

Models of growth: Longitudinal expectancy-value in elementary mathematics

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ABSTRACT

We examined how expectancy and value for math changes throughout two years and found that non-linear models had better fit than linear ones. Motivation generally declined over the two years and was lowest during the middle of the school year. Students in 4th grade had lower motivation than those in 3rd grade.

INTRODUCTION

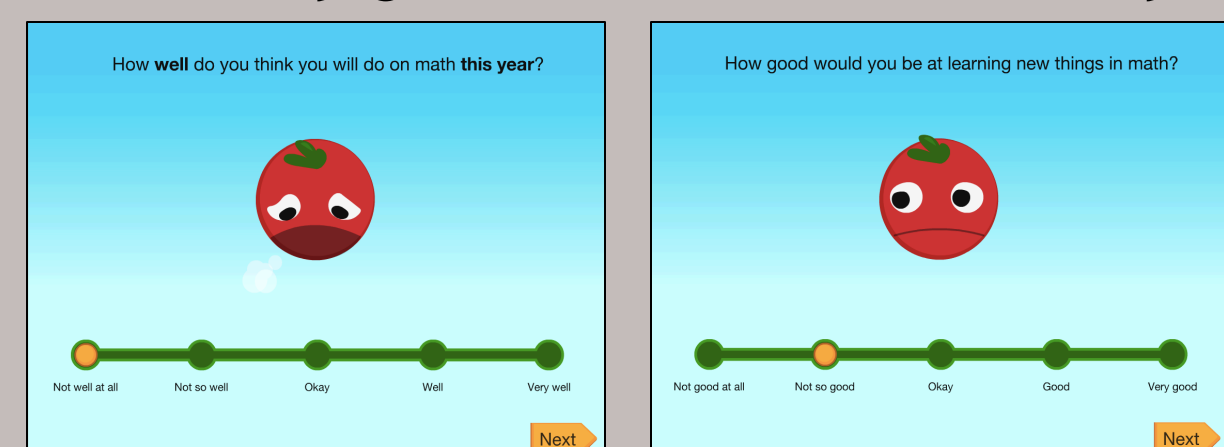
- Motivation is critical for success (Eccles & Wigfield, 2020)
- Motivation, including math motivation, declines in middle childhood (Wigfield et al., 2020)
- This decline may not be linear nor monolithic.

What are trends in expectancies, current value, and future value across two years?

Are these non-linear? The same by grade?

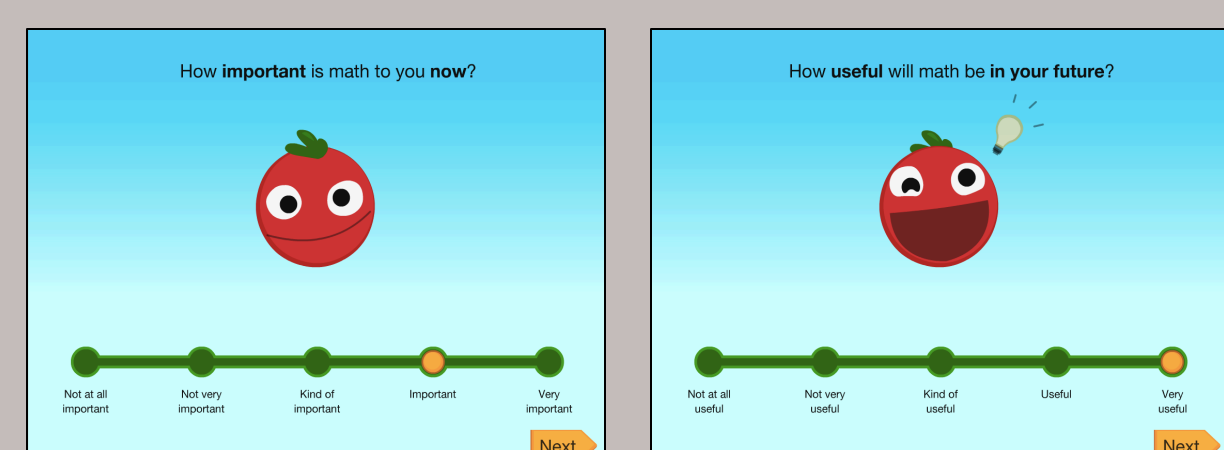
METHOD

- Third (n=4,270) and fourth (n=3,618) grade students
 - 50% female, 75% qualified for free/reduced lunch, 18% Black, 18% Hispanic, 52% White
- Survey given six times over two years



