Measuring Student Mindset Changes Using Course Evaluation Surveys
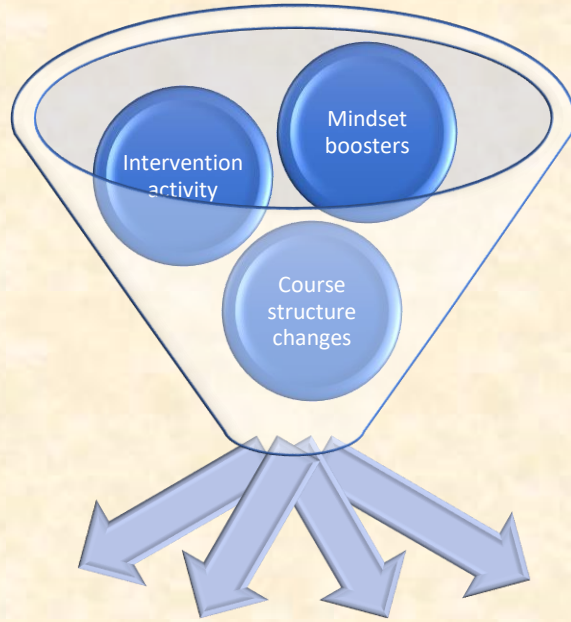
Brian Lee, *Dept. of Natural Sciences, Santa Fe College*

Beatriz Gonzalez, *Dept. of Natural Sciences, Santa Fe College*

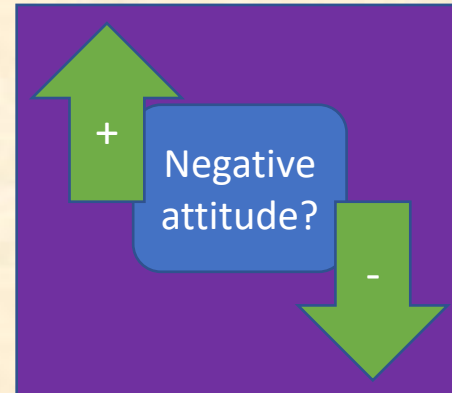**Maria Rinehart**, *Dept. of Mathematics, Santa Fe College*
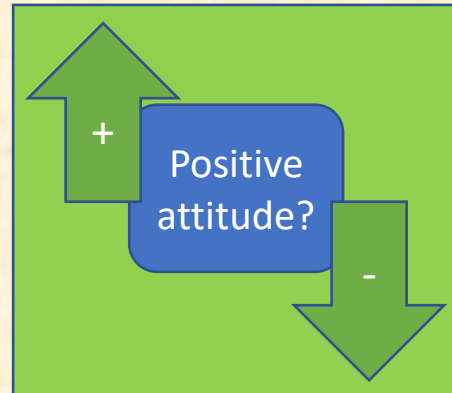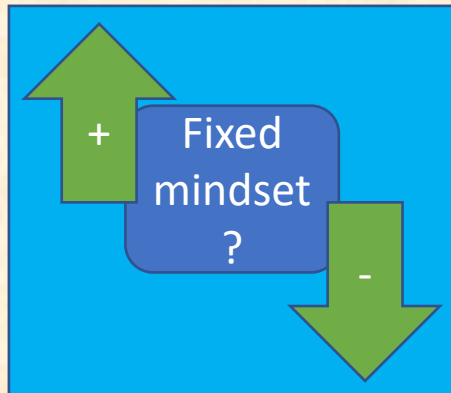
July 8, 2021

Our research question

Does the mindset intervention activity provided to FL-C LSRCE faculty by Omid Fotuhi's team increase or decrease the occurrences of:
- *growth mindset,*
- *fixed mindset,*
- *positive attitude, and*
- *negative attitudes,*

as expressed by students on their standardized end-of-course opinion surveys?
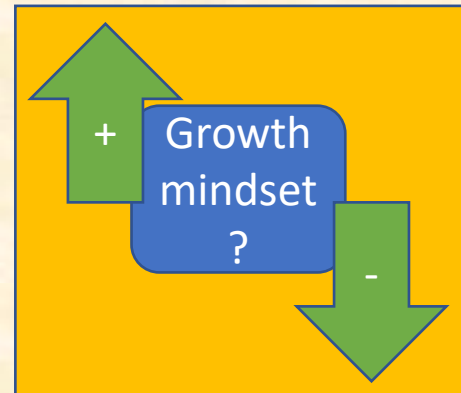
Intervention activity

Mindset boosters

Course structure changes

+ Growth mindset? -

+ Fixed mindset? -

+ Positive attitude? -

+ Negative attitude? -

What was the intervention

- FL-C LSRCE mindset intervention activity provided by Omid Fotuhi's team via a web link

