Models of growth: Longitudinal expectancy-value in elementary mathematics

Sarah M. Karamarkovich[1] & Teomara Rutherford[2]

[1]North Carolina State University, [2]University of Delaware

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?

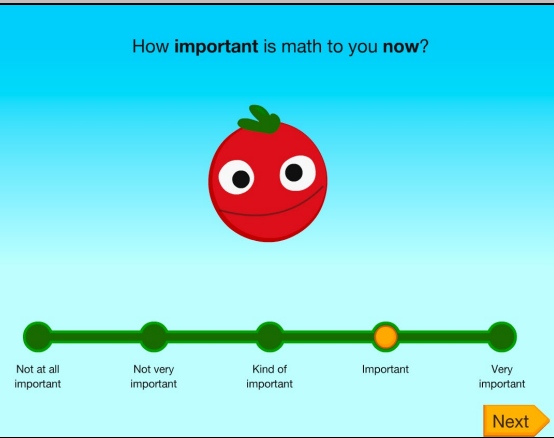*Are these non-linear? The same by grade?*

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

How well do you think you will do on math this year?

How good would you be at learning new things in math?

Expectancy
Ordinal α^* = .81

[Click this link to see all responses]

How important is math to you now?

Current Value
Ordinal α^* = .82
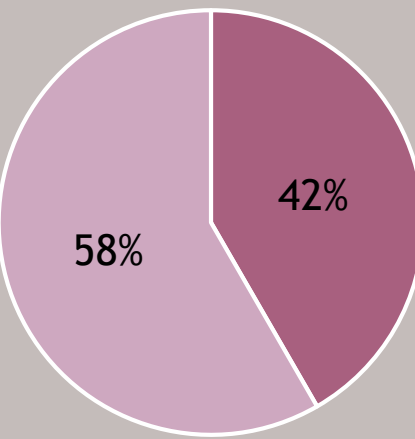

How useful will math be in your future?

Future Value
Ordinal α^* = .89

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

*Gadermann et al., 2012

RESULTS

Math Expectancy Variance by Level

- Between-Student 42%
- Within-Student 58%

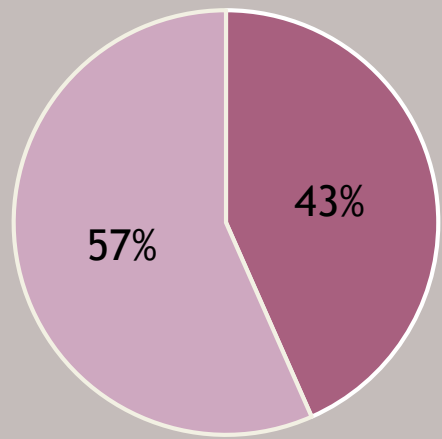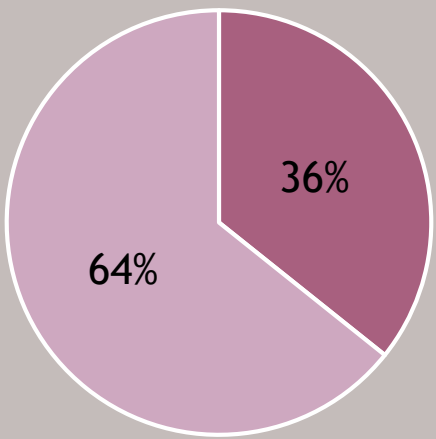Full model better fit than the null?
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- ✓ Factor model ($R^2_{overall}$ = 1.31%)

Interaction better fit than the full?
- ✓ Linear model ($R^2_{overall}$ = 1.16%)
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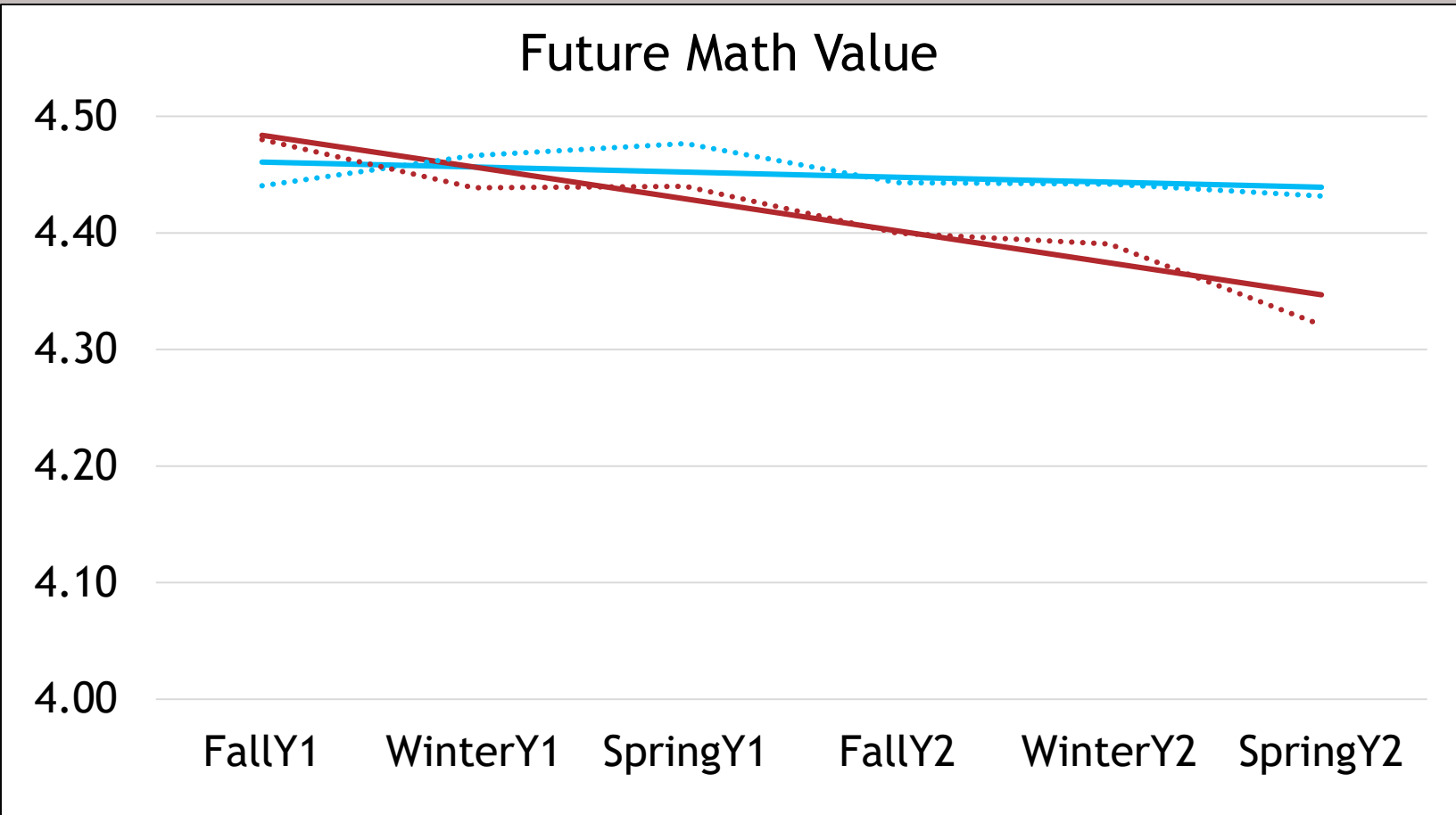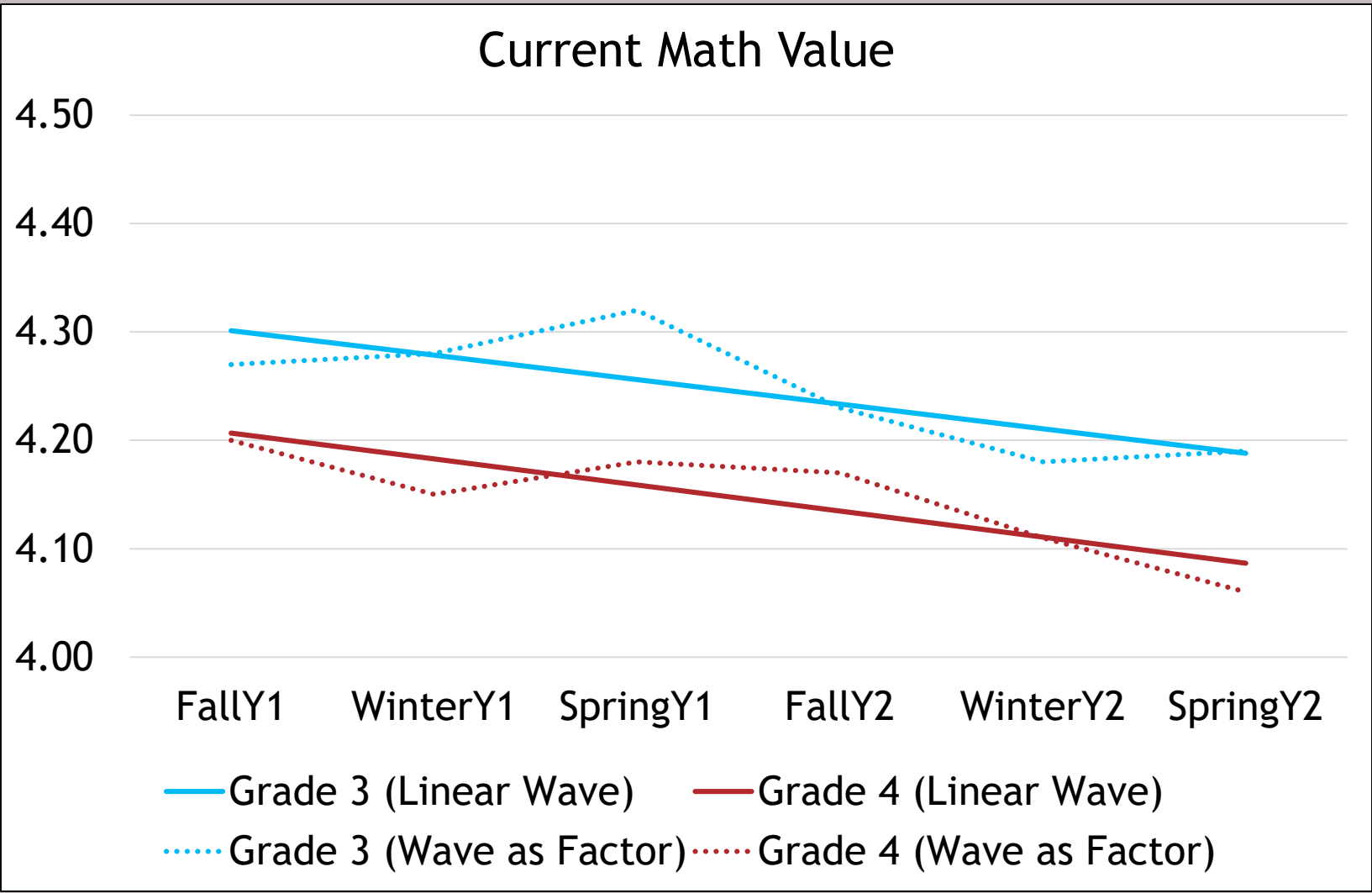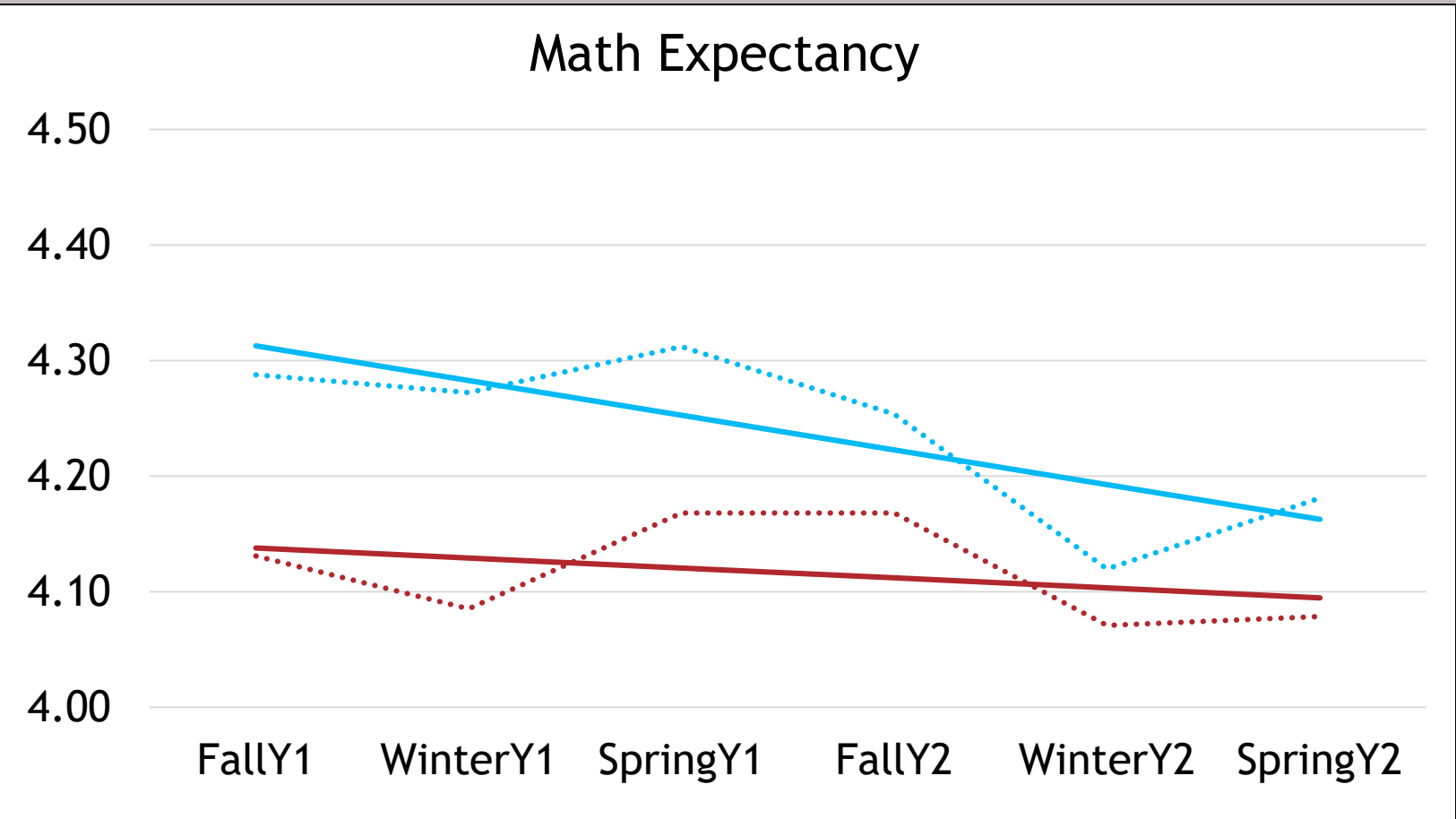
Future Math Value Variance by Level