Expectancy
Ordinal $\alpha^* = .81$

[Click this link to see all responses](#)



Current Value
Ordinal $\alpha^* = .82$

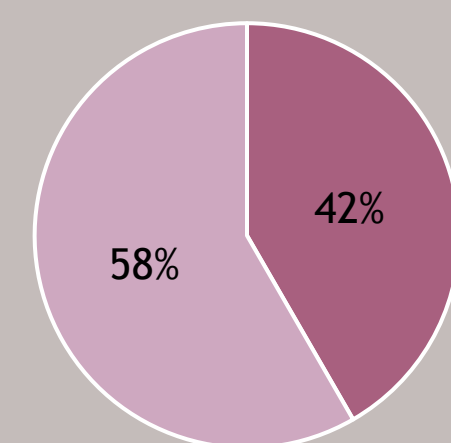
Future Value
Ordinal $\alpha^* = .89$

- Analyses:
 - Multilevel random slopes regression
 - Linear wave vs wave as factor

¹Gademmann et al., 2012

RESULTS

Math Expectancy
Variance by Level



■ Between-Student
■ Within-Student

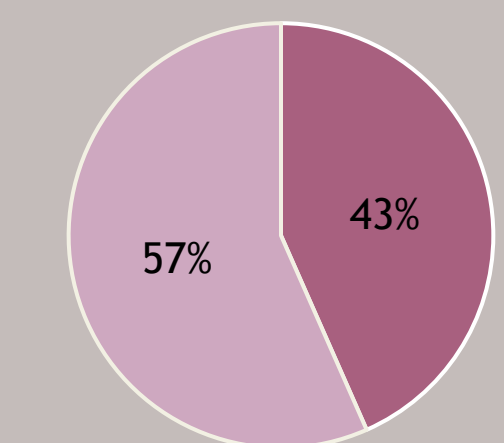
Full model better fit than the null?

- ✓ Linear model ($R^2_{\text{overall}} = 1.11\%$)
- ✓ Factor model ($R^2_{\text{overall}} = 1.31\%$)

Interaction better fit than the full?

- ✓ Linear model ($R^2_{\text{overall}} = 1.16\%$)
- ✓ Factor model ($R^2_{\text{overall}} = 1.38\%$)

Current Math Value
Variance by Level



■ Between-Student
■ Within-Student

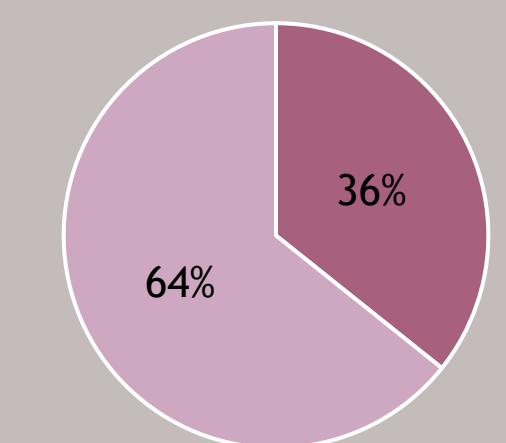
Full model better fit than the null?

- ✓ Linear model ($R^2_{\text{overall}} = 1.53\%$)
- ✓ Factor model ($R^2_{\text{overall}} = 1.58\%$)

Interaction better fit than the full?