Intervention class section → Randomly assign → Web link to intervention activity / Web link to placebo activity
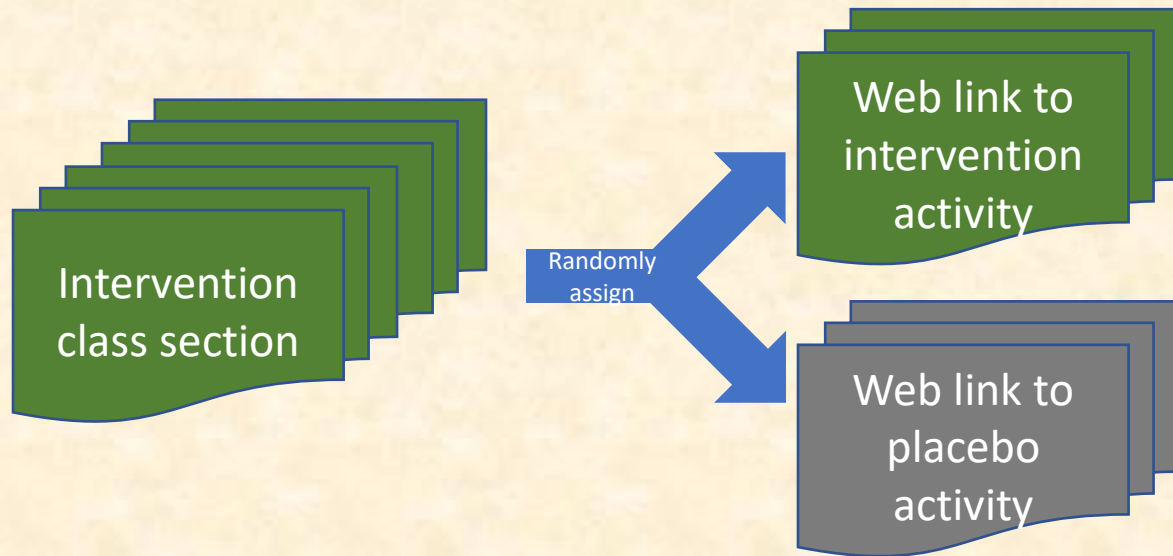
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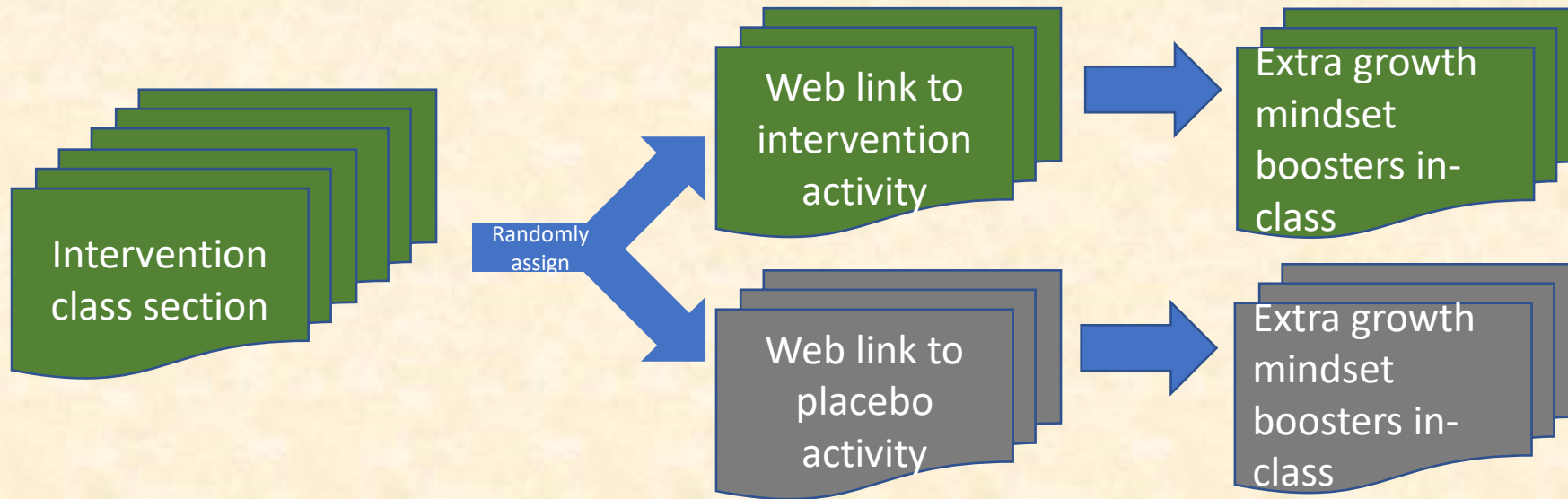
Intervention class section → Randomly assign →
- Web link to intervention activity → Extra growth mindset boosters in-class
- Web link to placebo activity → Extra growth mindset boosters in-class