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- Within-Student 64%

Full model better fit than the null?
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- ✓ Factor model ($R^2_{overall}$ = 0.60%)

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Math Expectancy

Current Math Value

Grade 3 (Linear Wave) — Grade 4 (Linear Wave)
Grade 3 (Wave as Factor) — Grade 4 (Wave as Factor)

Future Math Value

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

NC STATE UNIVERSITY
Contact: skessle@ncsu.edu
Sarah Karamarkovich Website
Data: teomara@udel.edu
Rutherford Lab Website
UNIVERSITY of DELAWARE

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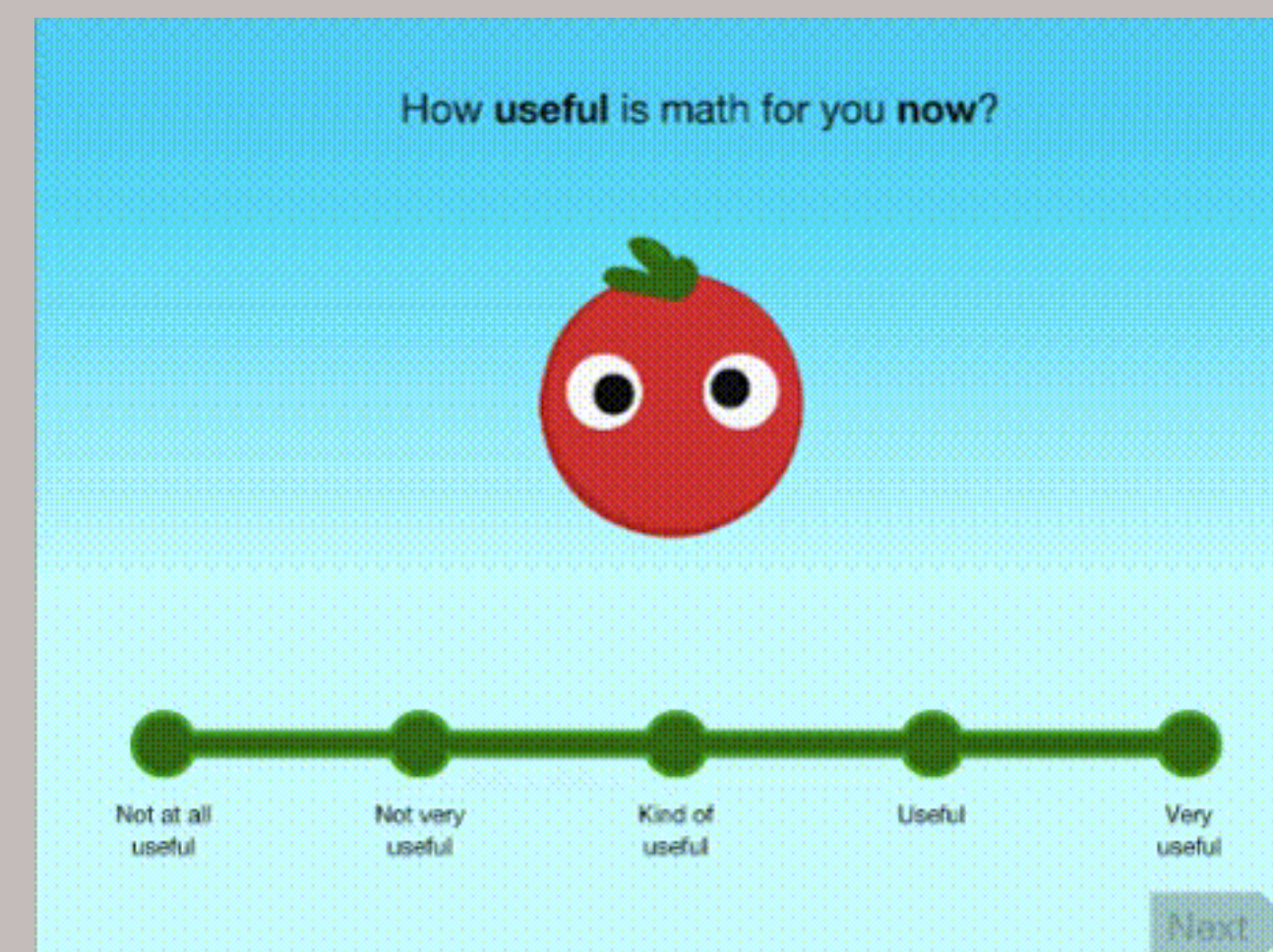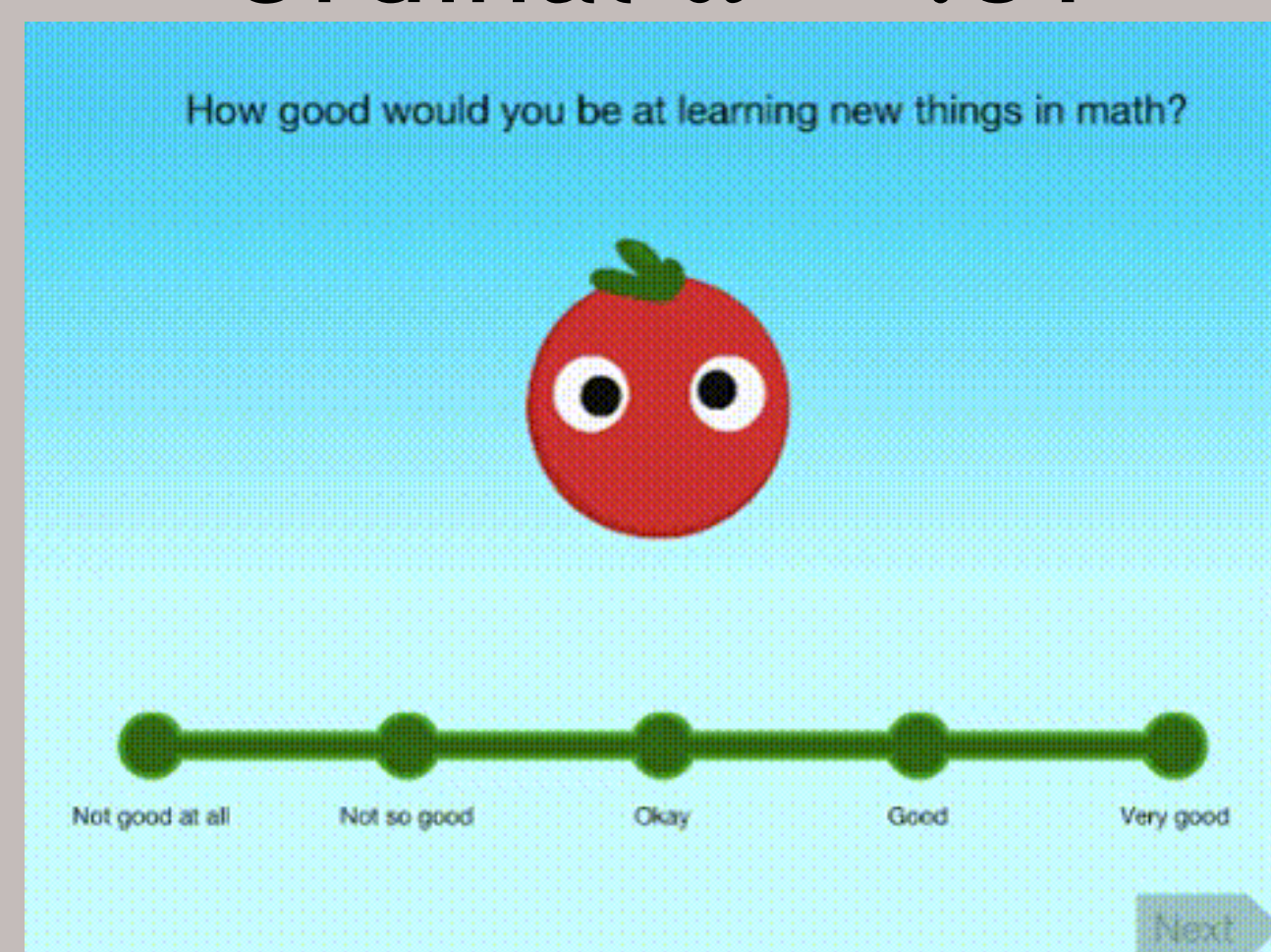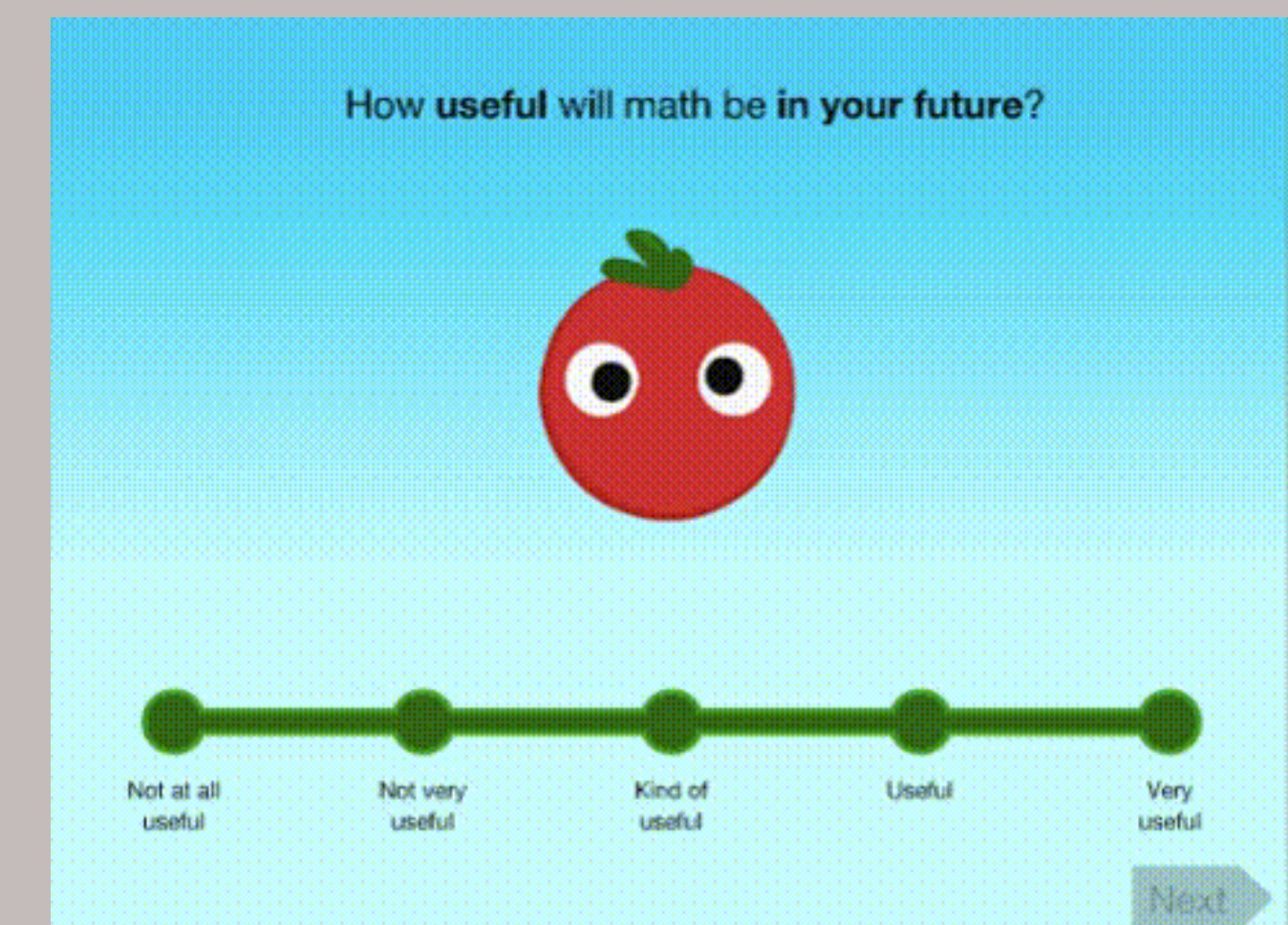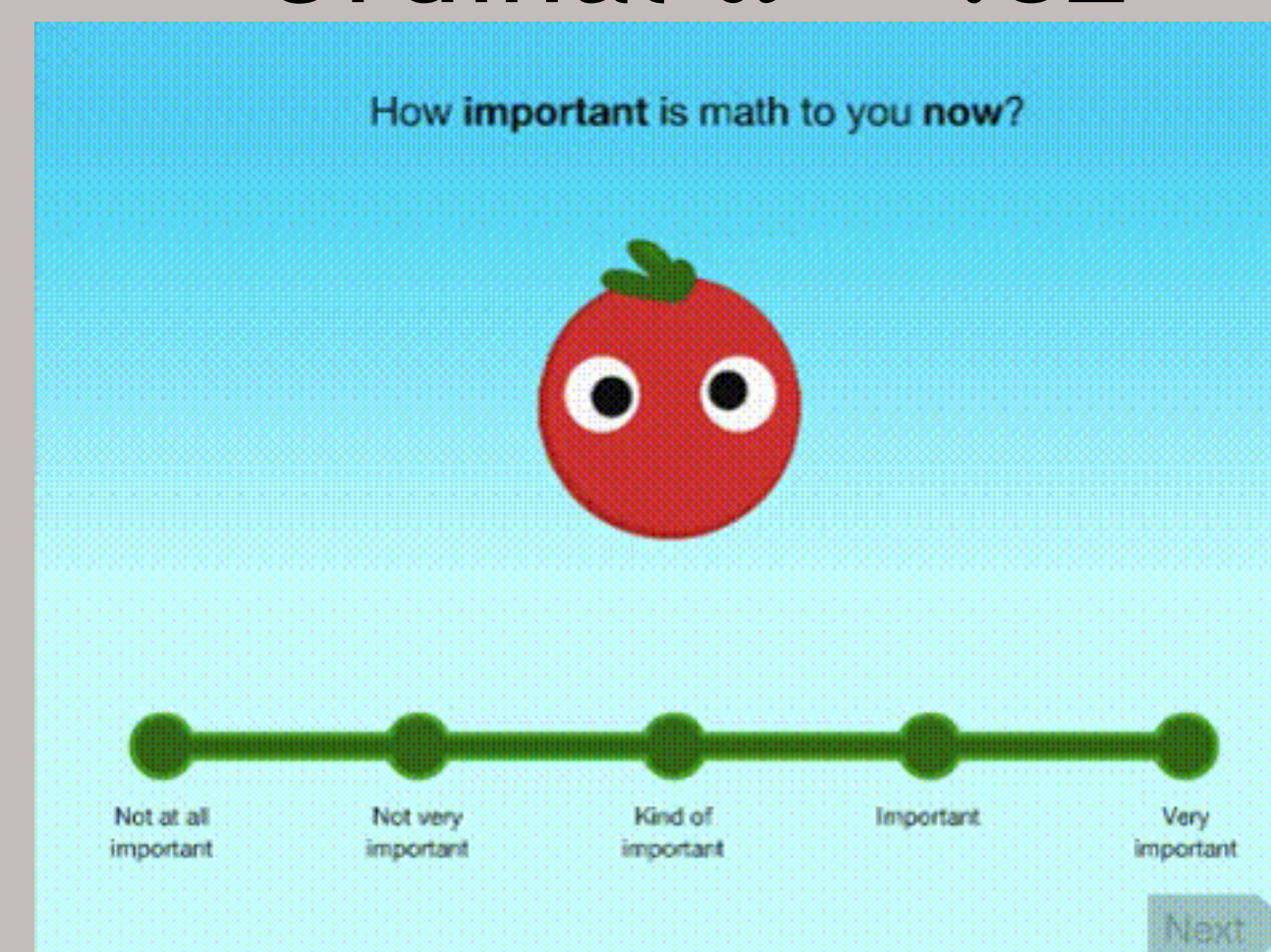*Are these non-linear? The same by grade?*

