Assessing Perceived Ability and Attitude in a Quantitative Literacy Course

Becky Matz (matz@msu.edu), Nick Rekuski, Rachael Lund

Michigan State University

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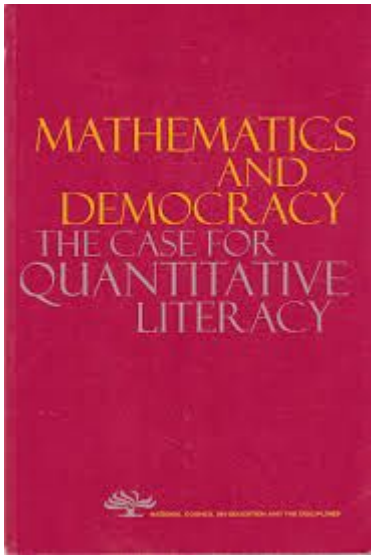
Confidence with mathematics is an important element of quantitative literacy

Confidence *with Mathematics.* Being **comfortable** with quantitative ideas and **at ease** in applying quantitative methods. Individuals who are quantitatively confident **routinely** use mental estimates to quantify, interpret, and check other information. Confidence is the opposite of “math anxiety”; it makes numeracy as **natural** as ordinary language.



National Council on Education and the Disciplines (2001). Mathematics and democracy: the case for quantitative literacy. Steen, Lynn Arthur, Ed.

Quantitative literacy at MSU

- 2005: Task force reviewed goals for QL at MSU
- 2010: Initial course pilots under existing course names
- 2015: First course offerings under QL course names
    - MTH 101 (QL1)
    - MTH 102 (QL2)
- 2018: Courses operating at scale (?)

We have addressed a variety of assessment questions in QL

- What is an appropriate assessment of prerequisite QL skills for entering MSU students?

Sikorskii, A.; Mell, V.; Gilliland, D.; Kaplan, J.; and Ahn, S. (2011) "Quantitative Literacy at MSU, 1: Development and Initial Evaluation of the Assessment," Numeracy, 4(2), 5.

- How were the two QL courses designed?

Tunstall, S. L.; Melfi, V.; Craig, J.; Edwards, R.; Krause, A.; Wassink, B.; and Piercey, V. (2016) "Quantitative Literacy at MSU, 3: Designing General Education Mathematics Courses," Numeracy, 9(2), 6.

- How do the students reason quantitatively when discussing their reactions to public issues?

Tunstall, S. L., Matz, R. L., & Craig, J. C. (2018). Quantitative Literacy Courses as a Space for Fusing Literacies. The Journal of General Education, 65(3-4), 178-194.

- Questions about student comfort with math, views of math, etc. have been ongoing as the courses have scaled

Survey development

- Reviewed existing surveys and scales about
    - Perceived ability
    - Preference for numerical vs. prose information
    - Perceptions about mathematics
    - Mathematics anxiety and self-efficacy
    - Confidence
- Narrowed our questions of interest to comfort and attitudes

Fagerlin, A., Zikmund-Fisher, B.J., Ubel, P.A., Jankovic, A., Derry, H.A., & Smith, D.M. Measuring numeracy without a math test: Development of the Subjective Numeracy Scale (SNS). Medical Decision Making, 2007: 27: 672-680.

Wismath, Shelly L. and Worrall, Alyson (2015) "Improving University Students' Perception of Mathematics and Mathematics Ability," Numeracy: Vol. 8 : Iss. 1 , Article 9.

Tapia, M., & Marsh, G. E. (2004). An instrument to measure mathematics attitudes. Academic Exchange Quarterly, 8(2), 16-22.

Example questions

I am comfortable working with fractions.

Disagree strongly	Disagree somewhat	Agree somewhat	Agree strongly

If a cookie recipe calls for 1 ¾ cups flour, and I want to make a half batch, I am comfortable computing the amount of flour needed without a calculator.

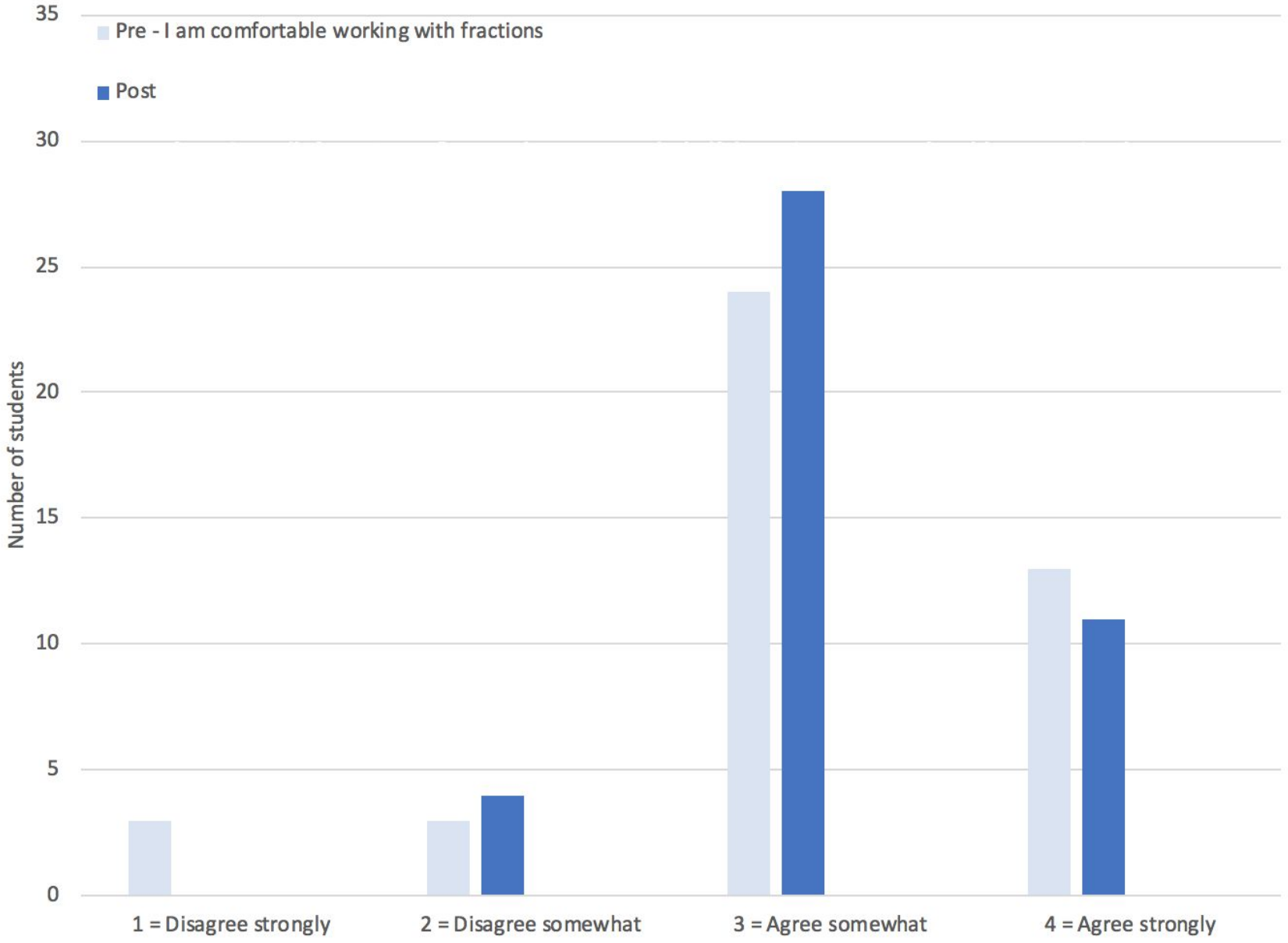
Disagree strongly	Disagree somewhat	Agree somewhat	Agree strongly

