

Epsilon School of Mathematics

By Naaisha, Parnitha, Colleen,
Adrika, and Saara

→ START!

Problem Overview:

At the Epsilon School of Mathematics, the student body was increased from 490 to 630 people. To account for this, 7 new faculty members need to be hired and distributed throughout all of the departments.

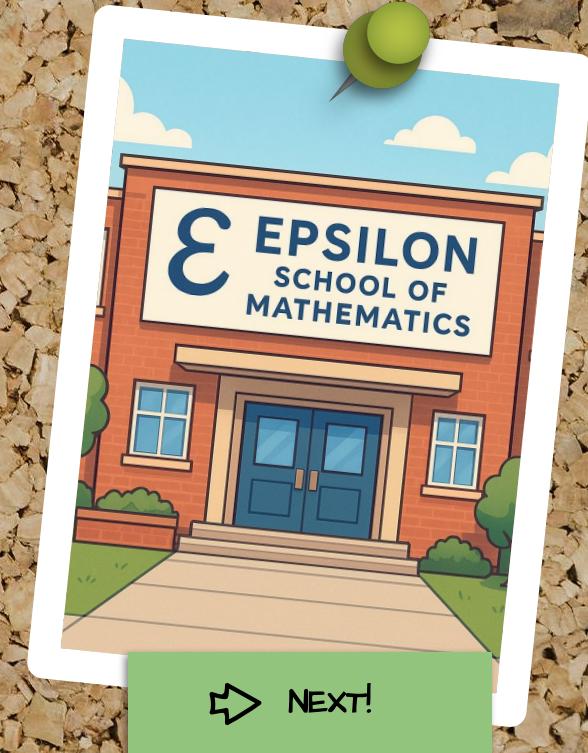


Table of Contents

► Background

► Process

► Results

► Next Steps

► Credits

Main Question

What is the best way to distribute the 7 faculty members across the departments?

Table of Contents

► Background

► Process

► Results

► Next Steps

► Credits

What is "Fair"?

- Keep as low of a change as possible to old student teacher ratio as possible
- Have a class size increase less than 25%

Table of Contents

► Background

► Process

► Results

► Next Steps

► Credits

What We Know:

- 11 Departments
- Students per department in 2024
- Student number increases: 490 → 630
- Drop out rate: 5%

Department Split: Given

Department	Student Total
Art	99
Biology	319
Chemistry	294
English	490
French	122
German	51
Spanish	110
Mathematics	647
Music	155
Physics	291
Social Studies	373

Table of
Contents

► Background

► Process

► Results

► Next Steps

► Credits



Teacher Split: Given

Department	Teacher Total
Mathematics	6
Chemistry	3
Physics	3
Biology	4
Social Studies	5
English	5
Foreign Language	3
Music	1
Art	1

Table of
Contents

► Background

► Process

► Results

► Next Steps

► Credits



Variables

- T_{24} = Total student body in 2024
- T_{25} = Total student body in 2025
- N_{T24} = Number of teachers in a department in 2024
- N_{T25} = Number of teachers in a department in 2025
- N_{S24} = Number of students in a department in 2024
- N_{S25} = Number of students in a department in 2025
- C = Number of new teachers to add
- d = drop out rate

Table of
Contents

► Background

► Process

► Results

► Next Steps

► Credits



Assumptions:

- One language teacher per language
- The ratio of students in each department is the same for 2025 as it is for 2024
- Each teacher teaches 5 classes per day
- We considered the school as a whole, not individual grades (ratio would stay the same)

Table of
Contents

► Background

► Process

► Results

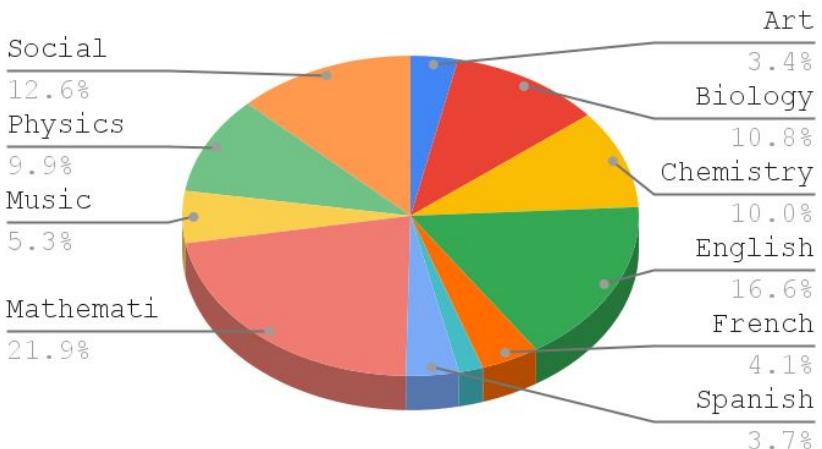
► Next Steps

► Credits



Data relationships (Our Process)

