

# MAPS – Math Attitudes and Perceptions Survey

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# [ Abstract ]

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Student perceptions of mathematics play a role in their motivation and approaches to learning in their math courses. We adapted an existing survey for Physics and surveyed students at the beginning and end of a range of Math courses (including several first-year calculus courses). This has allowed us to assess student attitudes and perceptions relative to those of experts, and to track how they shift over time. We present our development of the survey and some of these initial results.

# [ What is it? Why bother? ]

- Our Math Attitude and Perception Survey (MAPS) modelled on the C-LASS\* for Physics developed at Colorado U (adapted to Biology and Chemistry so far).
- Surveys alignment of student attitudes with professional academics in the field.
- More a measure of population, not really of individual students.
- Good at finding low scores and shifts over time.

\*C-LASS: Colorado Learning Attitudes about Science Survey

# [ Development ]

- Determine Expert Approach
  - What items do experts care about and agree on?
- Field Test
  - Run the survey with actual students.
- Categories
  - What questions make sense as group?
- Validate
  - Are students interpreting the questions consistently?
- Iterate (about 1 to 2 years)

# [ Categorization ]

- Start with questions that appear related.
- Use some form of Factor Analysis
  - Which groups of questions are usually answered in the same direction but independently from the other questions/blocks? (Move beyond pairwise correlation)

- 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)

# [ Category Scores ]

– An expertise index?

- For each statement, a score of -2, -1, 0, 1 or 2 is assigned.
- The scores are summed up for each category.
- The category scores are normalized to a scale from -1 to 1.
- Positive being expert, negative being novice.



# Who did the survey?

## ■ Differential Calculus

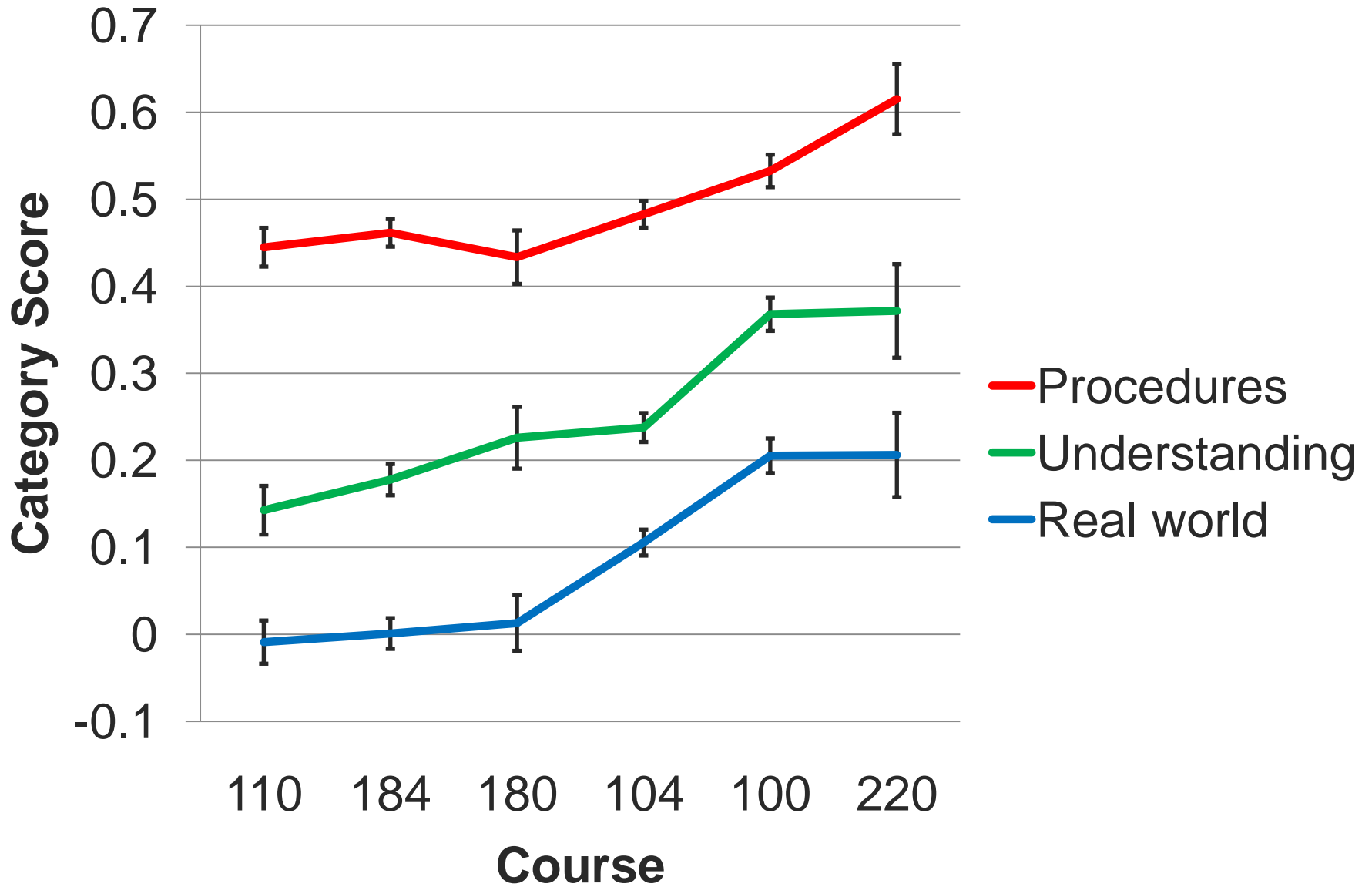
- without calculus background
  - Math 110 – Two-term course
  - Math 184 – Commerce and Social Sciences
  - Math 180 – Physical Sciences and Engineering
- with calculus background
  - Math 104 – Commerce and Social Sciences
  - Math 100 – Physical Sciences and Engineering