- ✗ Linear model ($R^2_{\text{overall}} = 1.53\%$)
- ✓ Factor model ($R^2_{\text{overall}} = 1.62\%$)

Future Math Value
Variance by Level



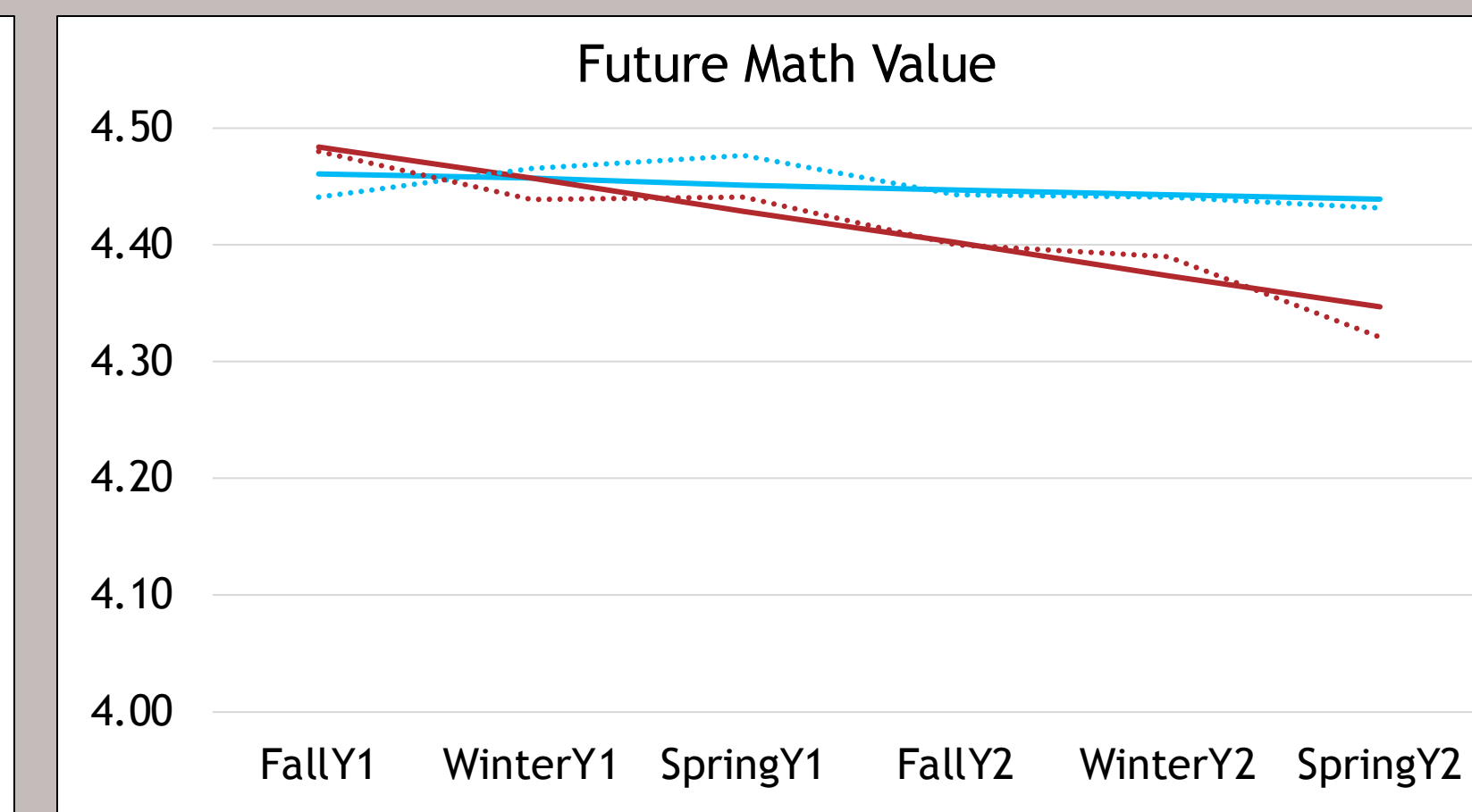
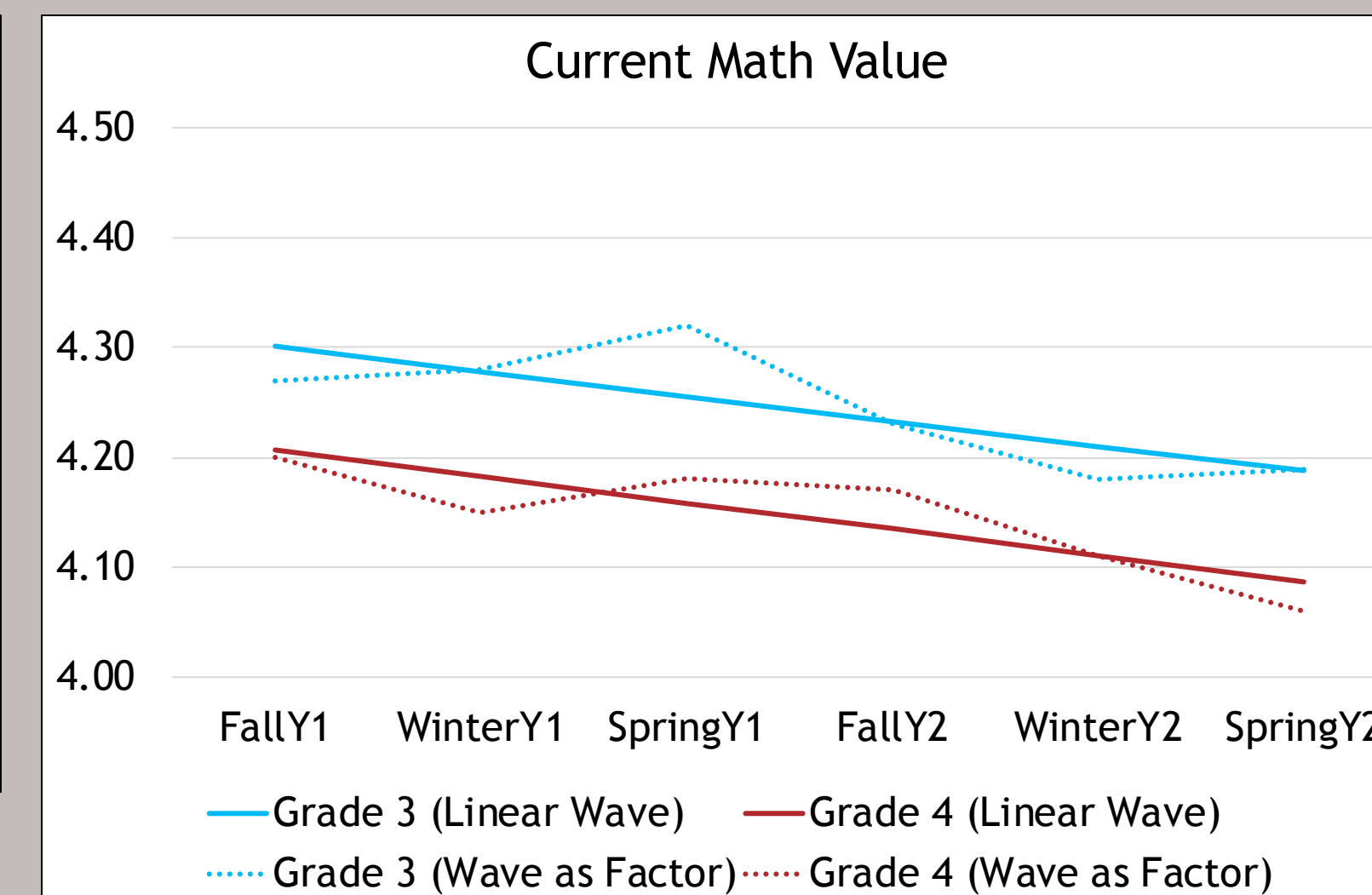
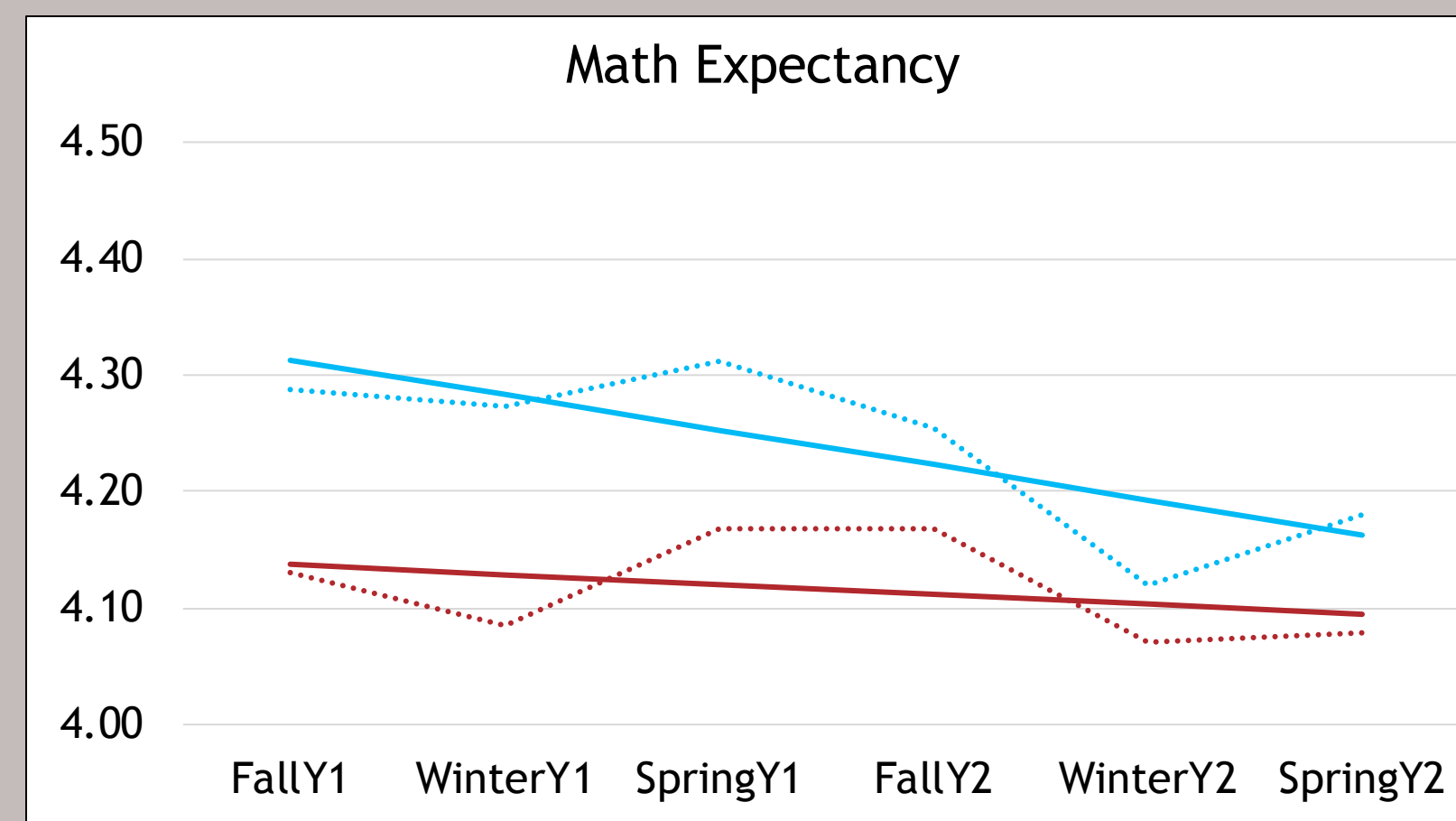
■ Between-Student
■ Within-Student

Full model better fit than the null?

- ✓ Linear model ($R^2_{\text{overall}} = 0.55\%$)
- ✓ Factor model ($R^2_{\text{overall}} = 0.60\%$)

Interaction better fit than the full?

- ✓ Linear model ($R^2_{\text{overall}} = 0.57\%$)
- ✓ Factor model ($R^2_{\text{overall}} = 0.64\%$)



General Findings

- Future math value is the highest for both grades.
- All components remained relatively high (over four on a five-point scale).
- There is a general decline in motivation over two years.

Linear vs Non-Linear Trends

- Models that treated wave as a factor provided a better fit than those that treated wave as linear.

Differences by Grades

- In general, fourth graders had lower motivation than third graders.
 - Exception: fourth graders had higher future math value at the beginning of year one.
- Future value had steeper decline for fourth graders; expectancy had a steeper decline for third graders.

CONCLUSION

Mathematics motivation had **non-linear trends** over two years.

There was often a **dip** in motivation **mid school year**.

Fourth graders had **lower motivation** than third graders.

ACKNOWLEDGEMENTS

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