Profiling Change:
Methods for Comparing Patterns in Mathematics Expectancies and Values Across Time

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THEORETICAL FRAMEWORK

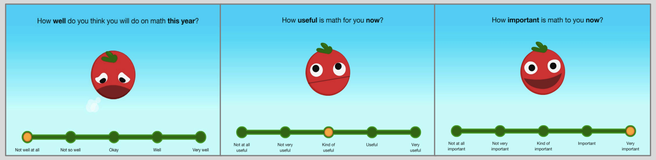
- Eccles' Expectancy-Value Theory: Students do things they believe they can and that they value (Wigfield & Eccles, 2000)
- Generally, these constructs are viewed separately, in a variable-centered approach; this may ignore how they interact within individuals as part of a holistic self.
- We use a person-centered approach (Magnusson, 1998; e.g., Corpus & Wormington, 2014) to consider patterns of expectancies and values and how these patterns change throughout the school year

RESEARCH QUESTIONS

1. What profiles of motivation are present throughout the school year?
   a. How do these profiles look when considering all time points?
   b. How do these profiles look when considering each time point separately?
   c. When looking at each time point separately, how do students move between profiles at each time point?
2. How are these profiles related to achievement?

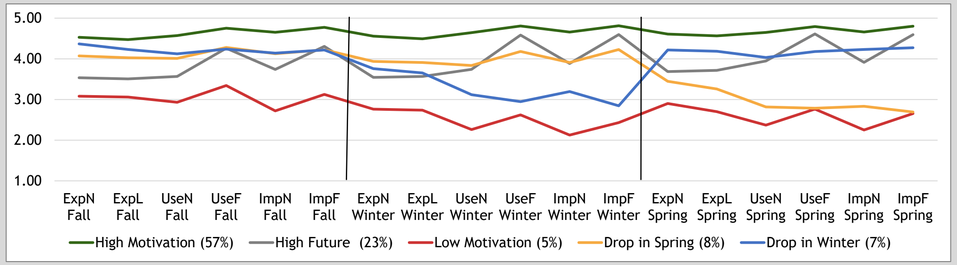
METHOD

- 5,365 fourth graders from four school districts across the United States
  - 51% male, 63% Free/Reduced Lunch, 11% English Language Learner
  - 52% White, 21% Black/African American, 18% Latinx, 10% Other
- Data collected through survey within a digital mathematics environment—Spatial Temporal Math (ST Math)
  - Three survey waves: beginning, middle, and end of school year
  - Questions addressed **expectancy** and **value** (as usefulness and importance of mathematics to students now and in the future)

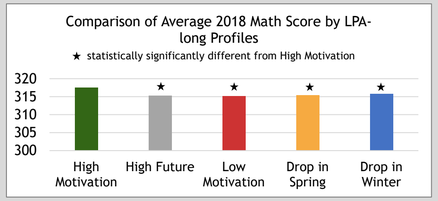


- **COMPARED TWO ANALYSES:**
  - **LPA-long:** latent profile analysis including information from *all three time-points together*, which incorporates student change in expectancies and values in the formation of the profiles
  - **LPTA:** latent profile analysis, examining *each time point separately*; latent transition analysis to understand changes in profiles between
- Regressions determined how profiles were related to achievement
  - Controlled for prior mathematics achievement and demographics
  - Huber White cluster adjustment to account for nesting in schools