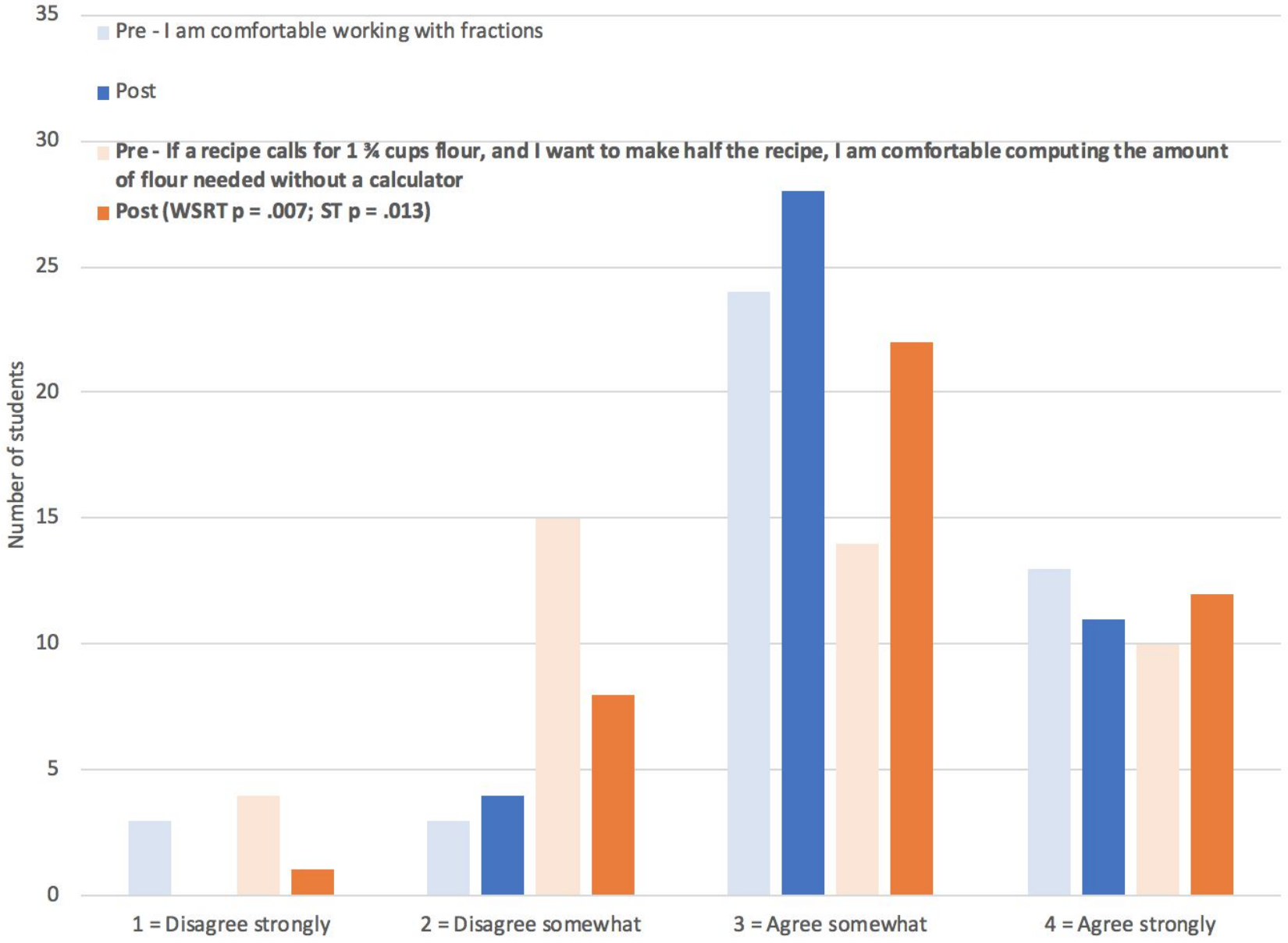
Data collection

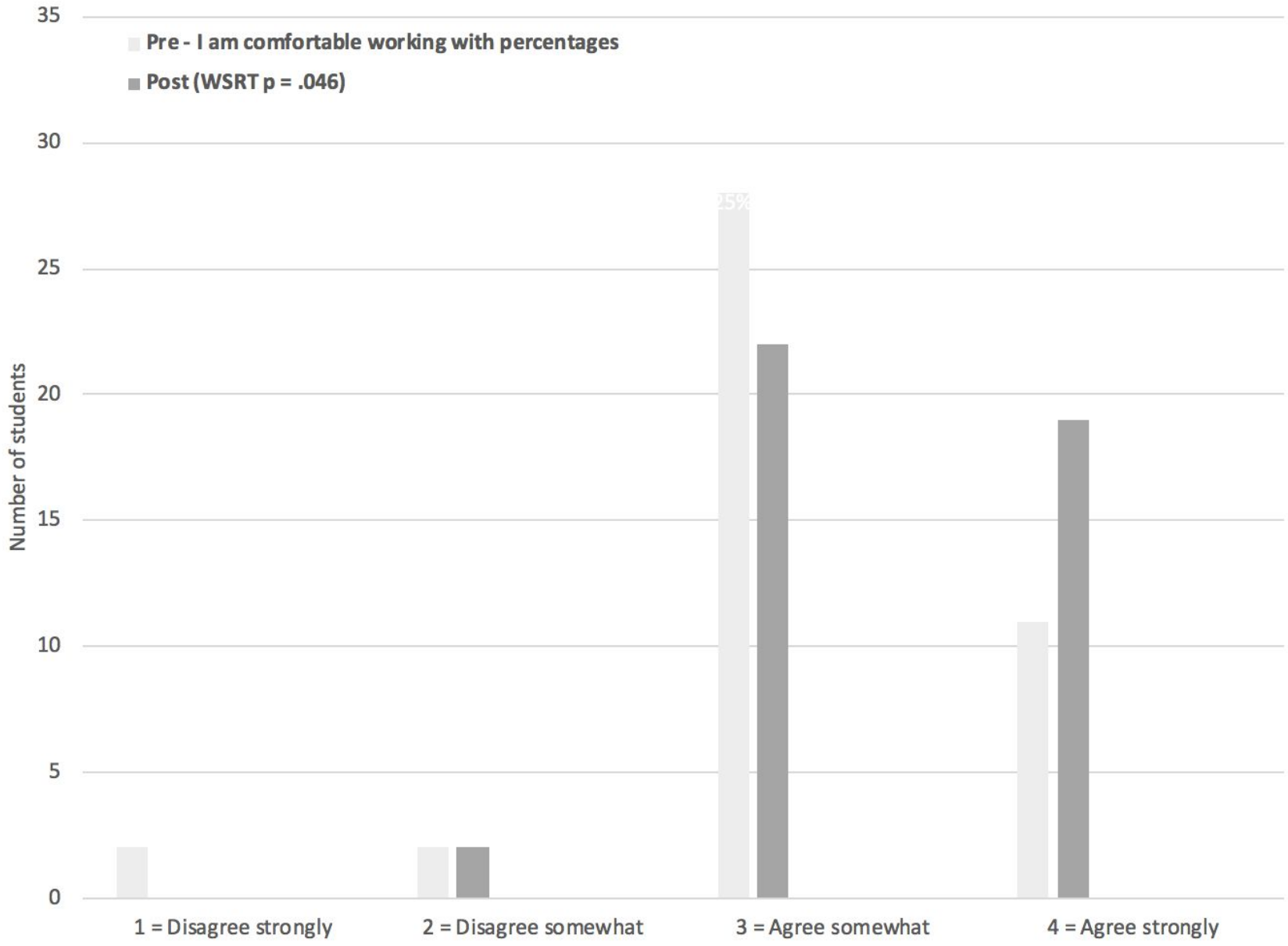
- Pre- and post-survey in the two Summer ‘18 QL1 courses