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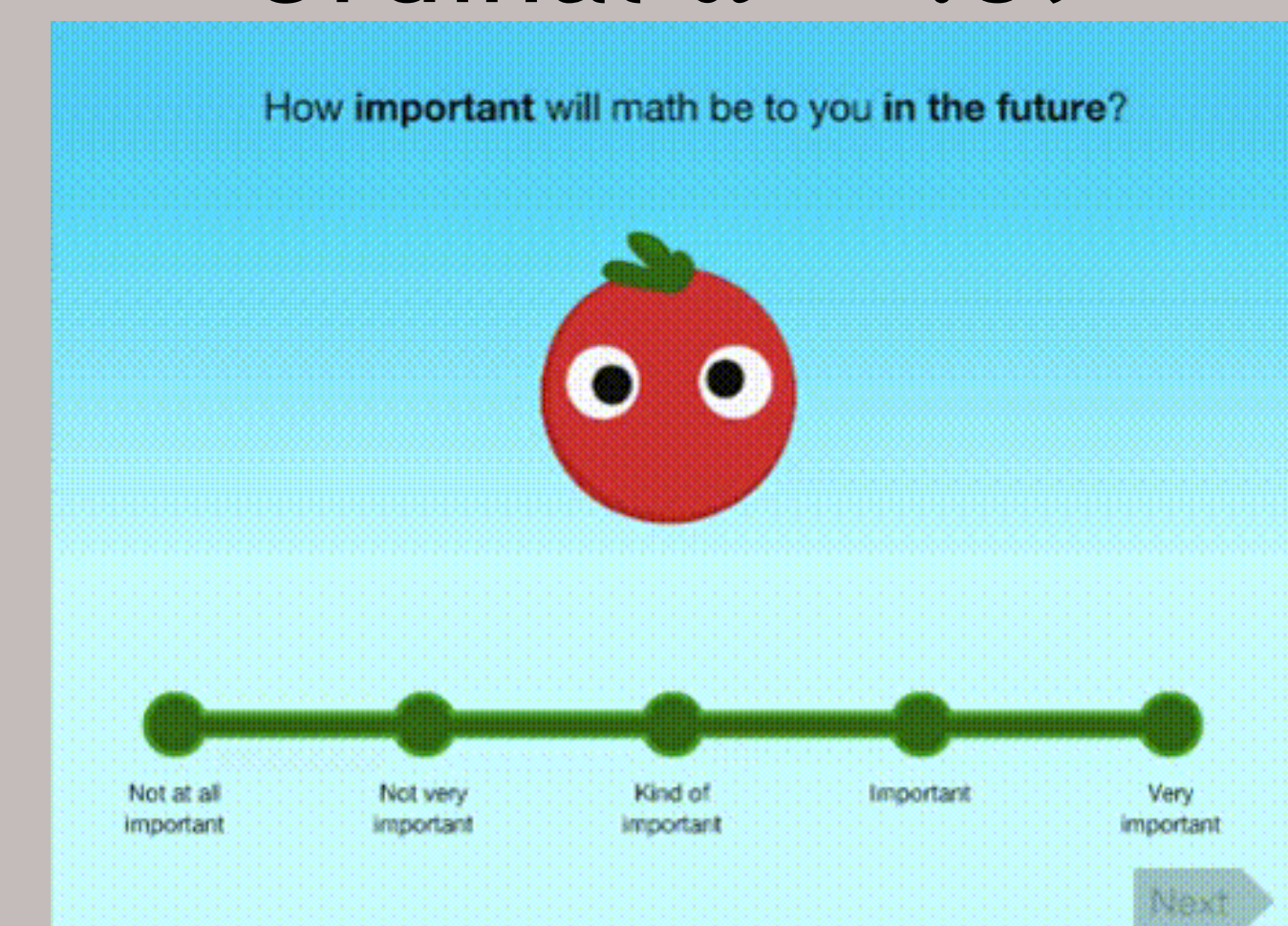• Survey given six times over two years
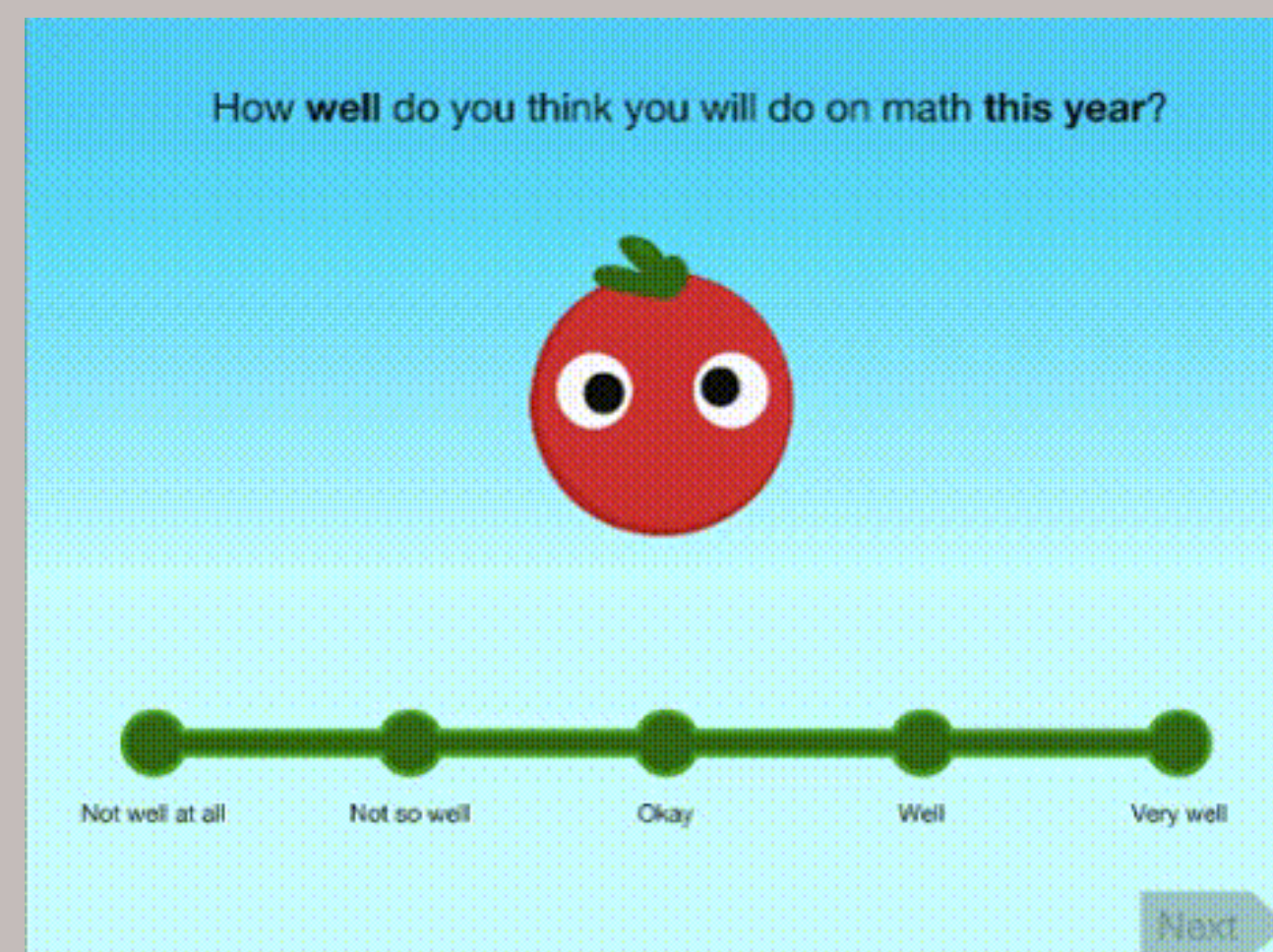
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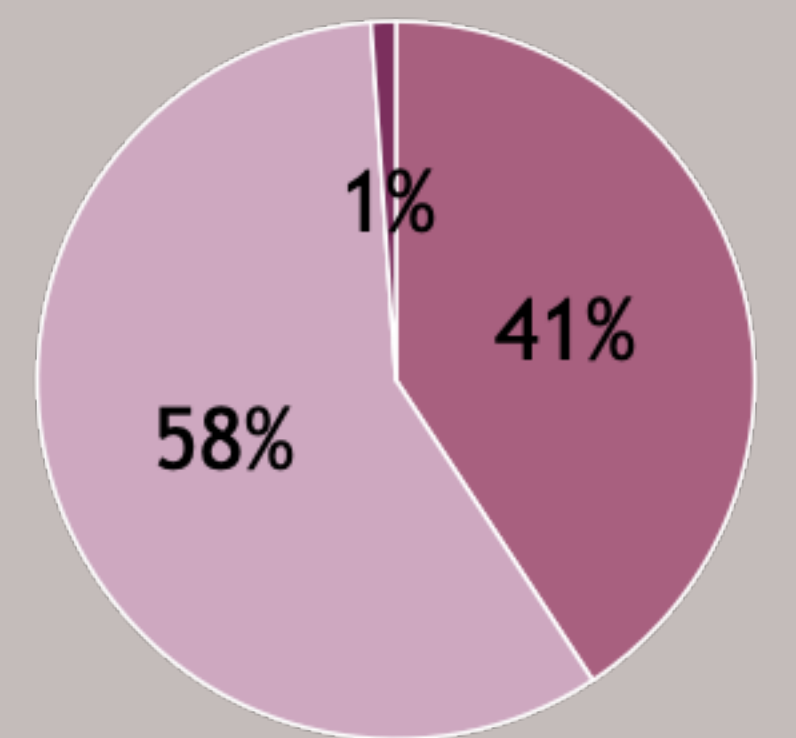
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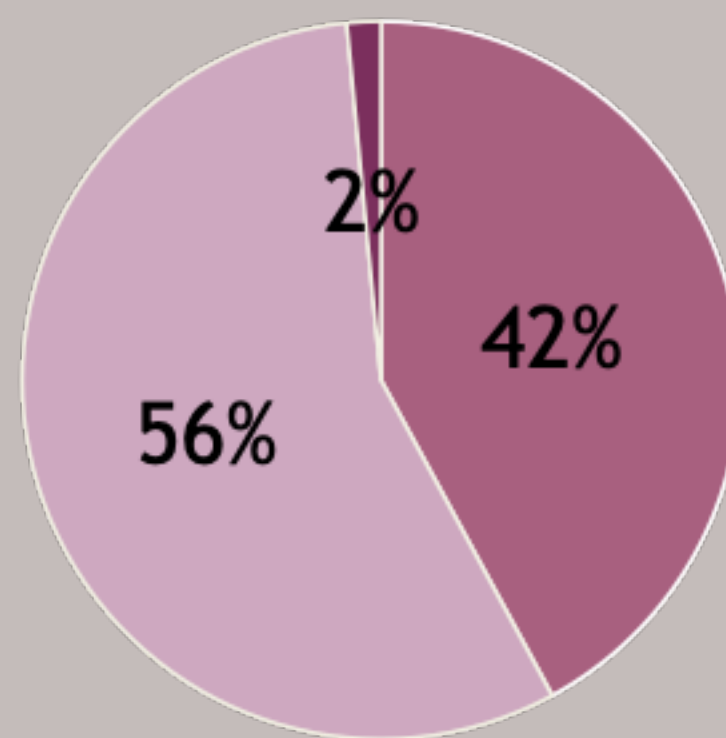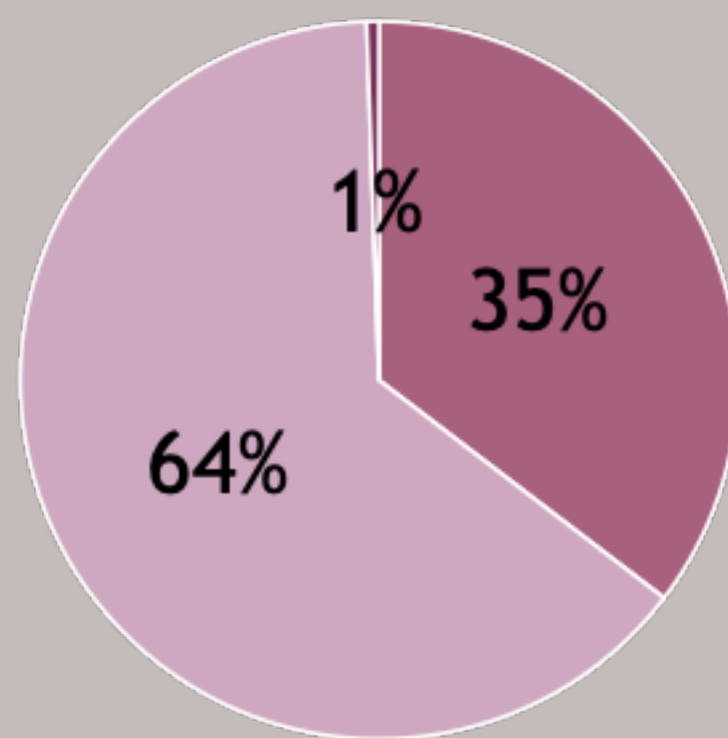
- Between-Student
- Within-Student
- Modeled Variance