LPA—LONG RESULTS

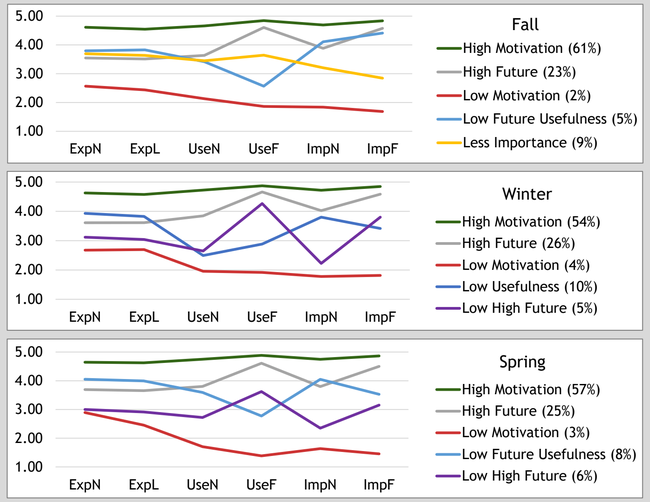


KEY:
ExpN: Expectancy Now
ExpL: Expectancy for Learning
UseN: Usefulness Now
USeF: Future Usefulness
ImpN: Importance Now
ImpF: Future Importance

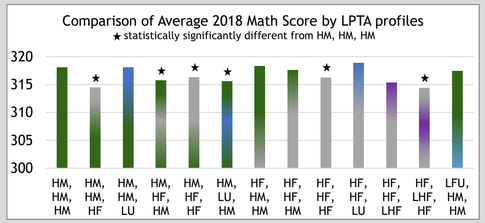


- Three profiles had same pattern at all time points—High Motivation, High Future, and Low Motivation
- Profile membership predicted end-of-grade math scale score:
  - On average, students in High Motivation profile had the highest end-of-grade math score
  - Other four profiles did not differ from each other in average end-of-grade math score

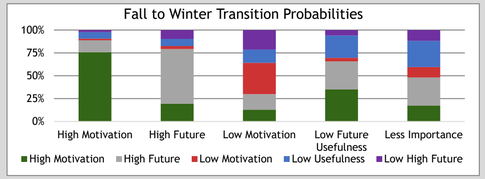
LPTA RESULTS

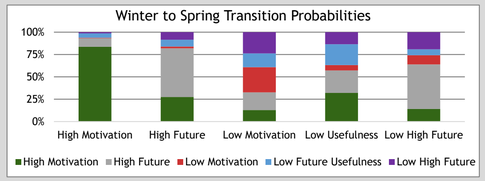


KEY:
HM: High Motivation
HF: High Future
LU: Low Usefulness
LHF: Low High Future
LFU: Low Future Usefulness



Bars represent profile at time 1
Colors represent percentage of students moving to time 2 profile





- Most students who started in High Motivation and High Future stayed in those profiles throughout the school year
- Few students stayed in Low Motivation all year (0.35%, n = 19)
- Groups based on all three profiles with at least 50 students were used in regression (13 of 122 groups; n = 3,986)
- The High Motivation all year group performed better than about 50% (six) than the other groups

METHOD REFLECTIONS

- All models had five profiles; three types of profiles were consistent across all time points: High Motivation, High Future, and Low Motivation
- **LPA-LONG**
  - Provides a wholistic interpretation of motivation throughout the school year
  - May be limited in demonstrating how students move across profiles—EX: Fewer than 0.5% of students stayed in the Low Motivation profiles in the LPTA, but 5% of students were in the Low Motivation profile in the LPA-long model (n = 19 and n = 252, respectively).
  - Although students in the High Motivation LPA-long profile performed better than other profiles, the LPTA High Motivation all year group was not the highest performing
  - Clearly demonstrates if/when motivation drops
- **LPTA**
  - Provides a detailed view of how students move between profiles
  - Allows for different profiles at different time points
  - The number of profiles and transitions made further analyses, such as predicting transitions, profile membership, and achievement, nearly impossible
  - Multiple attempts were made at predicting achievement with all profiles:
    - Using just the spring profile (not accounting for fall and winter)
    - Including dummy-coded profiles for all time points (interpreting the reference group was difficult)
    - Creating a profile of profiles to account for profile membership at each time point—VERSION DISPLAYED (limited to 13 groups which reduced sample size by 25%)

CONCLUSION

LPTA provides detailed information on transitions and complex patterns of motivation.

LPA-long provides a simplicity that allows for greater interpretability.

ACKNOWLEDGEMENTS AND CONTACT

This research was funded in part by the National Science Foundation (Grant Number 1544273).
We would like to thank the participating districts, teachers, and students.

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