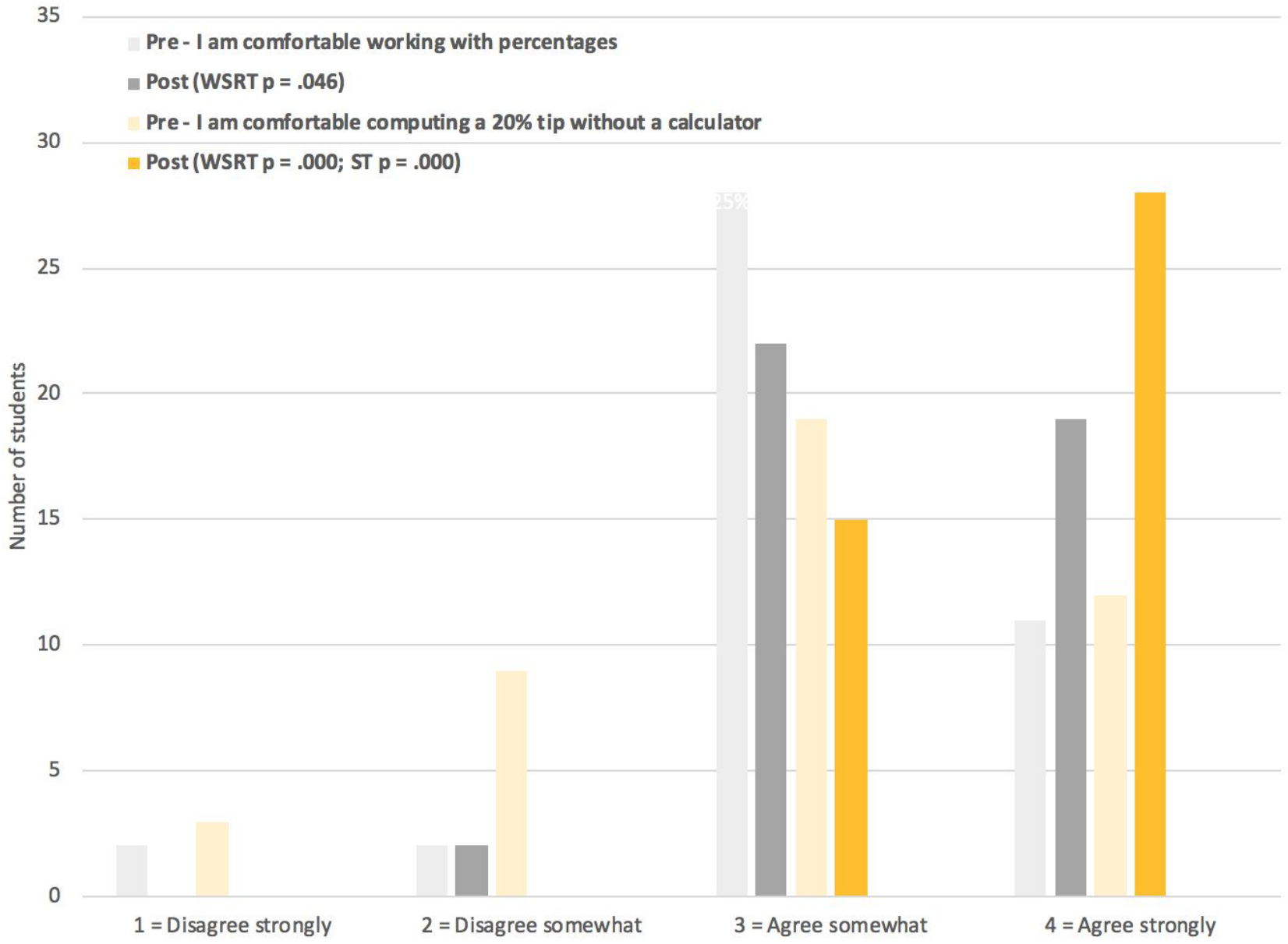
	Pre-survey	Post-survey	Matched students
QL1 - Section 1	25 / 34 (74%)	25 / 28 (89%)	22
QL1 - Section 2	18 / 26 (69%)	18 / 23 (78%)	13

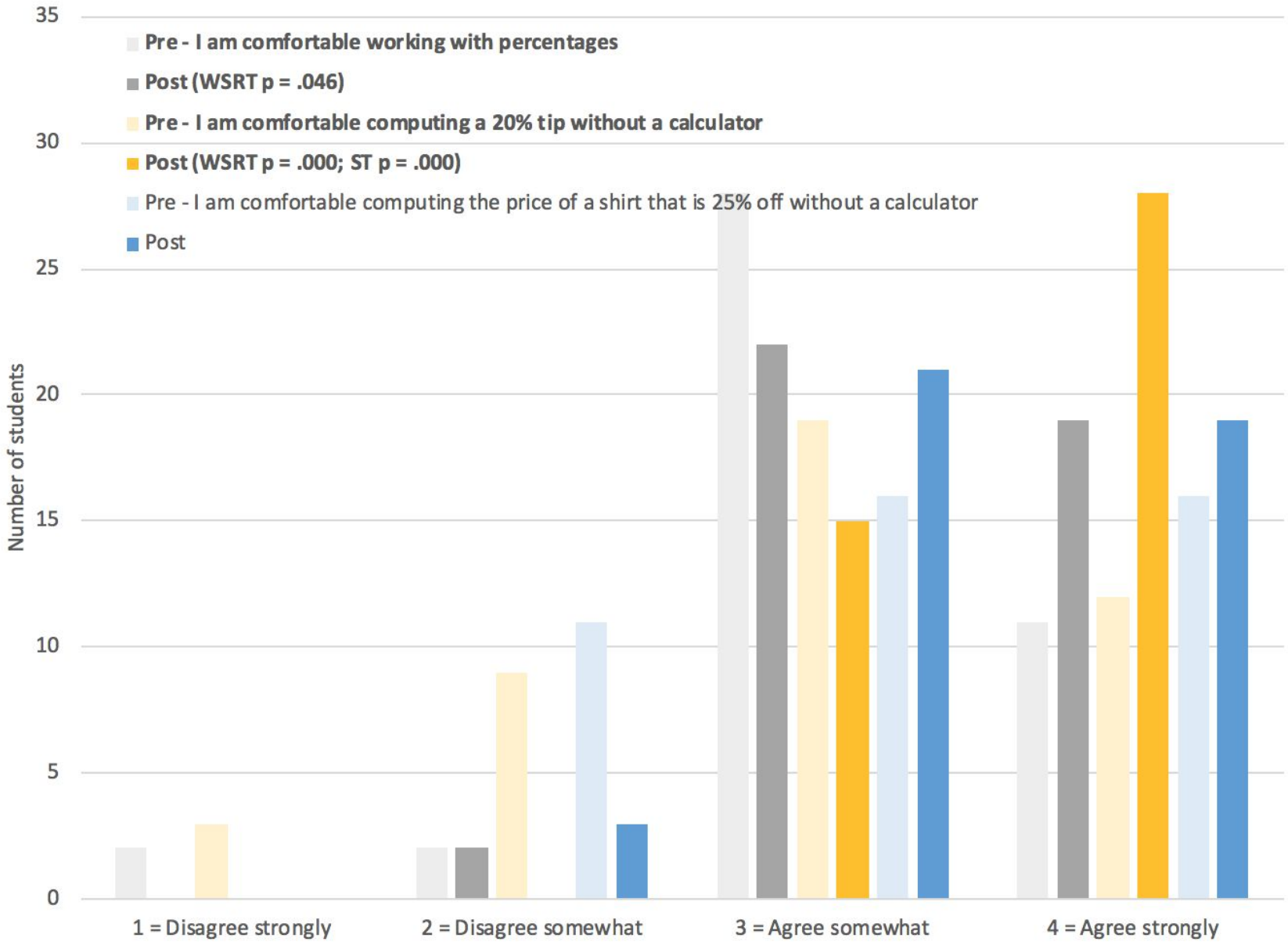
- Each survey took students 5-10 min to complete
- Also included open-ended questions about topics of interest to students