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Interaction better fit than the full?
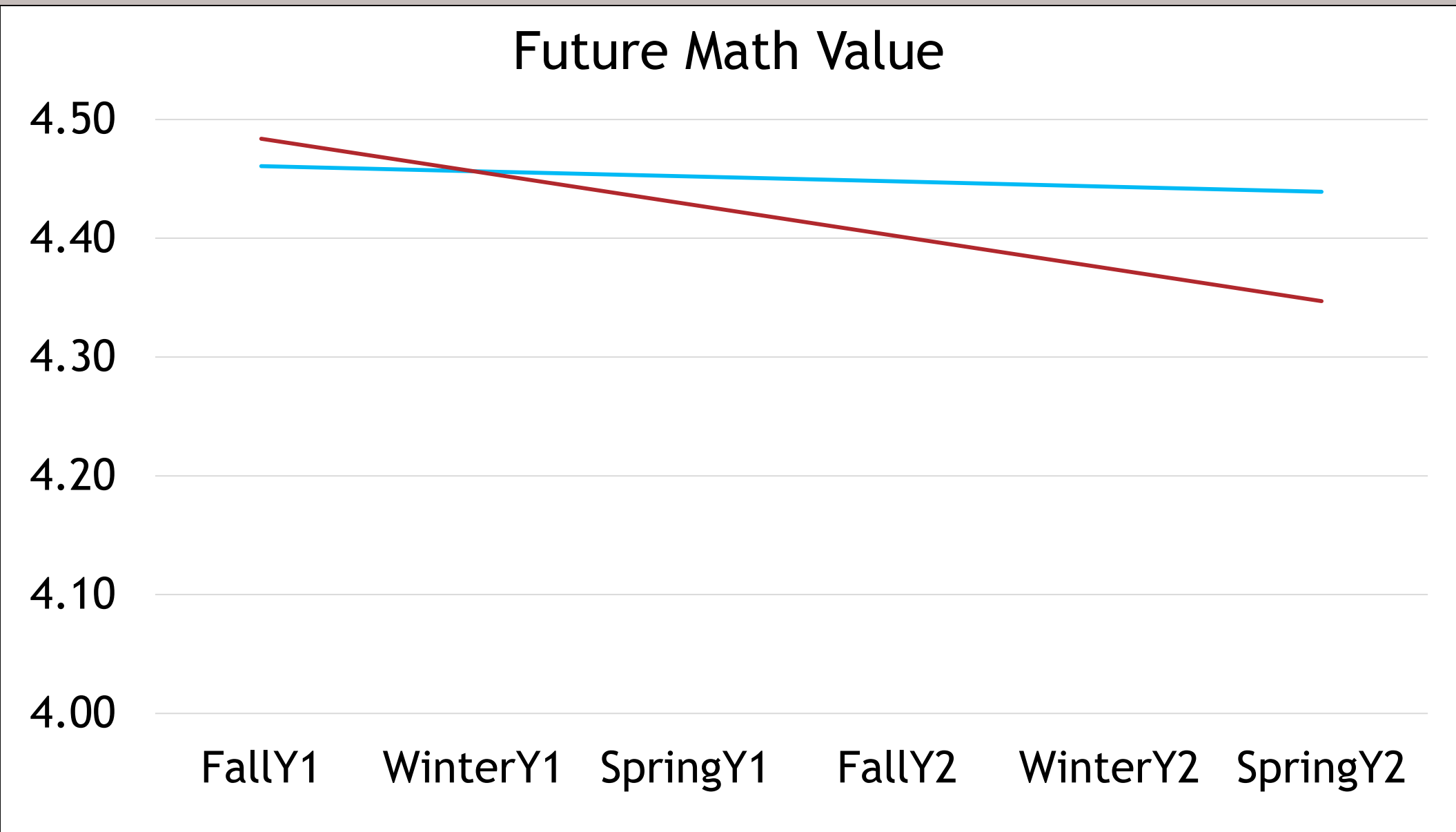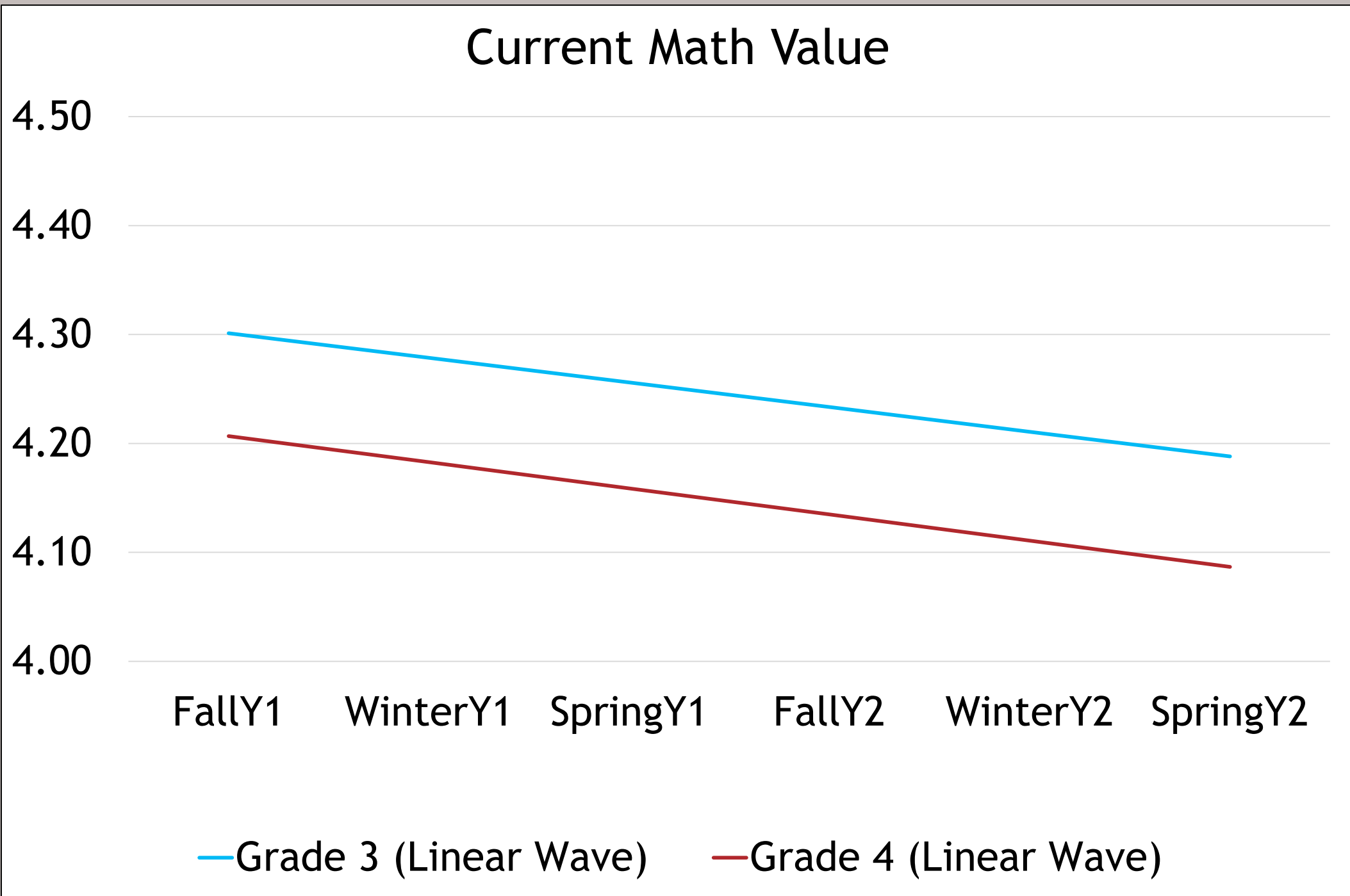✓ Linear model ($R^2_{overall}$ = 1.16%)