Non-intervention class section → No web link → No new mindset boosters in-class
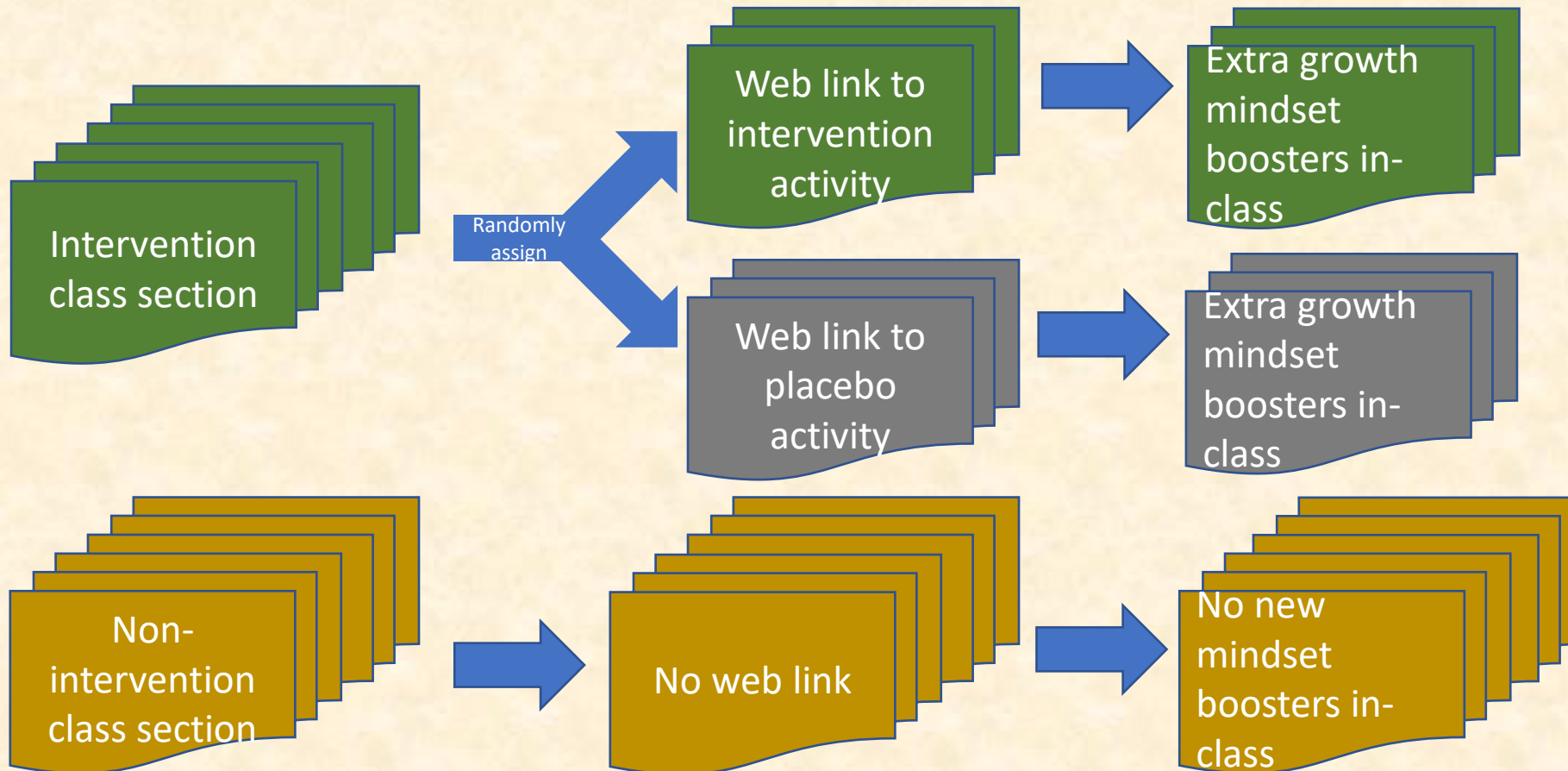
What data did we analyze