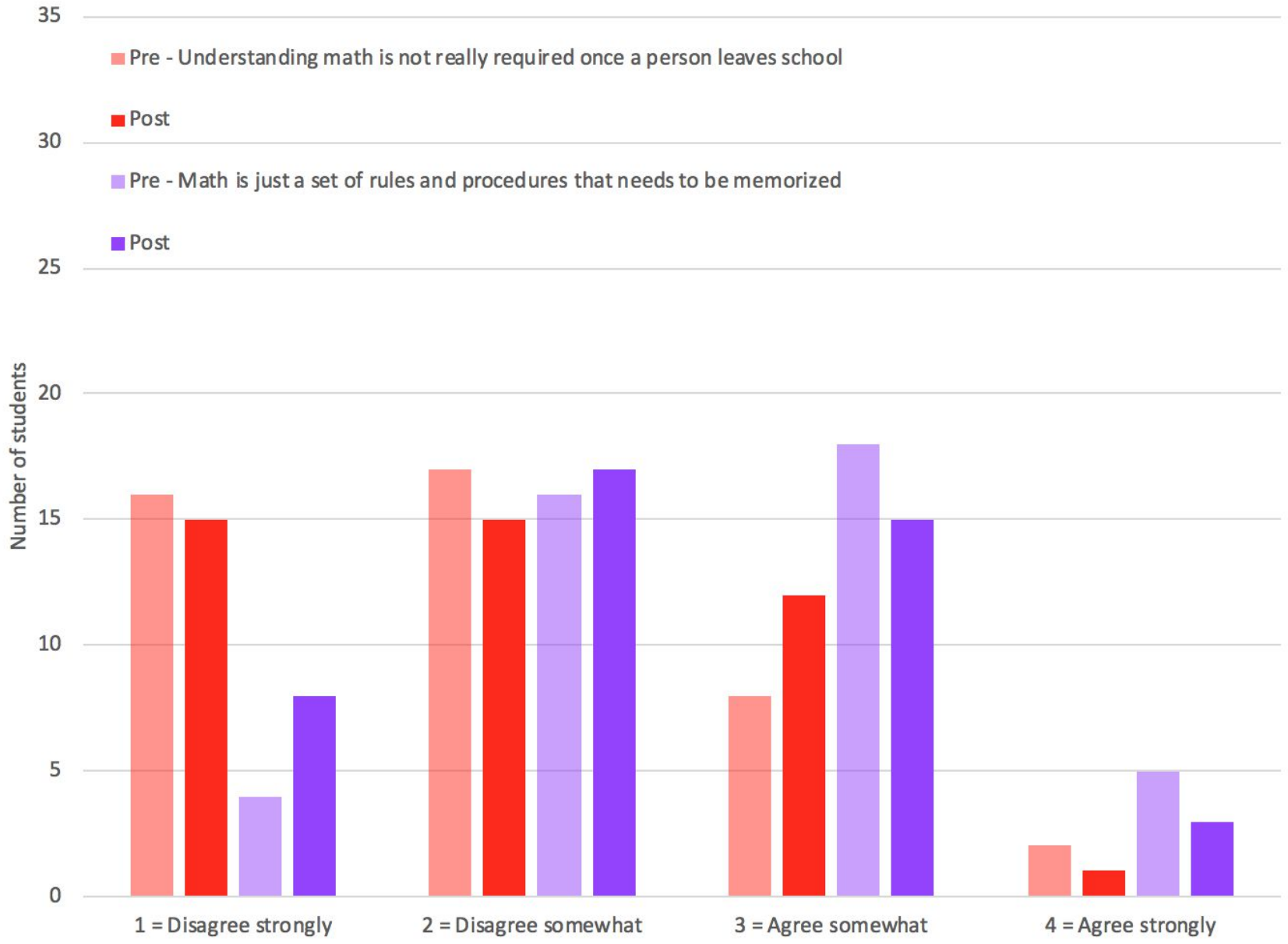

Pre - I am comfortable working with fractions
Post
Number of students
35
30
25
20
15
10
5
0
1 = Disagree strongly
2 = Disagree somewhat
3 = Agree somewhat
4 = Agree strongly


Pre - I am comfortable working with fractions
Post
Pre - If a recipe calls for 1 ¾ cups flour, and I want to make half the recipe, I am comfortable computing the amount of flour needed without a calculator
Post (WSRT p = .007; ST p = .013)
Number of students
35
30
25
20
15
10
5
0
1 = Disagree strongly
2 = Disagree somewhat
3 = Agree somewhat
4 = Agree strongly

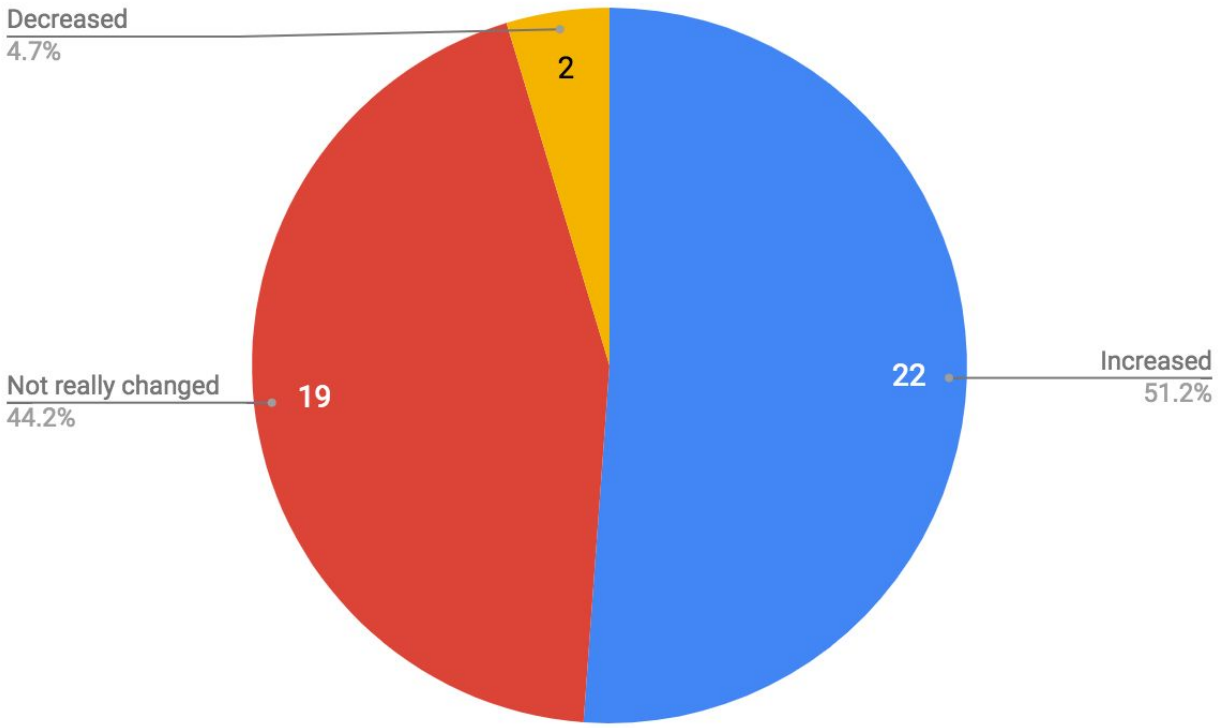

Pre - I am comfortable working with percentages
Post (WSRT p = .046)
Number of students
35
30
25
20
15
10
5
0
25%
1 = Disagree strongly
2 = Disagree somewhat
3 = Agree somewhat
4 = Agree strongly