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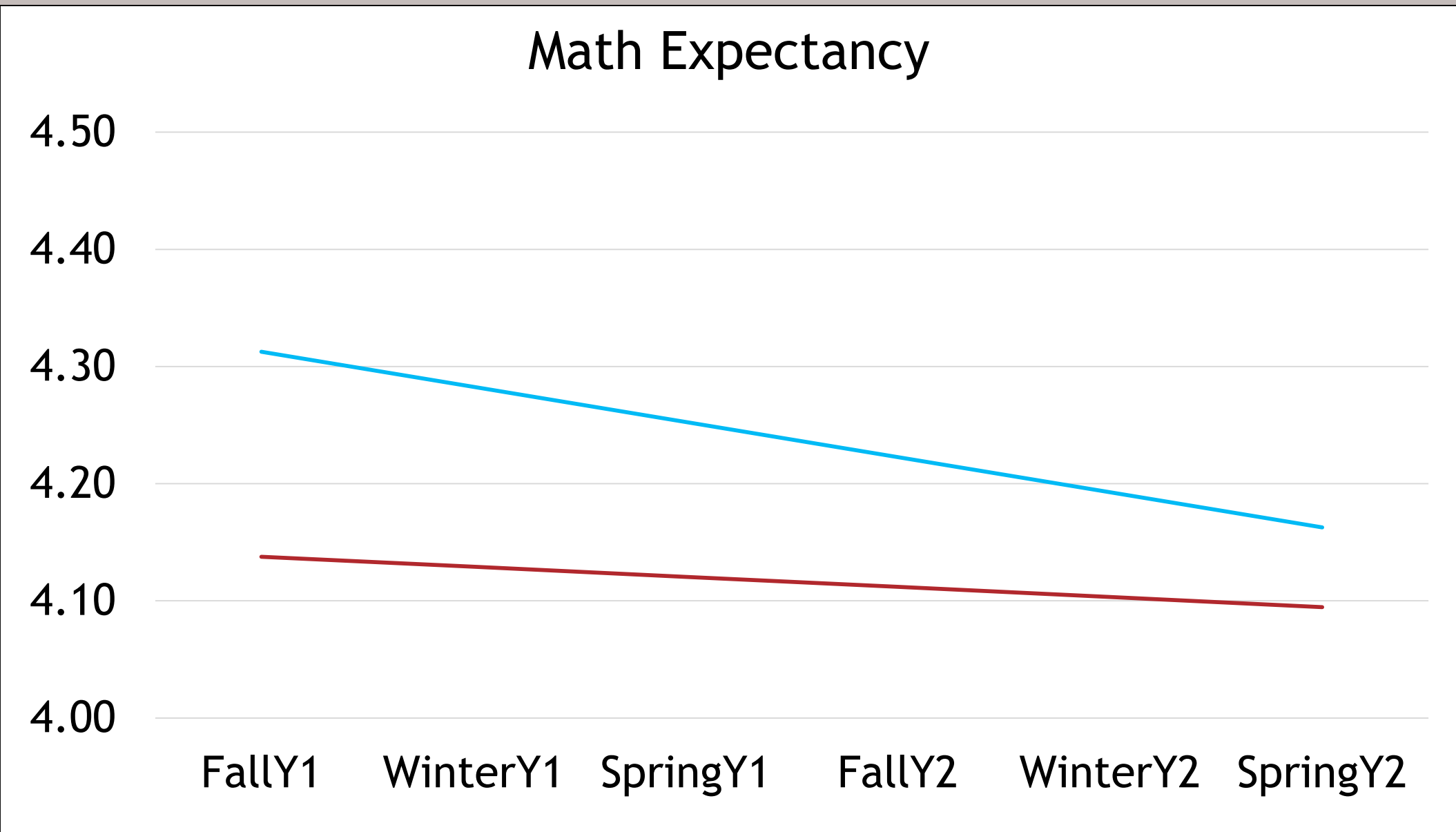✗ Linear model ($R^2_{overall}$ = 1.53%)

Future Math Value Variance by Level

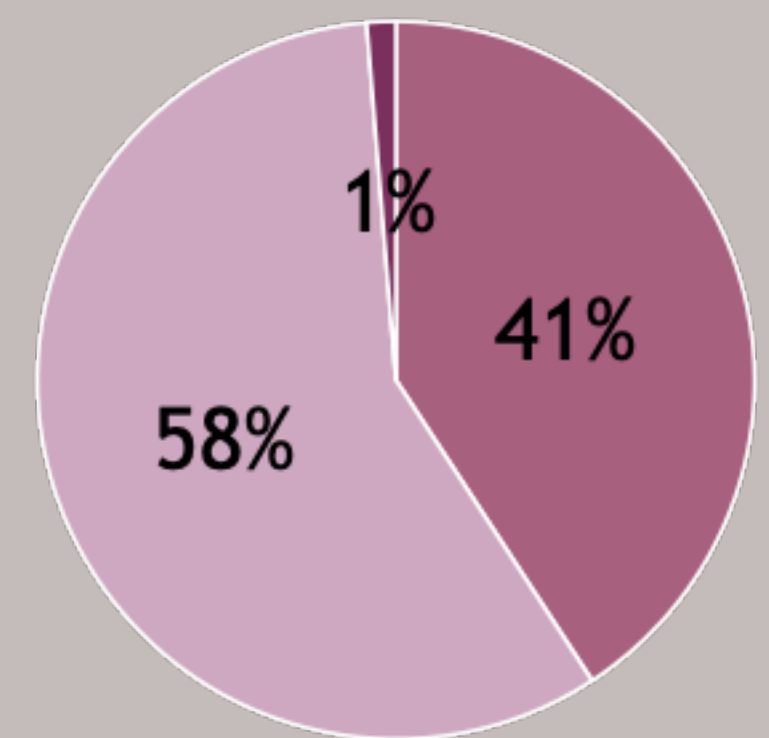- Between-Student
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Math Expectancy

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Future Math Value

— Grade 3 (Linear Wave)　　— Grade 4 (Linear Wave)

