” to determine preferential directions for questions.

• For each question with an expert direction, students score 1 for alignment with expert, 0 for neutral, -1 for opposite response (group Strongly Agree with Agree)
Student responses from Fall 2010

- **Differential Calculus**
  - **Math 110** – Two-term course
  - **Math 184** – Commerce and Social Sciences
  - **Math 180** – Physical Sciences and Engineering
  - **Math 104** – Commerce and Social Sciences
  - **Math 100** – Physical Sciences and Engineering

- **Introduction to Mathematical Proofs**
  - Math 220
Grades of upper half attitudes
– Grades of lower half attitudes

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<thead>
<tr>
<th>% difference</th>
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<tbody>
<tr>
<td>Real world</td>
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<tr>
<td>Understanding</td>
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<tr>
<td>Procedures</td>
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<tr>
<td>Confidence</td>
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<td>Exploration</td>
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<tr>
<td>Independence</td>
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Graph indicates % difference in grades for different categories.
Validation

• Handful of summer Calc 2 students so far.

• Boosted to 45 questions to try some new ones.

• A lesson to learn over and over:
Validation

• Handful of summer Calc 2 students so far.

• Boosted to 45 questions to try some new ones.

• A lesson to learn over and over:

  You can learn a lot by asking students what they think.
Replace “physics” with “math”? 

- Reasoning skills used to understand *physics/biology/chemistry* can be helpful to me in my everyday life.

- To understand *physics/biology/chemistry*, I sometimes relate my personal experiences to the topic being studied.
Reasoning skills used to understand math can be helpful to me in my everyday life. 

Expert responses (N=22):
To understand math, I sometimes relate my personal experiences to the topic being studied.

Expert responses (N=22):
Summary of initial findings

• Math experts don’t agree on the same things as other science experts with respect to their own discipline.
• “Expertise level” correlates with performance in Calc 1 in our matched data.
• Students in courses requiring more math background have more expert-like attitudes.
• Attitude shifts are generally negative in the first year, though this is typical of the CLASS.
Expected (typical) results

• Shift away from “expert” attitudes early in university unless attitudes are tackled during courses, independent of teaching method.

• Some predictive value in terms of program retention and course performance.

• Gender differences in confidence and levels of interest.
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