Pre - I am comfortable working with percentages
Post (WSRT p = .046)
Pre - I am comfortable computing a 20% tip without a calculator
Post (WSRT p = .000; ST p = .000)
Number of students
35
30
25
20
15
10
5
0
1 = Disagree strongly
2 = Disagree somewhat
3 = Agree somewhat
4 = Agree strongly


35
30
25
20
15
10
5
0
Number of students
Pre - I am comfortable working with percentages
Post (WSRT p = .046)
Pre - I am comfortable computing a 20% tip without a calculator
Post (WSRT p = .000; ST p = .000)
Pre - I am comfortable computing the price of a shirt that is 25% off without a calculator
Post
1 = Disagree strongly
2 = Disagree somewhat
3 = Agree somewhat
4 = Agree strongly


35
30
25
20
15
10
5
0
Number of students
Pre - Understanding math is not really required once a person leaves school
Post
Pre - Math is just a set of rules and procedures that needs to be memorized
Post
1 = Disagree strongly
2 = Disagree somewhat
3 = Agree somewhat
4 = Agree strongly

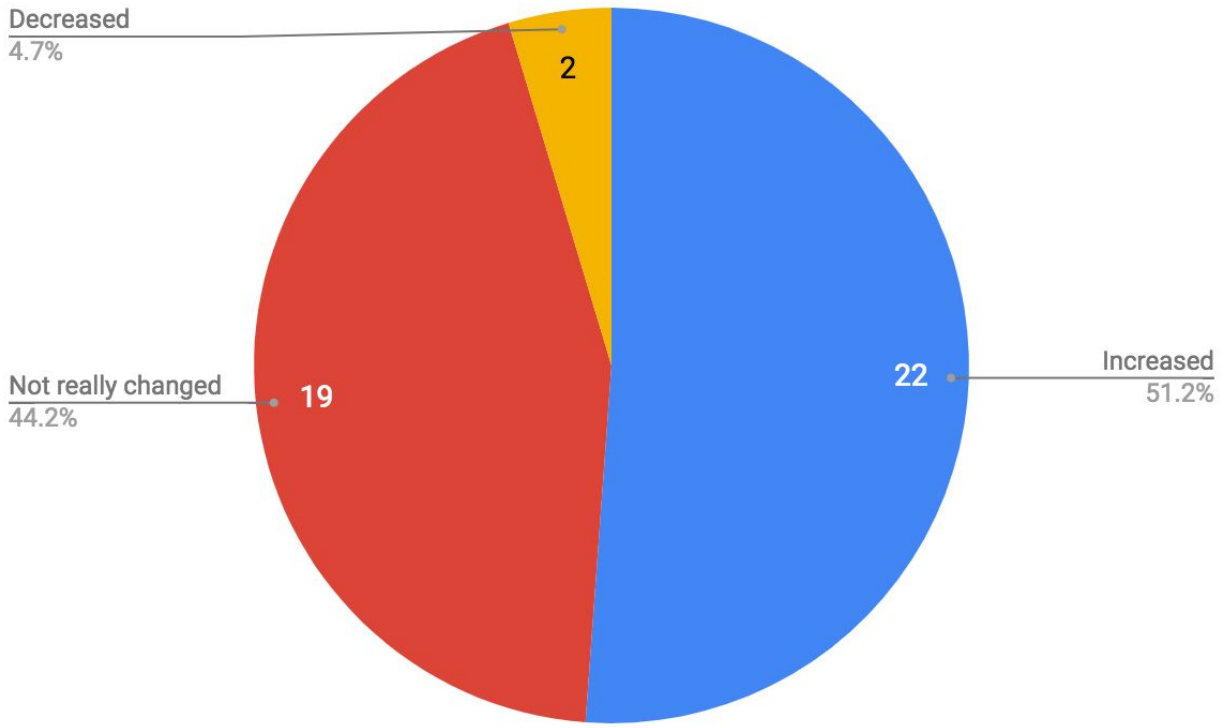
Compared to the beginning of this course, my confidence in my math abilities has decreased, not really changed, or increased.



Not really changed

- *Was not motivated to learn much.*
- *Many of the topics I have already learned about but were taught in odd ways*
- *Due to strong prior knowledge from other courses*
- *I'm still just as confident in my abilities*

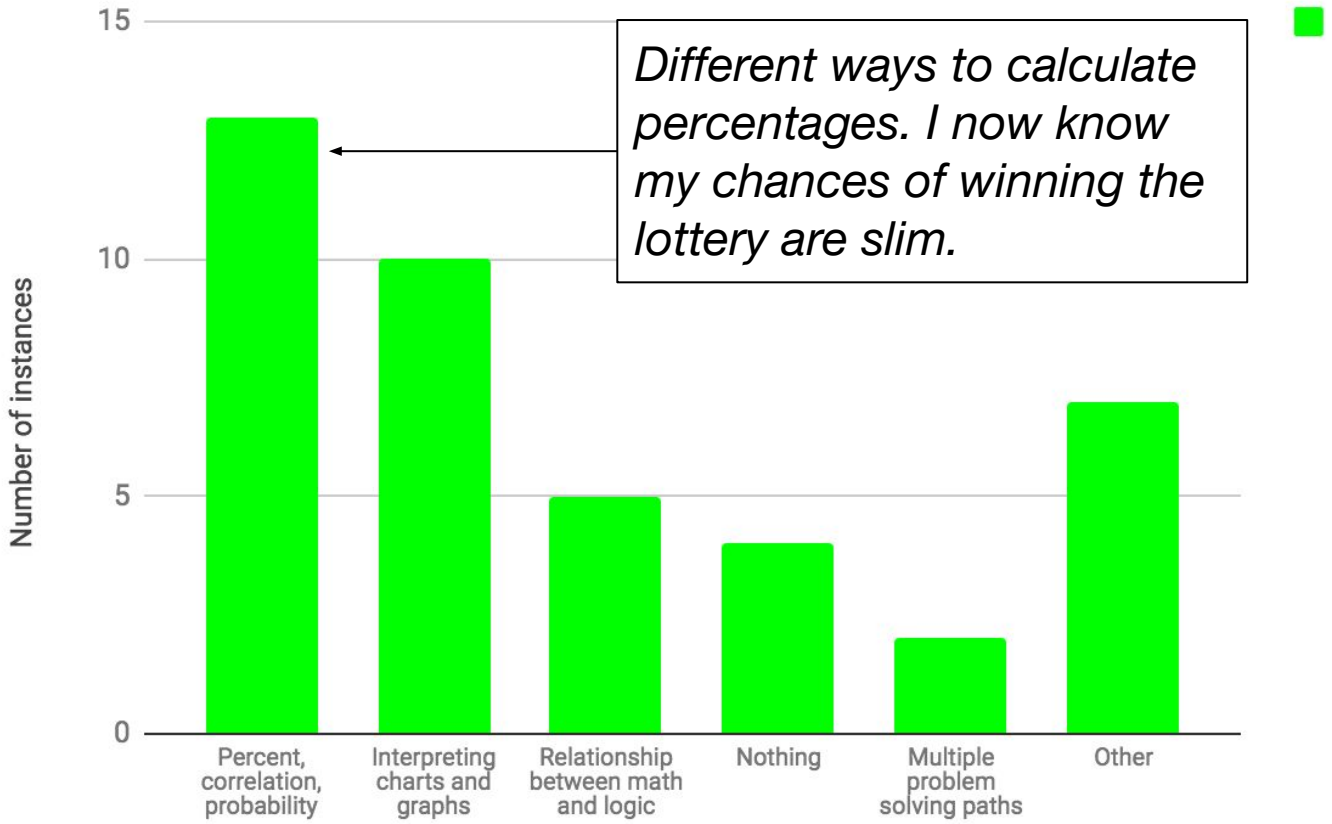
Compared to the beginning of this course, my confidence in my math abilities has decreased, not really changed, or increased.