RESULTS

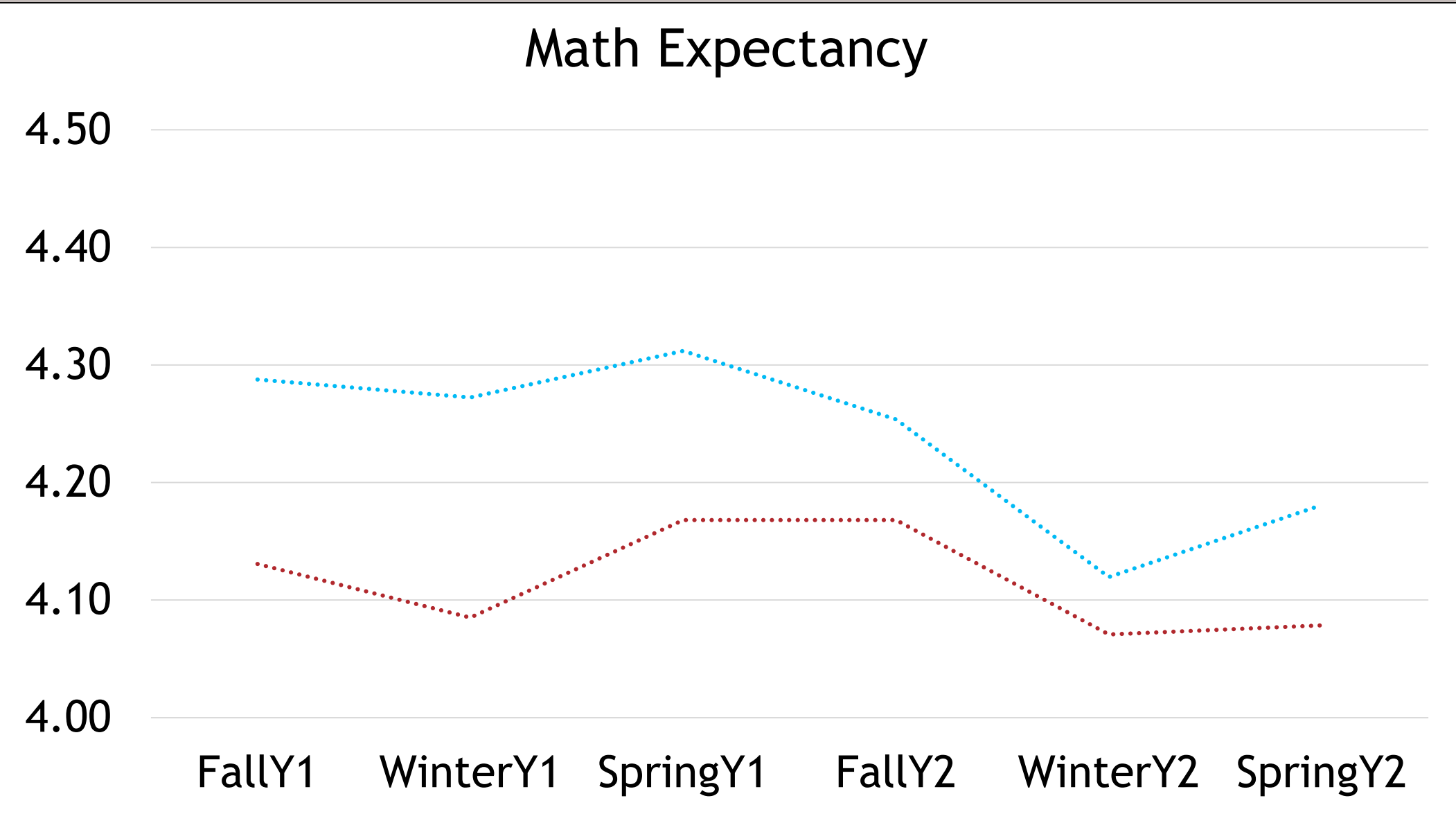## Math Expectancy Variance by Level

- 1%
- 41%
- 58%

■ Between-Student
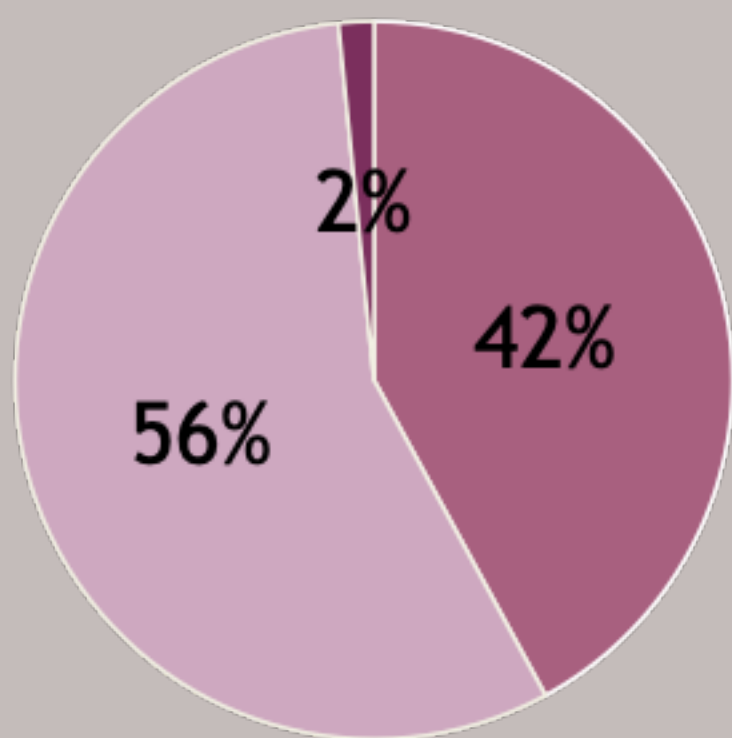■ Within-Student
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Math Expectancy