- Data: optional freeform comments entered by students in SF College's standardized end-of-course opinion survey
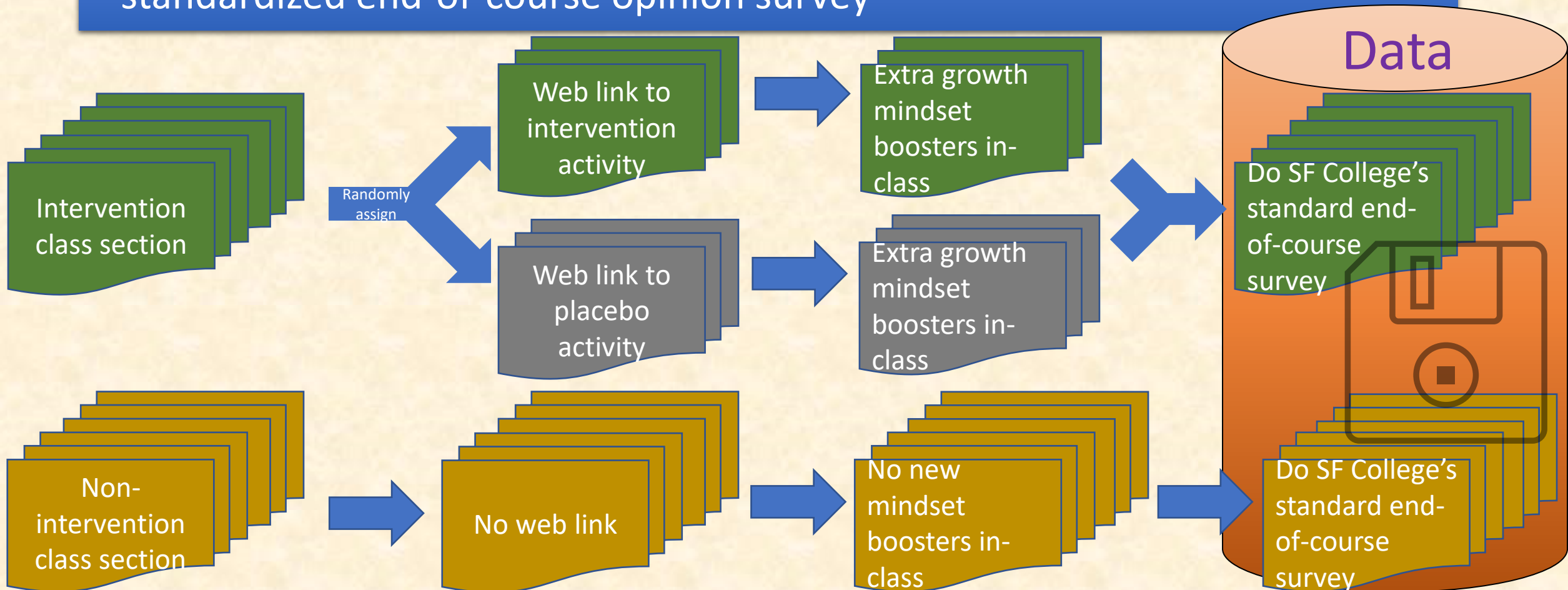
How we analyzed the data

Data

Randomize order of comments

Distribute comments to co-authors for ratings

- We randomized the order of all student comments, to reduce bias.
- All three co-authors (Brian, Beatriz, and Maria) looked through all the randomized comments and marked comments that they thought represented a student with growth mindset. To count a comment towards the final tally, 2/3 co-authors had to have independently marked it.
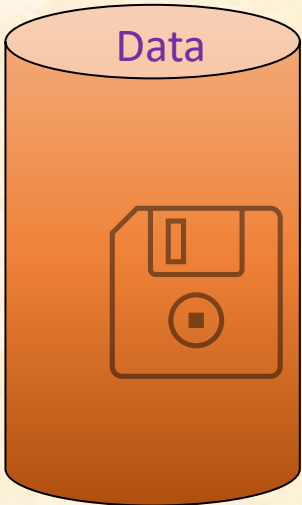- We repeated the tally for fixed mindset, positive attitude, and negative attitude.