Increased

- *I hadn't done some of these topics previously, but now I know how to.*
- *Because I thought I sucked at math before*
- *I re-learned basics like converting fractions and such.*
- *I feel that I've learned how to use logic more accurately in my everyday life*

What did students think were important big ideas from the course?



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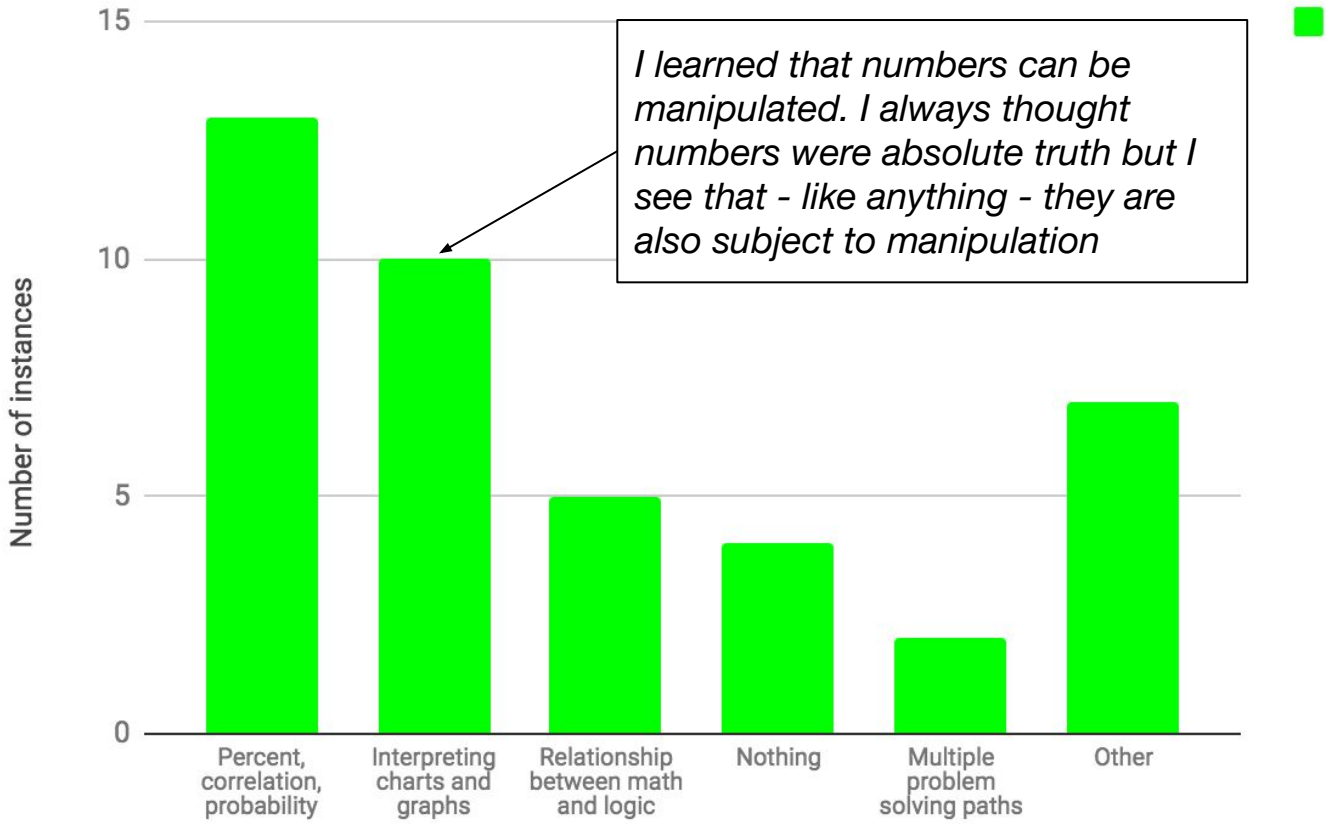

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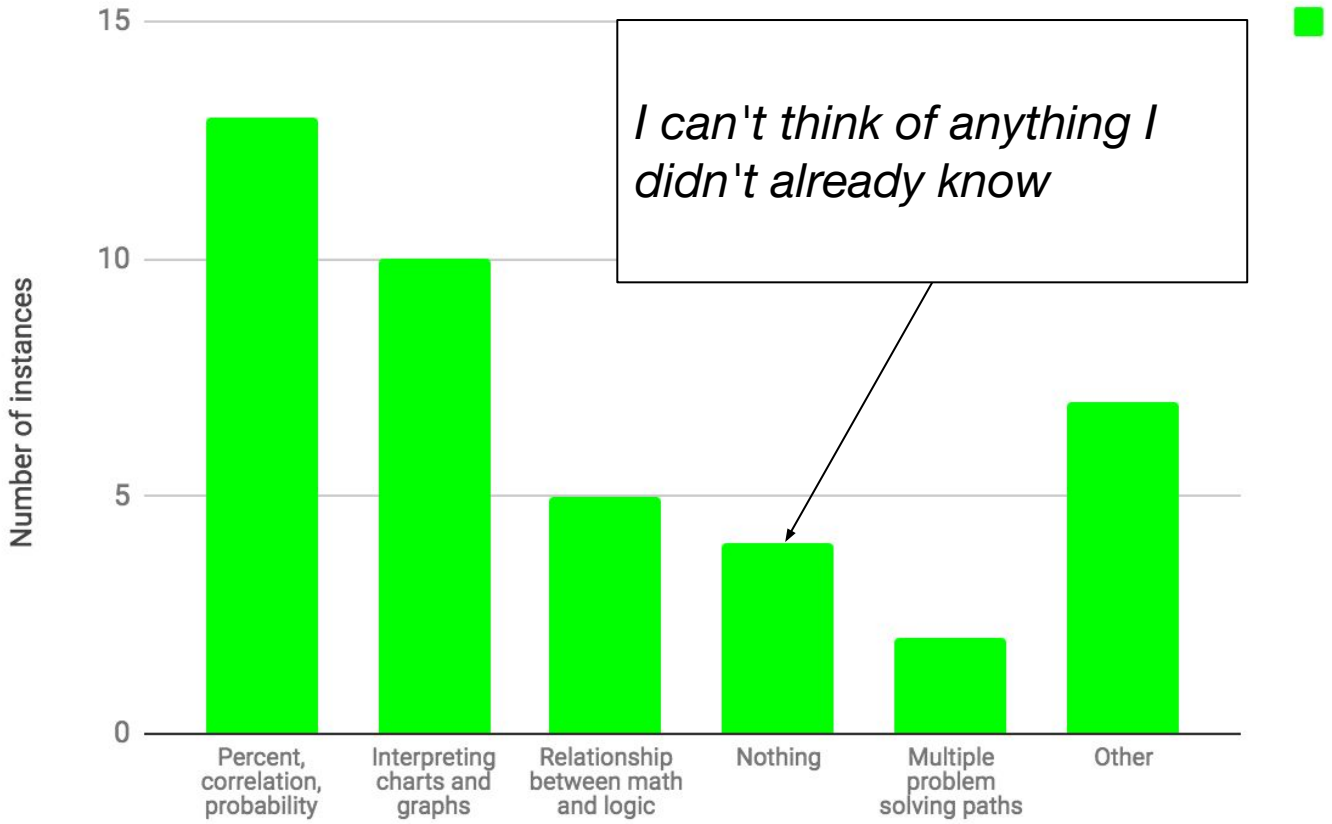