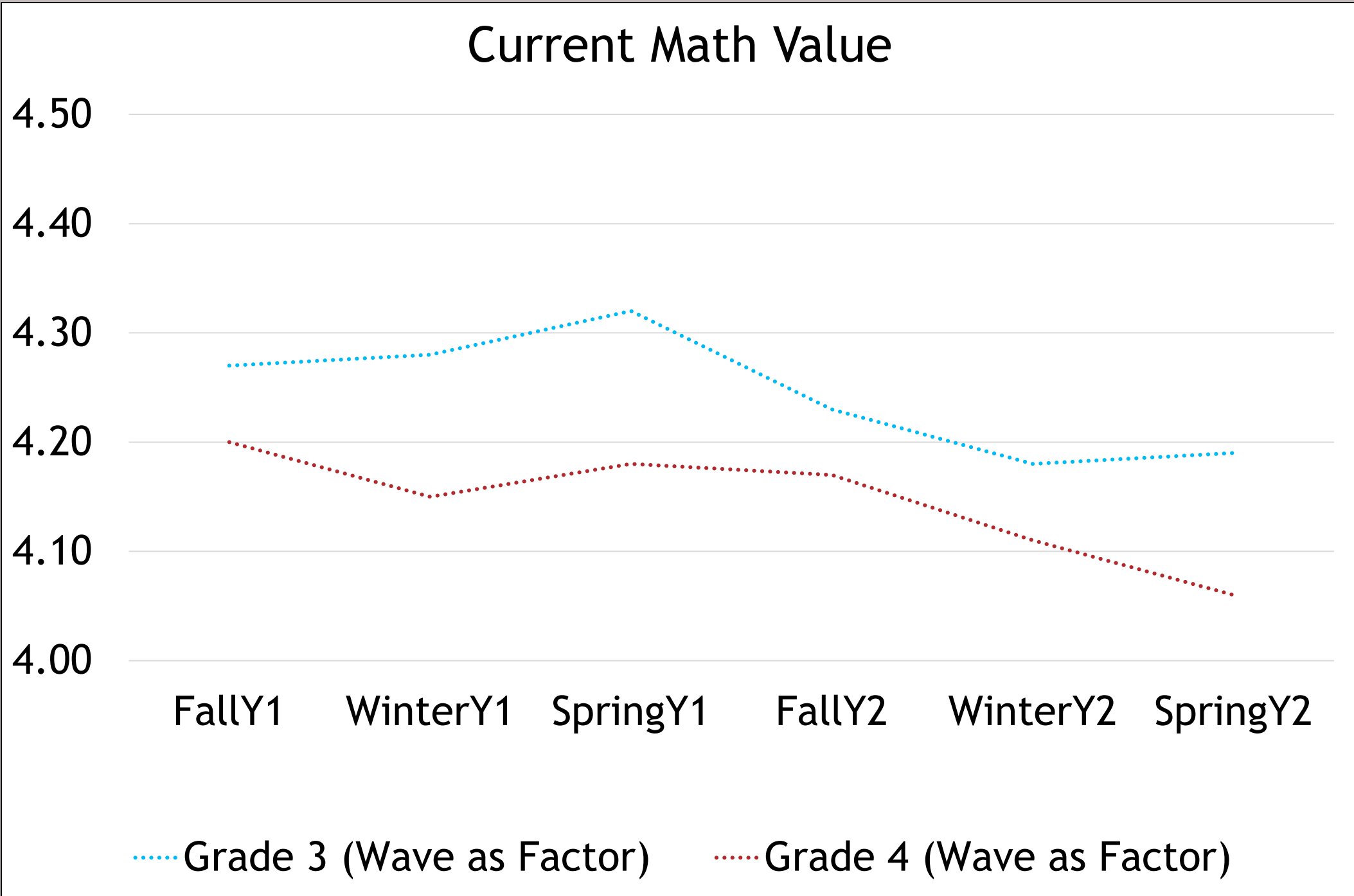## Current Math Value Variance by Level

- 2%
- 42%
- 56%

■ Between-Student
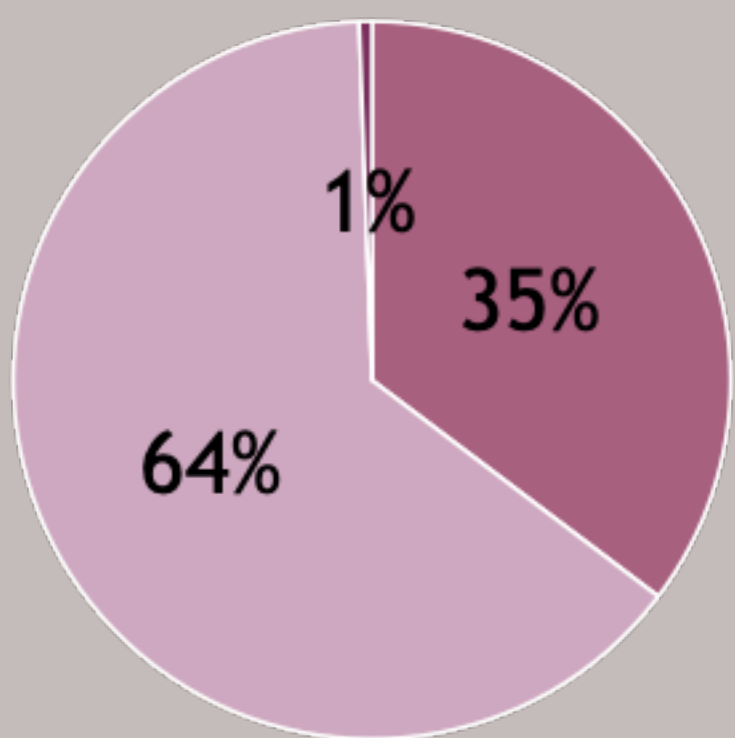■ Within-Student
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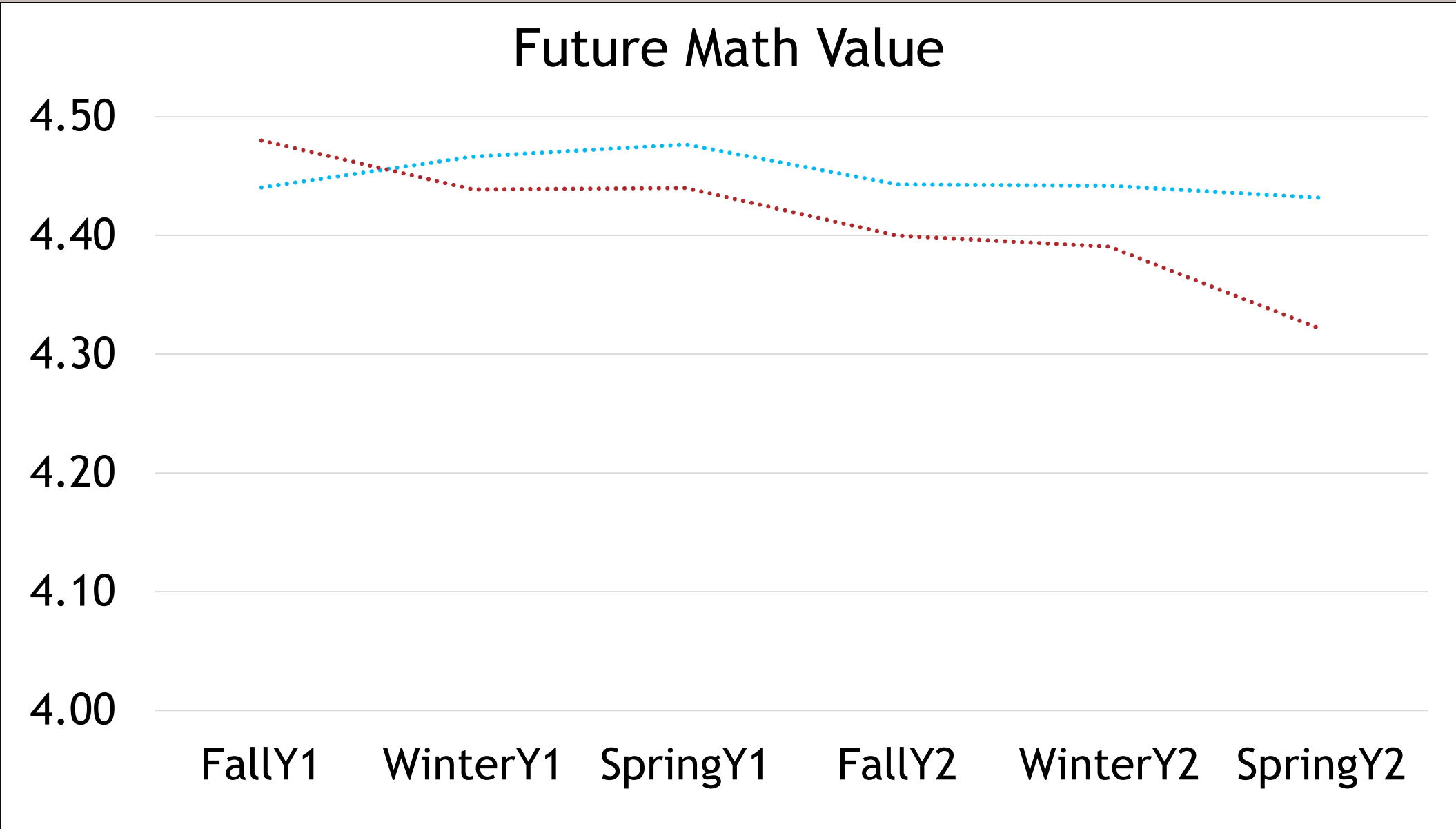## Future Math Value Variance by Level

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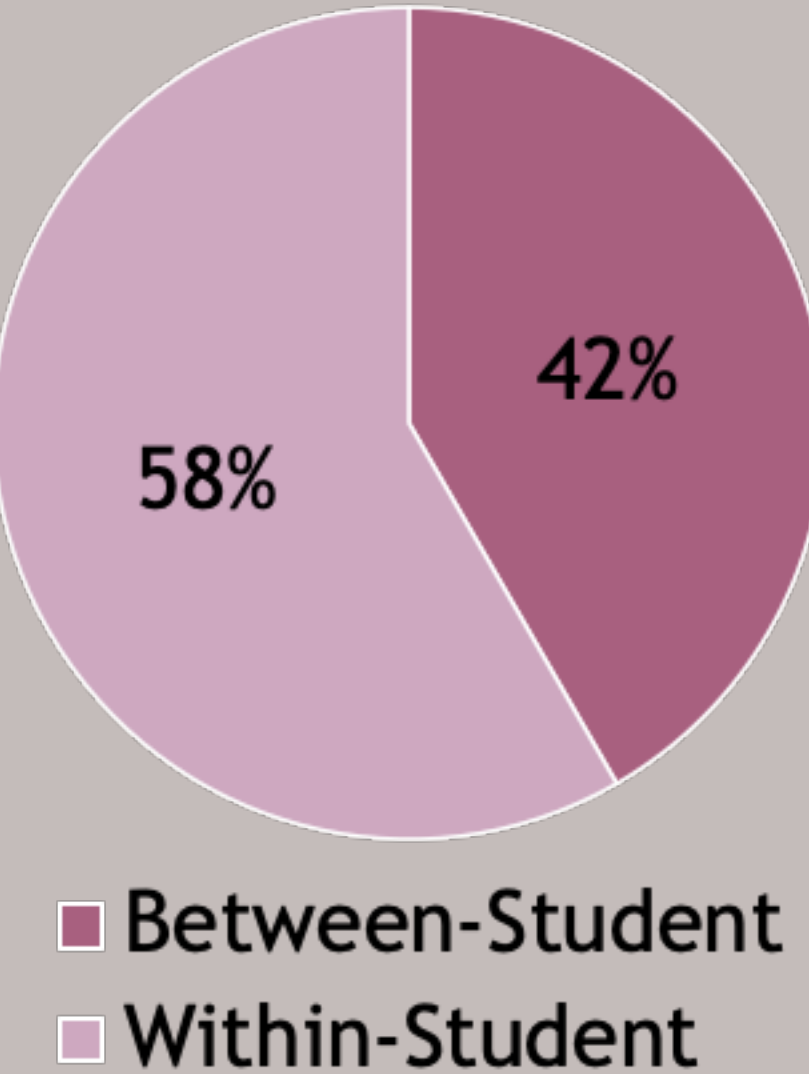Full model better fit than the null?

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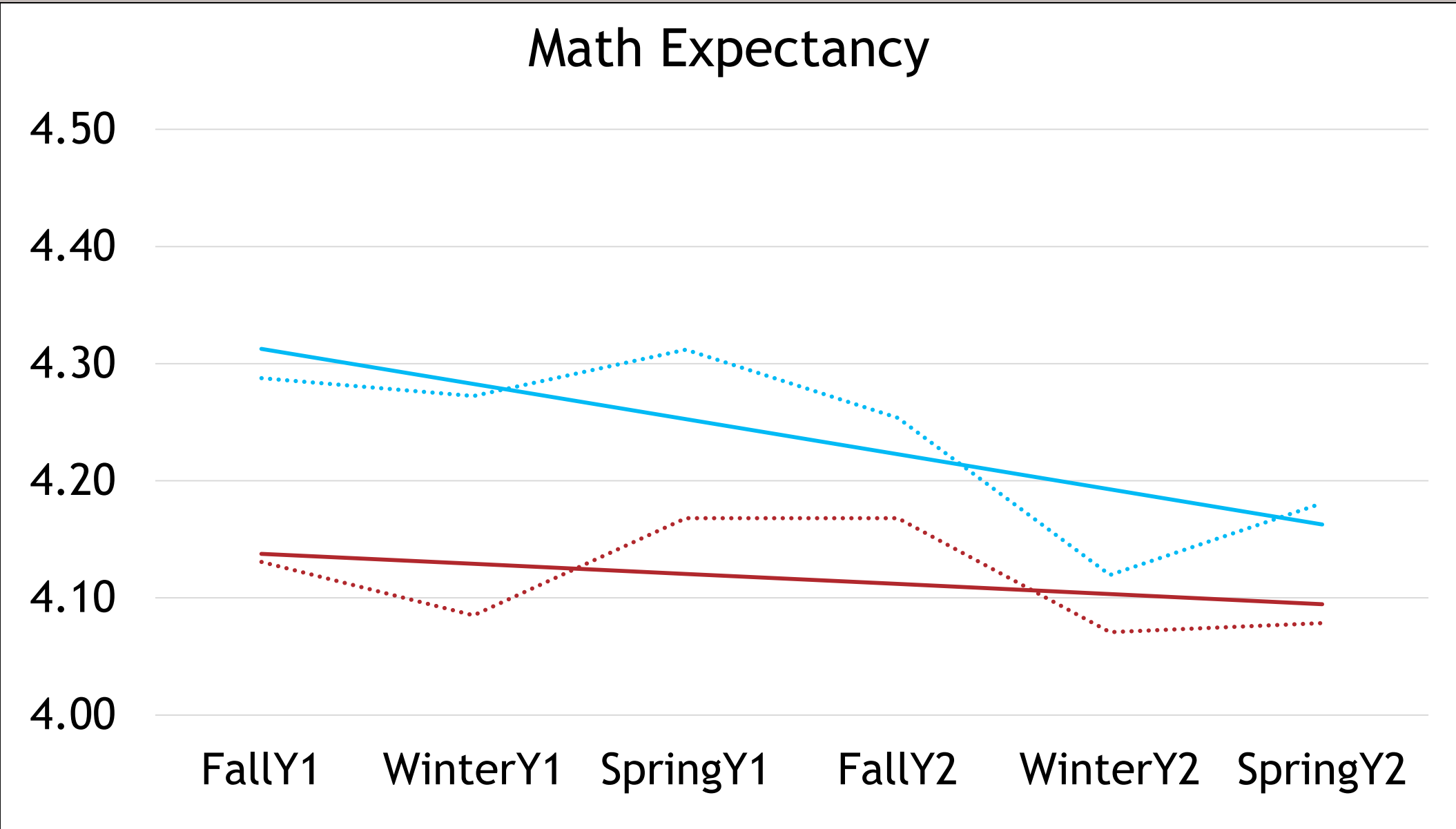
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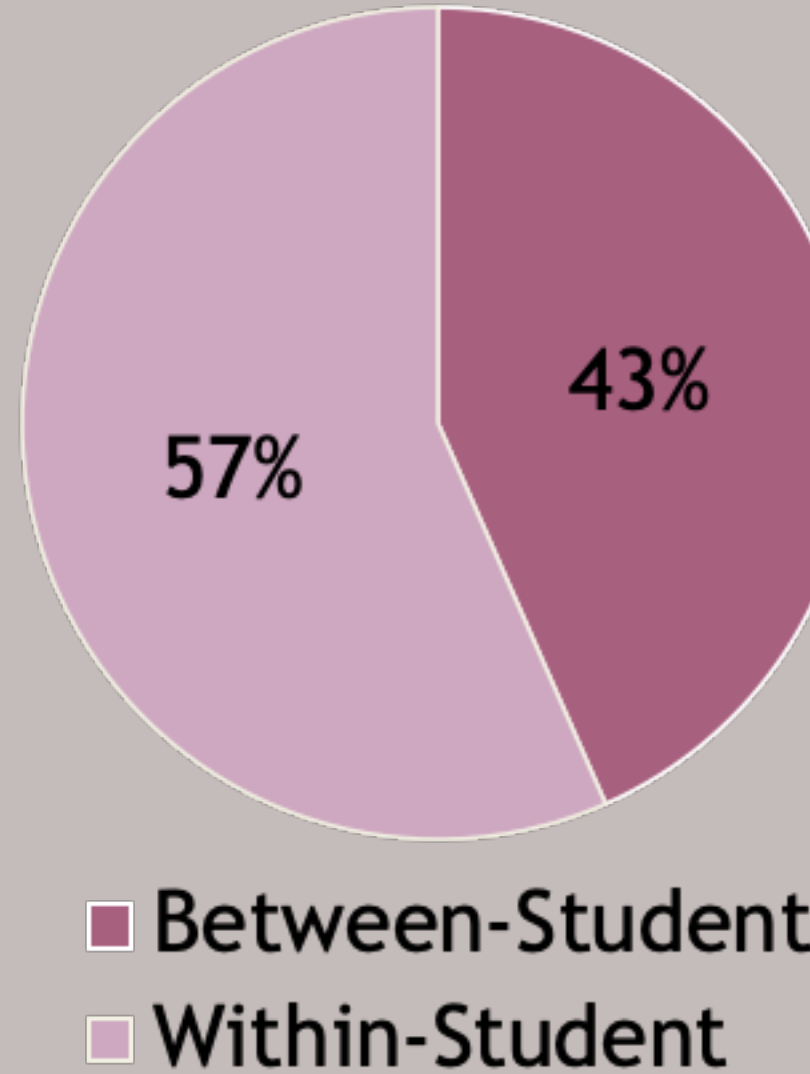
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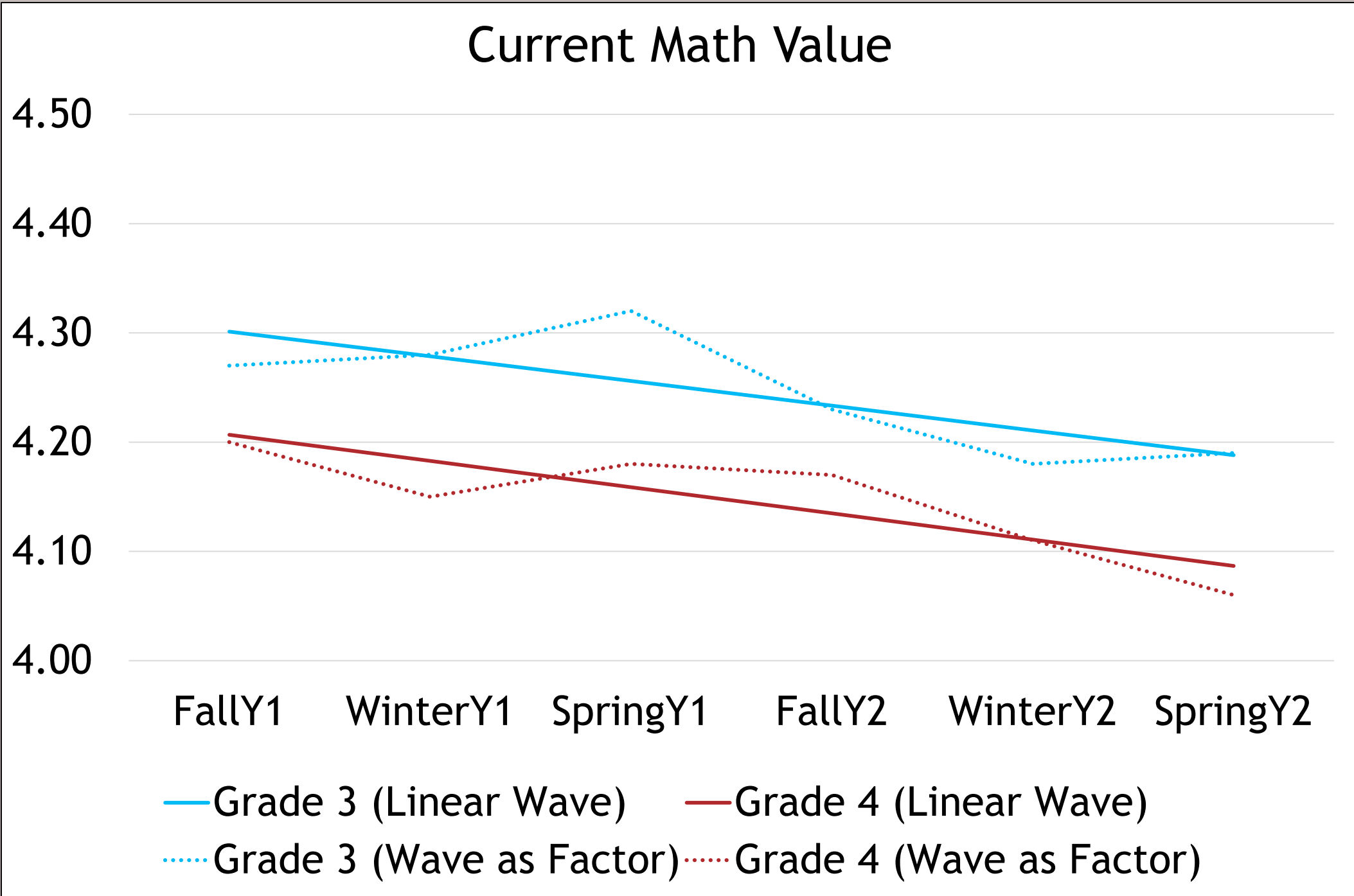✓Factor model ($R^2_{overall}$ = 1.38%)