## ■ Introduction to Mathematical Proofs

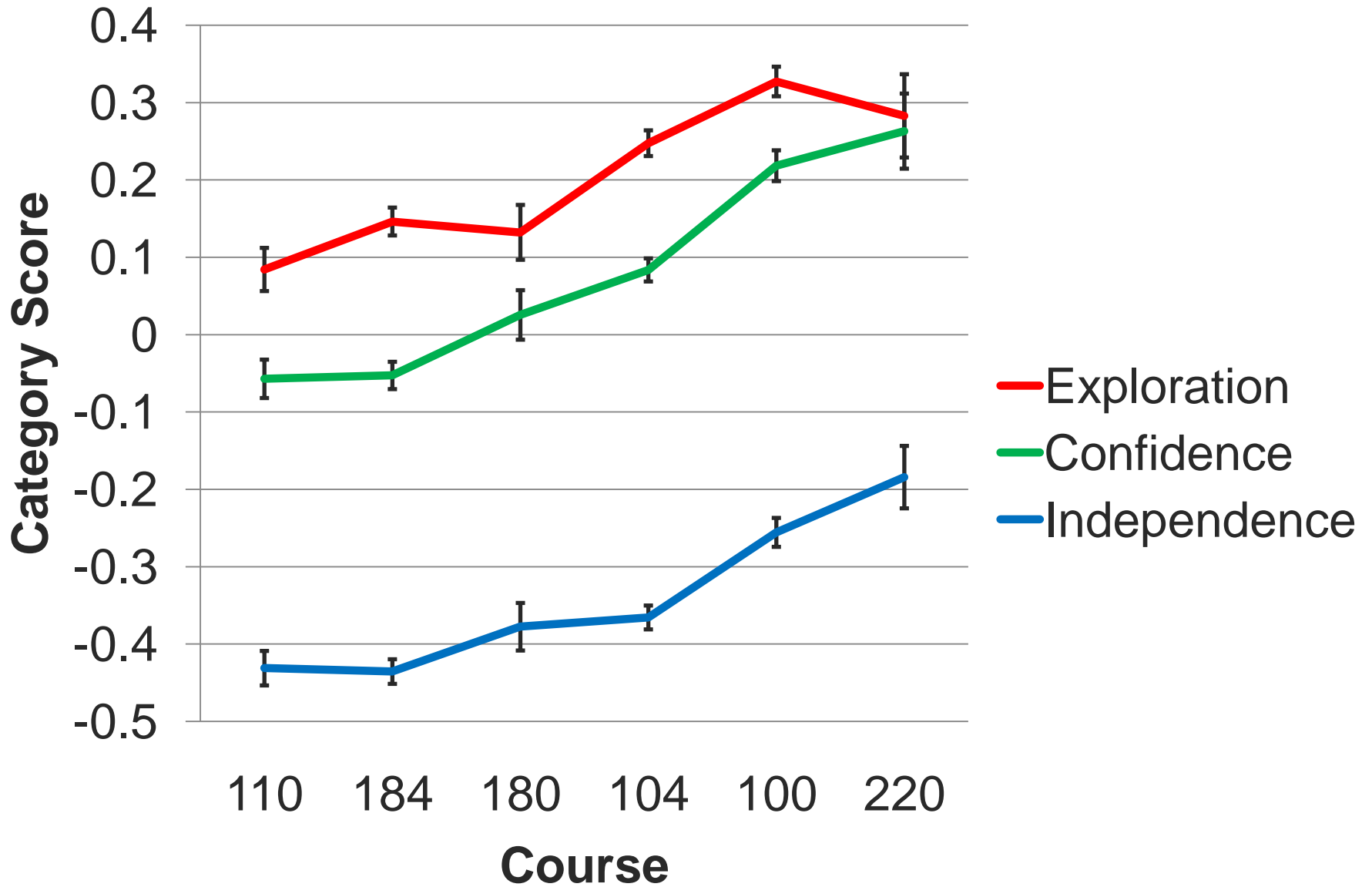
- Math 220

## ■ Repeats and new courses, 2011W

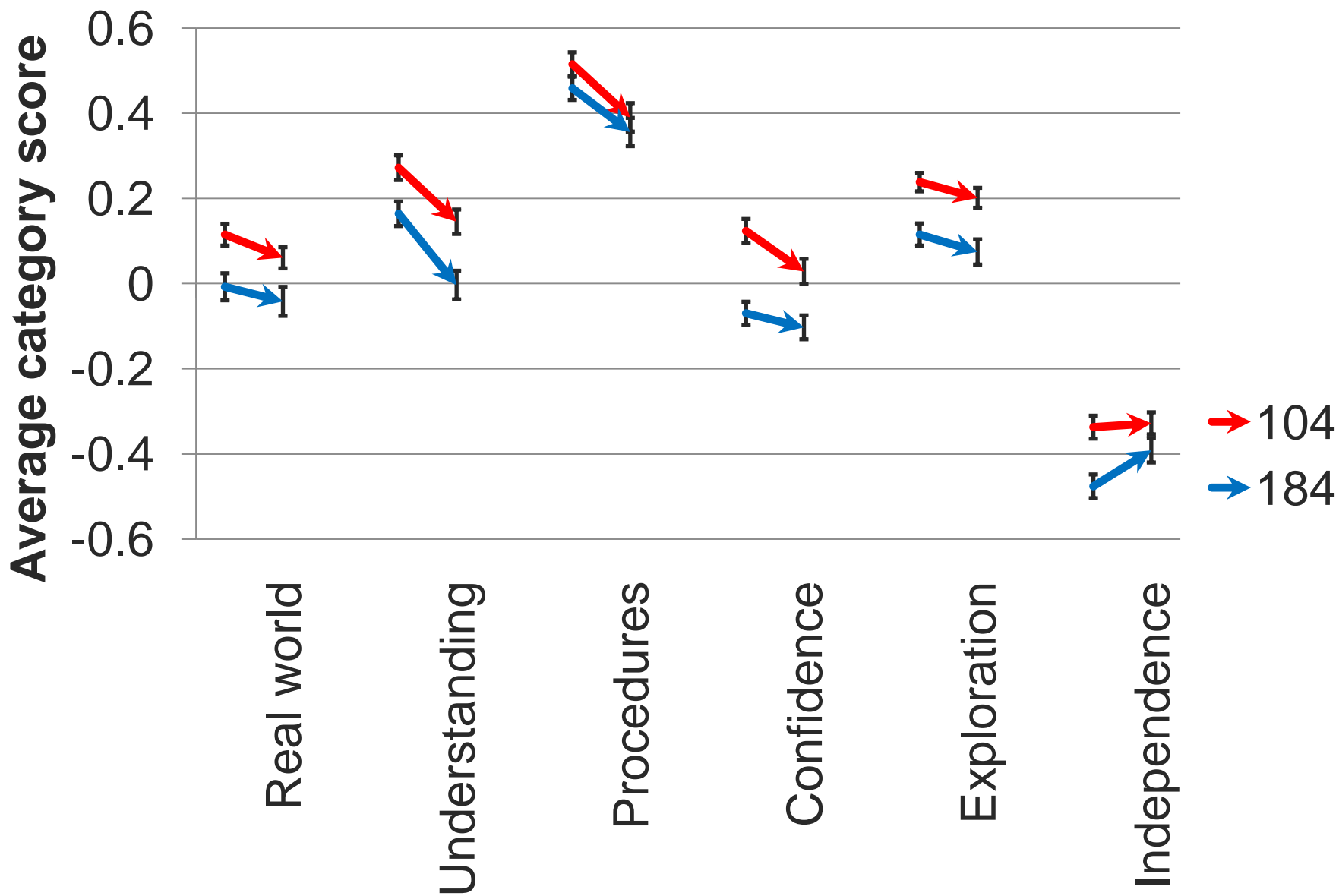
# Attitudes: Start of Term 2010W



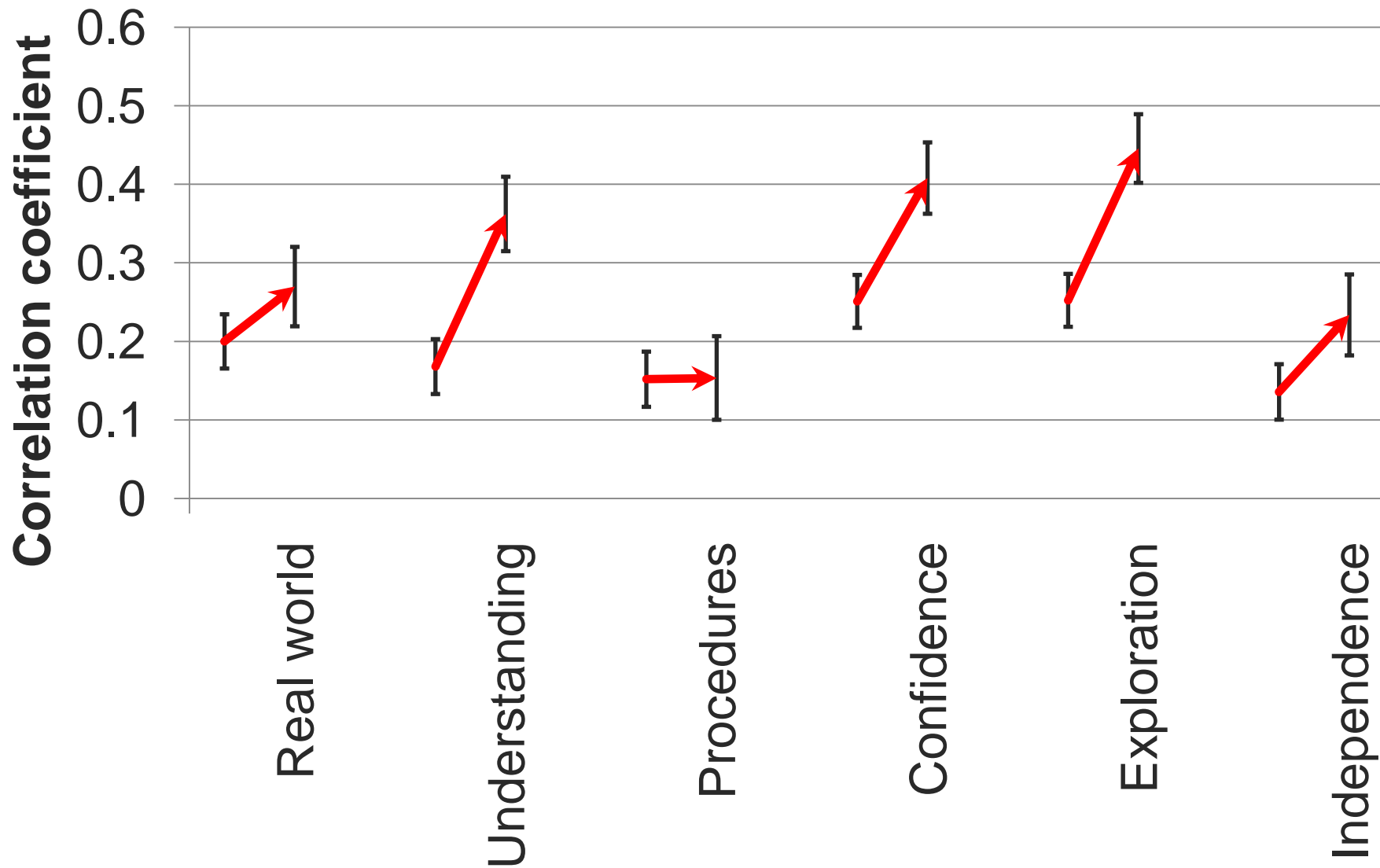
# Attitudes: Start of Term 2010W



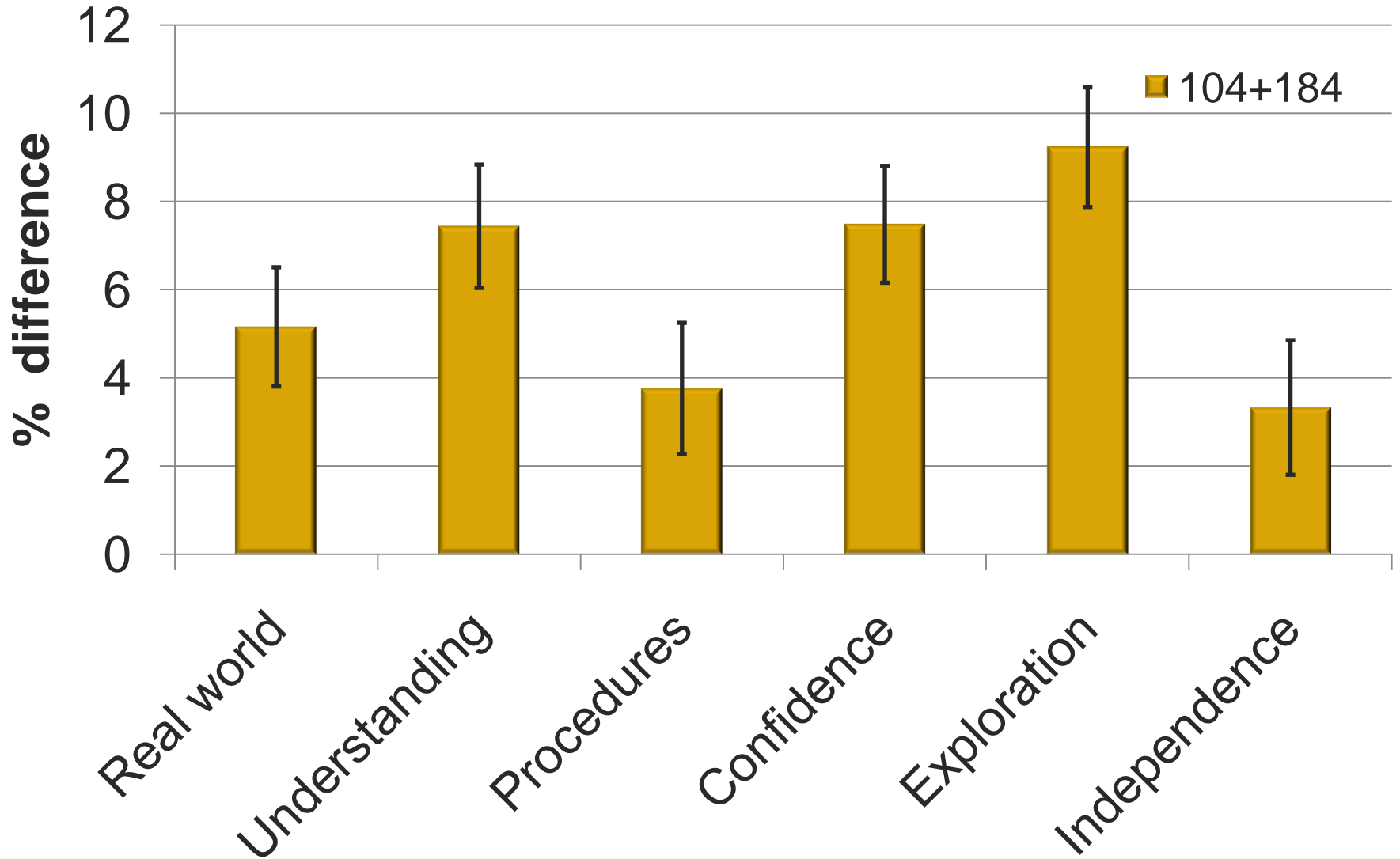
# Shifts of Category Scores, Pre to Post 2010W



## Correlation with Course Grades in Math 104/184 (pooled), Pre to Post 2010W



# Grades of Upper Half Attitudes Minus Grades of Lower Half Attitudes (Dec 2010)



# [ New Work 2011-12 ]

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- New version
  - removed statements with ambiguous expert and novice response.
  - bolstered smaller question categories.
- Robustness calculation for categories.
- New data collected; we are currently in the process of analyzing it.

# [ Conclusion ]

We have found three main results in our math courses. First, the "expertise level" of attitudes correlates positively with performance in first-year differential calculus. Second, on average, students in courses that require more math background have more expert-like attitudes. Finally, in a differential calculus course we generally observed shifts towards more *novice-like* attitudes from the start to end of term. Future work on MAPS will include interviews with students to validate the survey and the refinement of the current questions and categories.



# **MAPS – Math Attitudes and Perceptions Survey**

**Introduction**

**Categorization**

**Results**