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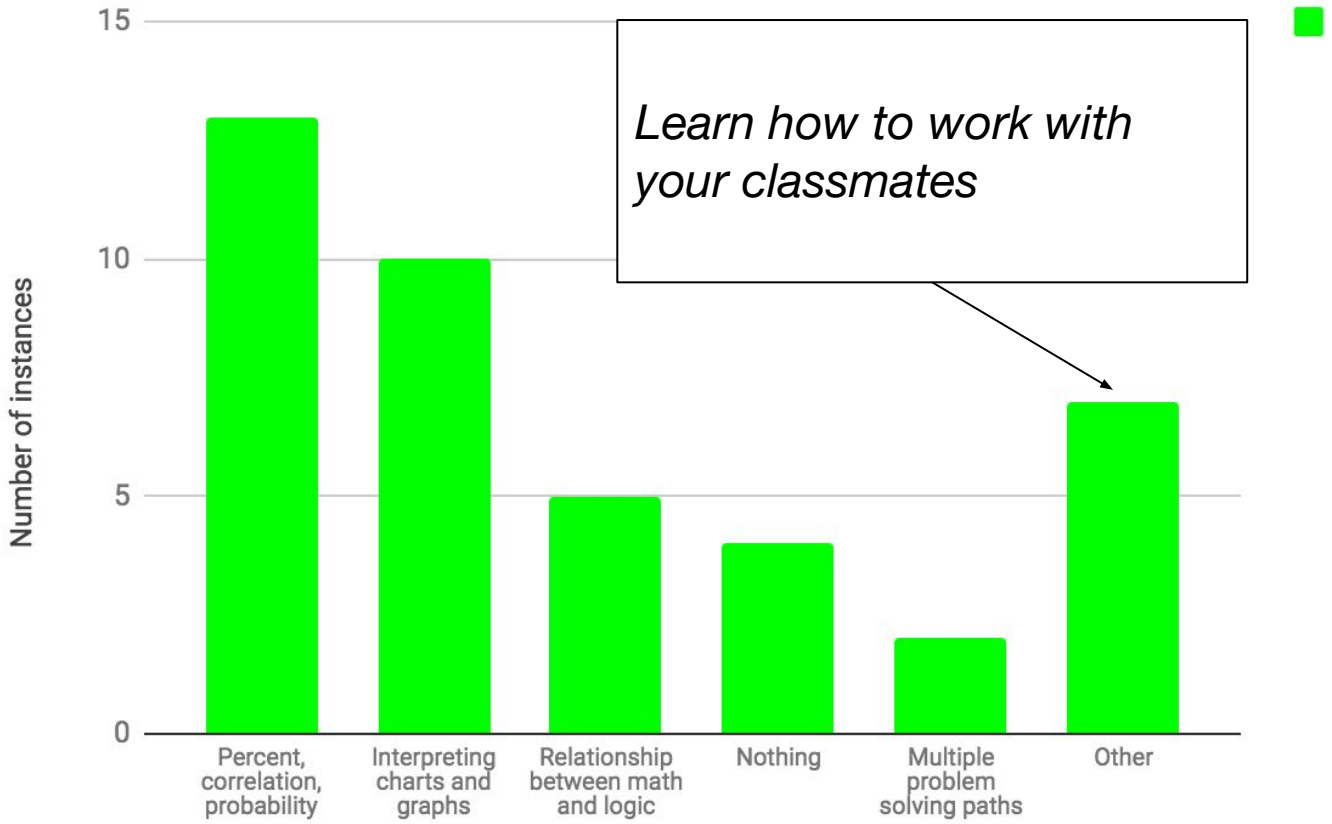