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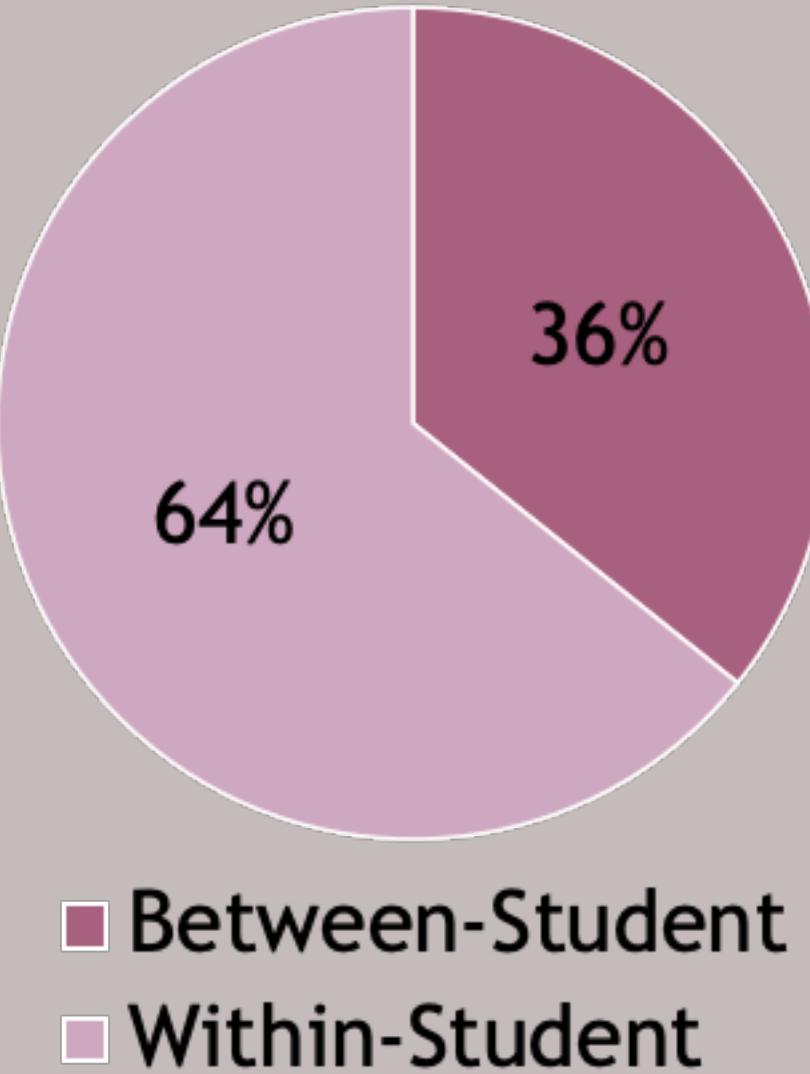- Within-Student

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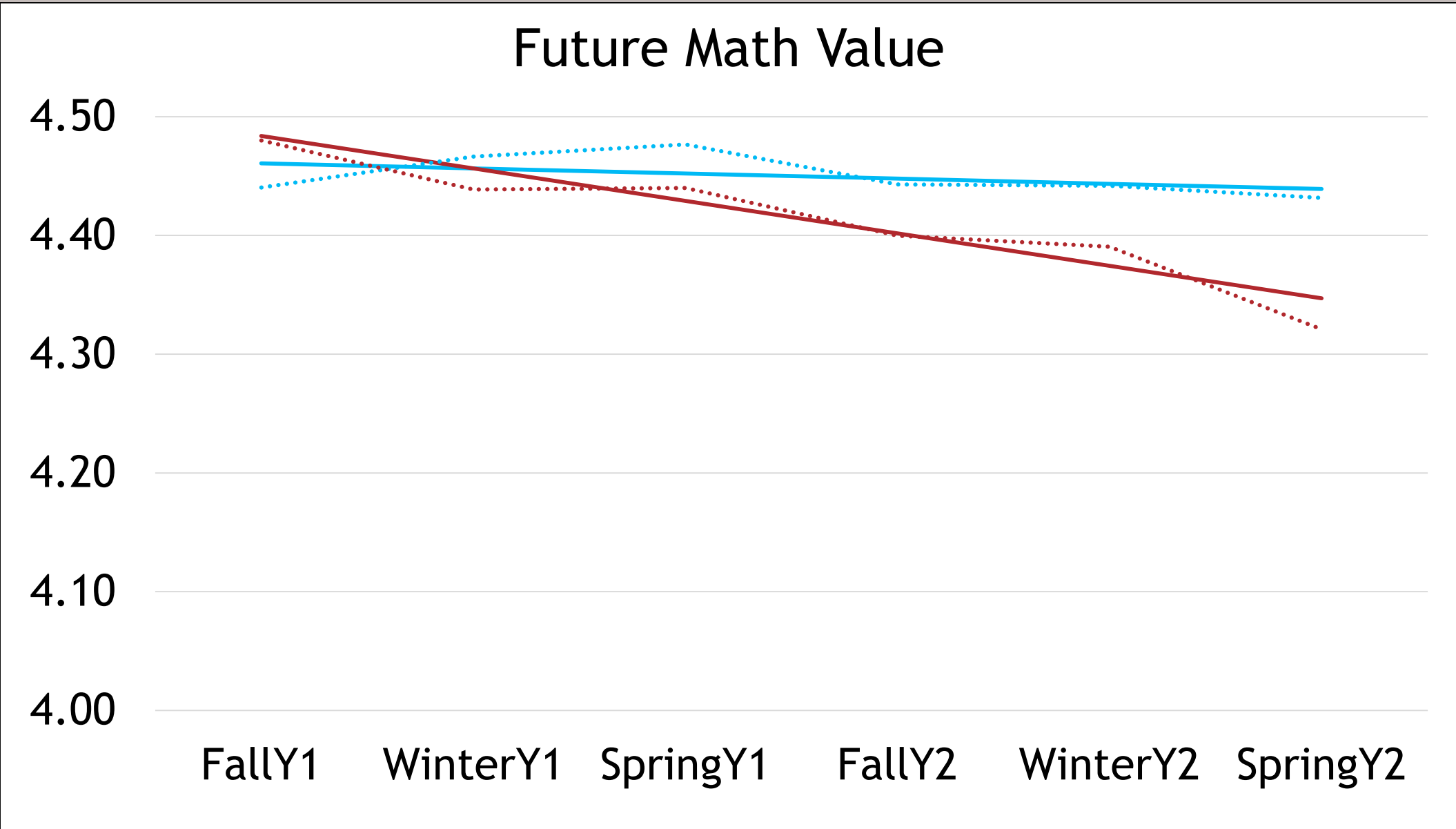## Future Math Value Variance by Level

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