Co-author #1

Comment	Growth?	Fixed?	Positive?	Negative?
"Quizzes made excellent practice for the exam."	X			

Co-author #2

Comment	Growth?	Fixed?	Positive?	Negative?
"Quizzes made excellent practice for the exam."			X	

Co-author #3

Comment	Growth?	Fixed?	Positive?	Negative?
"Quizzes made excellent practice for the exam."	X			

Tally rating if 2/3 co-authors marked it

Comment	Growth?	Fixed?	Posi
"Quizzes made excellent practice for the exam."	XX		

What were our results

	No intervention (Total of Fall '19 + Fall '20 + Spring '21)	Fall 2019 intervention	Fall 2020 intervention	Spring 2021 intervention	Total of Fall '19 + Fall '20 + Spring '21 interventions
# growth comments out of all surveys	10 out of 60	0 out of 29	8 out of 61	6 out of 50	14 out of 140
# of fixed comments out of all surveys	3 out of 60	1 out of 29	1 out of 61	1 out of 50	3 out of 140
# of positive comments out of all surveys	16 out of 60	8 out of 29	16 out of 61	21 out of 50	45 out of 140
# of negative comments out of all surveys	2 out of 60	0 out of 29	3 out of 61	2 out of 50	5 out of 140

What were our results

	No intervention (Total of Fall '19 + Fall '20 + Spring '21)	Fall 2019 intervention	Fall 2020 intervention	Spring 2021 intervention	Total of Fall '19 + Fall '20 + Spring '21 interventions
# growth comments out of all surveys	10 out of 60 =17%	0 out of 29 =0%	8 out of 61 =13%	6 out of 50 =12%	14 out of 140 =10%
# of fixed comments out of all surveys	3 out of 60 =5.0%	1 out of 29 =3.4%	1 out of 61 =1.6%	1 out of 50 =2.0%	3 out of 140 =2.1%
# of positive comments out of all surveys	16 out of 60 =27%	8 out of 29 =28%	16 out of 61 =26%	21 out of 50 =42%	45 out of 140 =32%
# of negative comments out of all surveys	2 out of 60 =3.3%	0 out of 29 =0%	3 out of 61 =4.9%	2 out of 50 =4.0%	5 out of 140 =3.6%

What was statistically significant

(Probabilities check whether Poisson mean without intervention = Poisson mean with)		Fall 2019 intervention	Fall 2020 intervention	Spring 2021 intervention	Total of Fall '19 + Fall '20 + Spring '21 interventions
Probability that growth # was random chance		1.9% (result is unlikely to be random)	39%	35%	15%
Probability that fixed # was random chance		61%	31%	38%	26%
Probability that positive # was random chance		55%	55%	11% (approaching significance)	31%
Probability that negative # was random chance		45%	51%	62%	65%

What was statistically significant

	No intervention (Total of Fall '19 + Fall '20 + Spring '21)	Fall 2019 intervention	Fall 2020 intervention	Spring 2021 intervention	Total of Fall '19 + Fall '20 + Spring '21 interventions
# growth comments out of all surveys	10 out of 60	0 out of 29 (expected 5 out of 29)	8 out of 61	6 out of 50	14 out of 140
# of fixed comments out of all surveys	3 out of 60	1 out of 29	1 out of 61	1 out of 50	3 out of 140
# of positive comments out of all surveys	16 out of 60	8 out of 29	16 out of 61	21 out of 50 (expected 13 out of 50)	45 out of 140
# of negative comments out of all surveys	2 out of 60	0 out of 29	3 out of 61	2 out of 50	5 out of 140

Summary of key results of the interventions

- **Strange news: Fall 2019 intervention sections had fewer students rated as growth mindset, compared to no intervention.** *Why? Possibly due to student populations: intervention biology sections were face-to-face and contained more young students, but the non-intervention bio section was online and contained more working, mature students. (Mature students may better embrace a growth mindset, even without interventions.) ---> Need to gather more data from population-matched classes.*

- **Good news: Spring 2021 intervention sections had more students rated as positive attitude, compared to no intervention.** *Why during Spring 2021? Possibly due to maturity of delivery techniques as both faculty and students adjusted to pandemic classes. ---> Need to compare Spring 2021 results with future online classes.*

- **Other news: Rates from all other intervention terms had no statistically significant difference from the non-intervention baseline.**

Caveats on the statistical analysis

We assumed comments were distributed in a single Poisson-type distribution for students without intervention, and a different Poisson-type distribution for students with intervention. However, the real distribution was more heterogeneous than assumed, because:

- 1) there is a mix of physics, biology, and math classes in the sample (each type may have different comment % response rates), and,

- 2) there is a mix of actual intervention and placebo intervention students in the intervention sections (each type may have different comment % response rates)

Effect: this probably caused somewhat inflated significance values compared to using correct distributions.

Future work to improve these results

- Gather data for more non-intervention sections
- Gather data for more sections with better matched populations (young vs. mature students)
- Gather data for more sections with better matched modalities (face-to-face vs. online)
- A dedicated statistician will need to do a more detailed analysis once the sample of students is large enough
- In future data collection campaigns, ask multiple-choice end-of-course survey questions to better assess growth mindset
- In future data collection campaigns, think of ways to disentangle comments from intervention students vs. placebo students