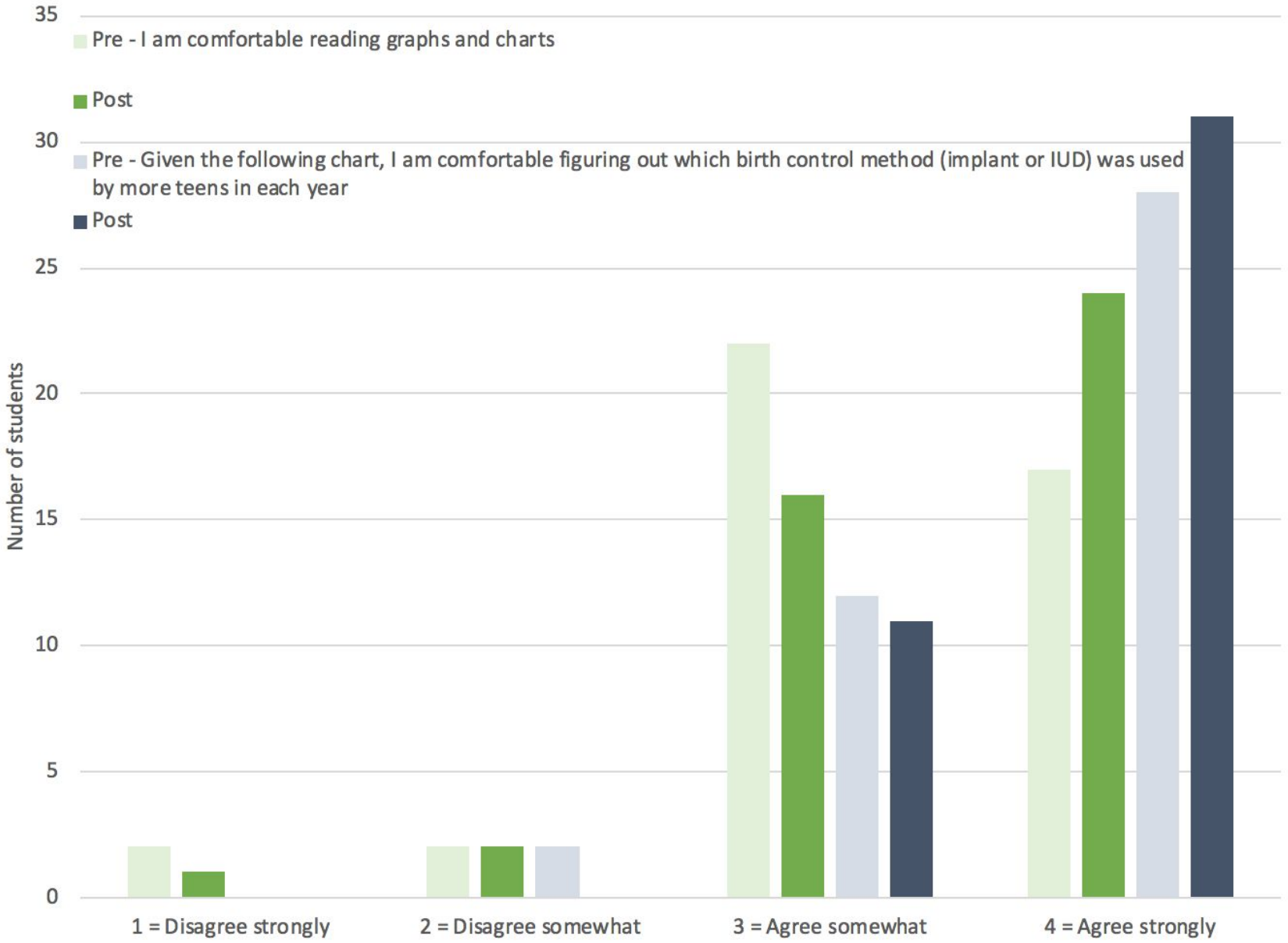
Initial findings

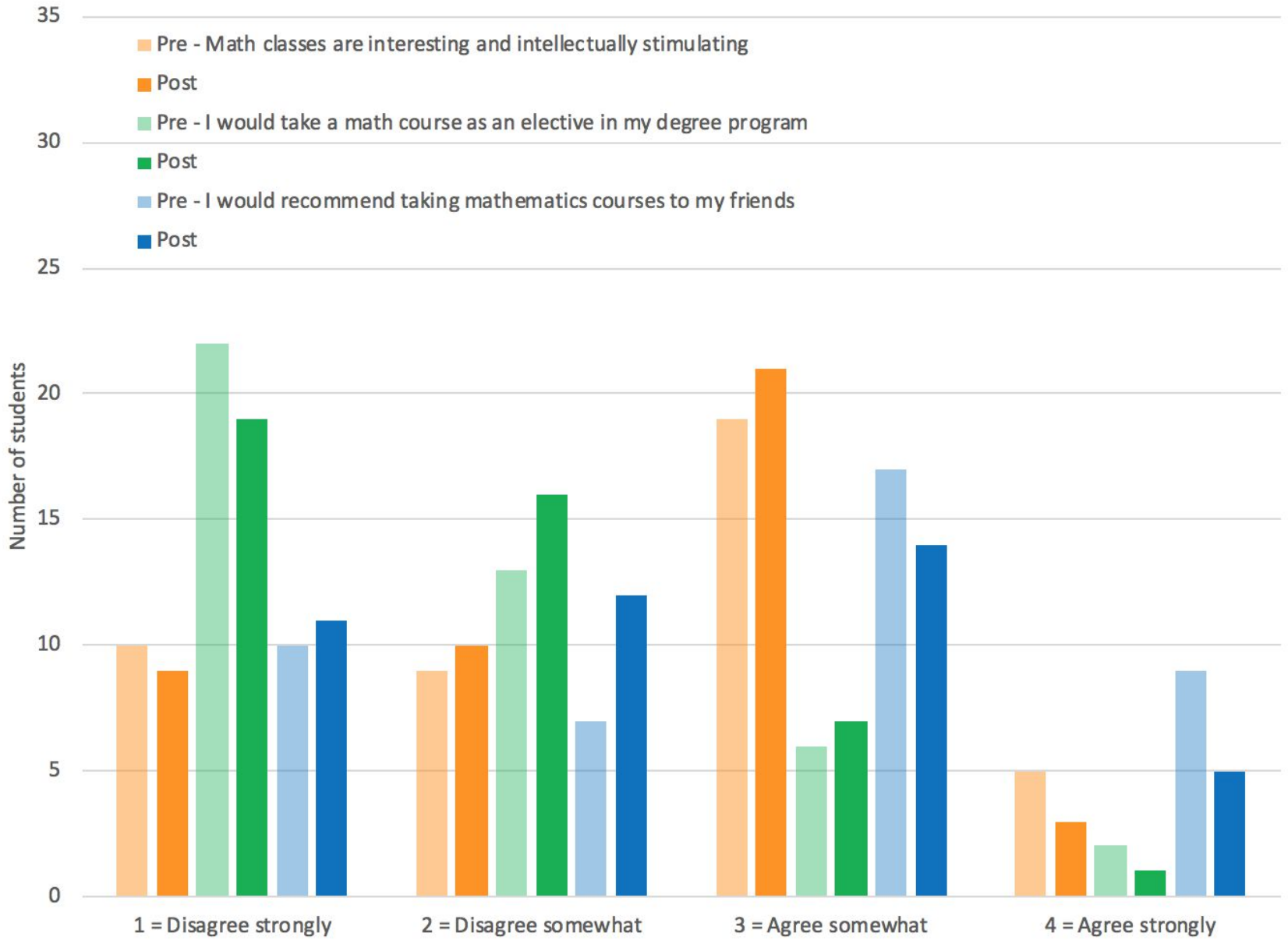
- The general and specific comfort questions show interesting differences that perhaps depend on the nature of the specific question.
- Student attitudes about mathematics did not appear to appreciably shift during these summer courses.
- Most students described either no change or increased confidence in their mathematics abilities.
- The big ideas that students identify in the course largely align with overall course goals.

Thank you!

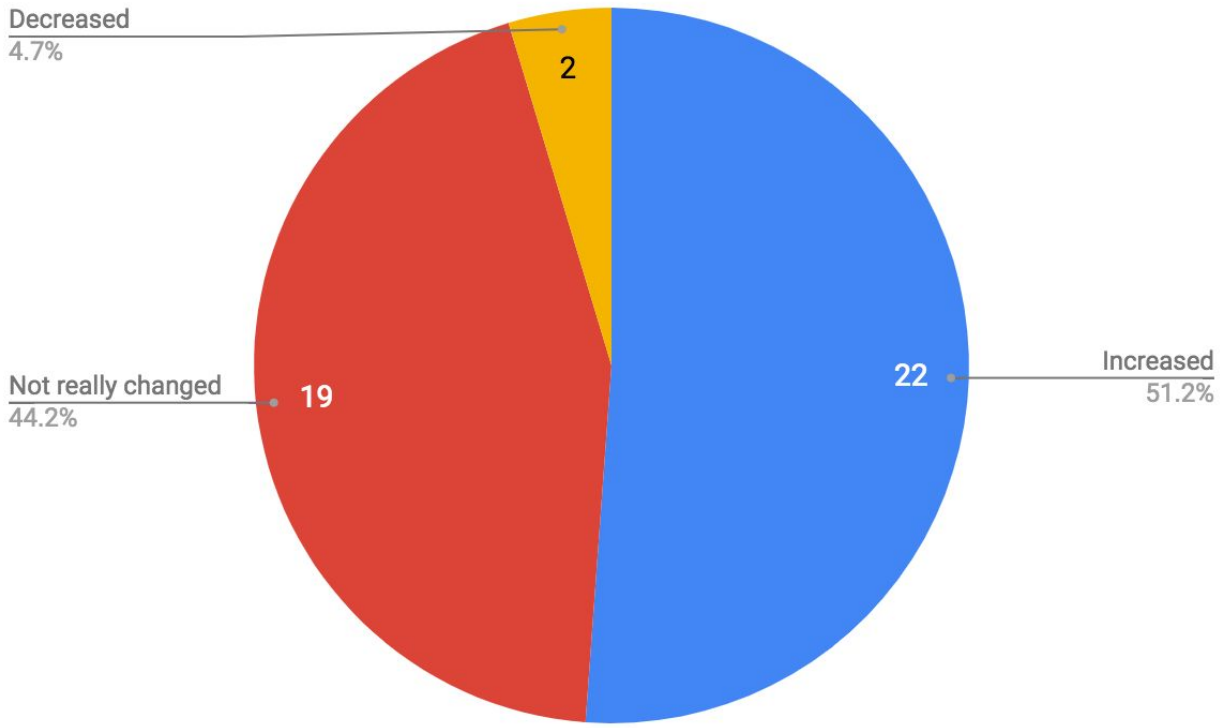
Questions for discussion

- What affective measures have you used with success?
- How have you tried to improve student affect? And what outcomes have you observed?
- What relationships between course performance and affective measures have you observed?


35
30
25
20
15
10
5
0
Number of students
Pre - I am comfortable reading graphs and charts
Post
Pre - Given the following chart, I am comfortable figuring out which birth control method (implant or IUD) was used by more teens in each year
Post
1 = Disagree strongly
2 = Disagree somewhat
3 = Agree somewhat
4 = Agree strongly


35
30
25
20
15
10
5
0
Number of students
Pre - Math classes are interesting and intellectually stimulating
Post
Pre - I would take a math course as an elective in my degree program
Post
Pre - I would recommend taking mathematics courses to my friends
Post
1 = Disagree strongly
2 = Disagree somewhat
3 = Agree somewhat
4 = Agree strongly

Compared to the beginning of this course, my confidence in my math abilities has decreased, not really changed, or increased.



Decreased

- *The class reminded me what I didn't know and the method for teaching was very different than what I experienced before.*
- *Because I think the styles of teaching makes a huge impact how well you can grasp the material and understand it the right way and memorise everything more.*