2024-Total vs. Department



To account for the student dropout rate, the size of the class was multiplied by 95%

Table of Contents

Background

Process

Results

Next Steps

Credits

Process

$$\frac{\text{Students 2024 per subject}}{\text{Teachers per subject}} = \text{Student Teacher Ratio 2024 for each subject}$$

Table of Contents

► Background

► Process

► Results

► Next Steps

► Credits

Data relationships (Our Process)

Student-Teacher Ratio vs. Department

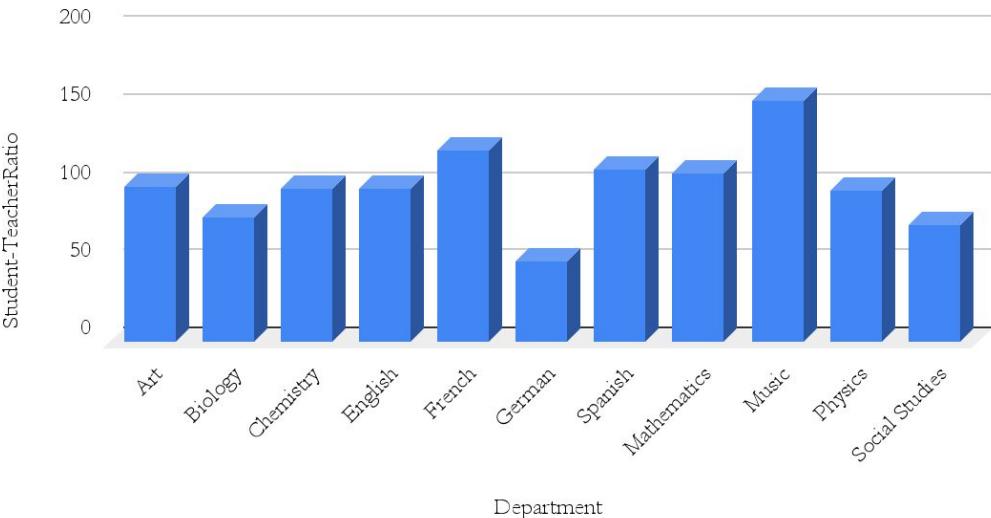


Table of Contents

Background

Process

Results

Next Steps

Credits

Process

$$\frac{\text{Students per subject 2025}}{\text{Student-teacher Ratio 2024}} = \text{Teachers needed per subject 2025}$$

Table of Contents

► Background

► Process

► Results

► Next Steps

► Credits

Table of
Contents

Background

Process

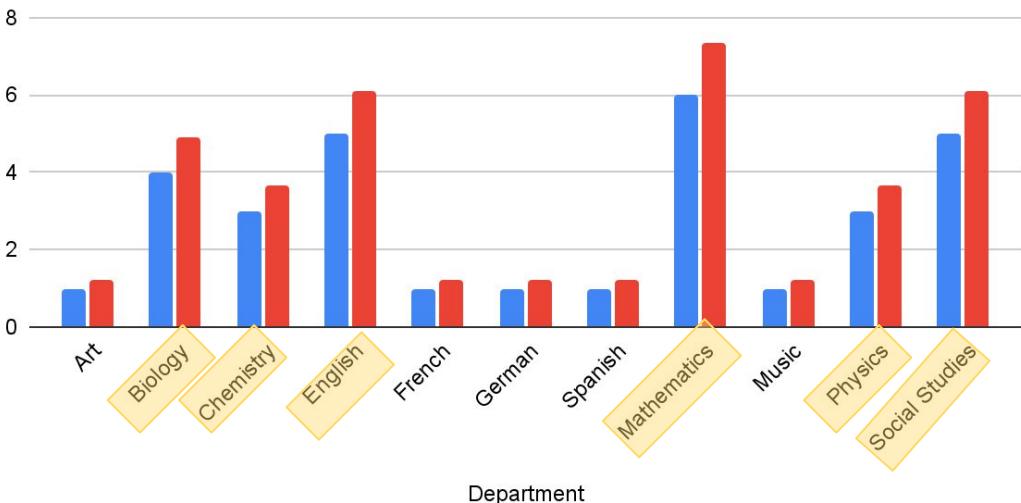
Results

Next Steps

Credits

2024 Numbers of Teachers and 2025-Teacher-Necessary

2024Numbers of teachers 2025-teacher-necessary





Our Model

$$\left[\frac{\frac{N_{S24}}{T_{24}} \cdot T_{25} \cdot (1-d)}{\frac{N_{S24}}{N_{T24}}} + 0.5 \right] - N_{T24} = C$$

Table of
Contents

► Background

► Process

► Results

► Next Steps

► Credits



Teachers We Add:

1 teacher for
Biology, Chemistry,
English, Math,
Physics, Social
Studies

1 teacher who
teaches French and
Spanish

Results

Change in teacher (unrounded) vs. Department

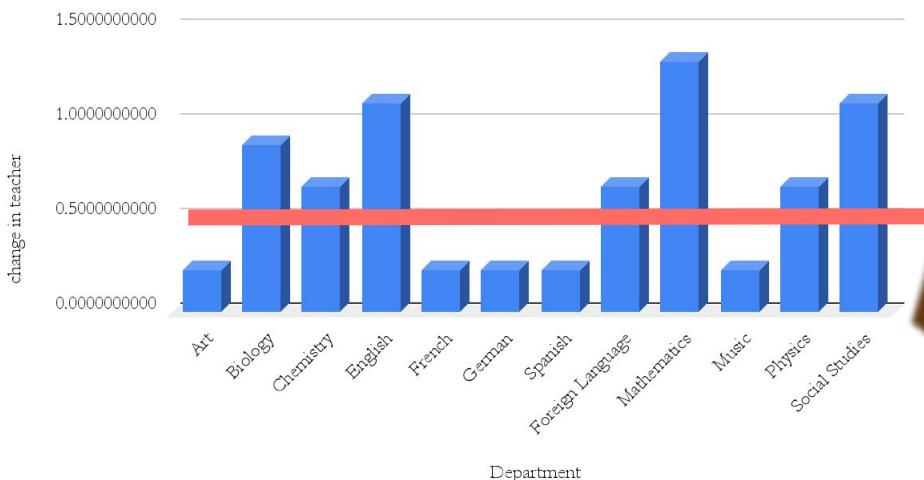


Table of
Contents

► Background

► Process

► Results

► Next Steps

► Credits

French, Spanish, and German alone
don't mathematically need another
teacher.

But...

The foreign language department
overall does...

So...

So we need a teacher to teach
Spanish and French.

Without a teacher
that teaches
spanish and french,
class size increases
by 23% and 25%

Class Size Calculations

$$\frac{\text{Student Teacher ratio}}{5 \text{ Classes}} = \text{Students in each class}$$

Table of
Contents

► Background

► Process

► Results

► Next Steps

► Credits

Table of Contents

► Background

► Process

► Results

► Next Steps

► Credits

Justification

- Student-teacher ratio doesn't increase drastically
- Checked using only 10th grade numbers and found it works
- % class size increase is under threshold

Table of Contents

► Background

► Process

► Results

► Next Steps

► Credits

Students Per Class 2024 and Difference in Class Size

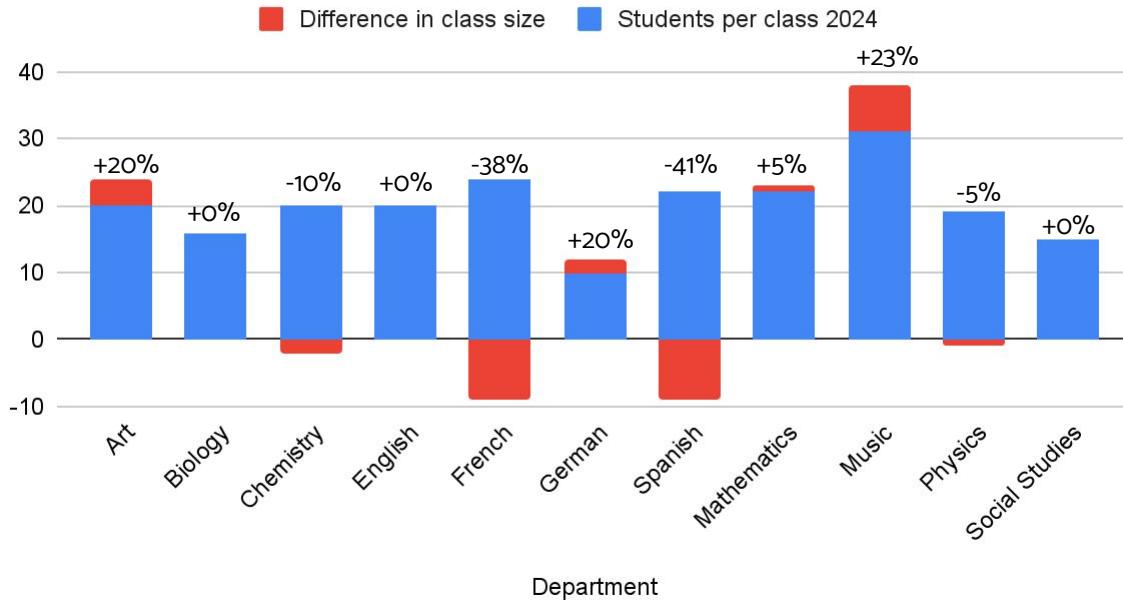


Table of Contents

► Background

► Process

► Results

► Next Steps

► Credits

Strengths

- Accounts for drop out rate
- Easily modifiable for any year
- Reflects past data well
- Overall trends

Table of Contents

► Background

► Process

► Results

► Next Steps

► Credits

Weaknesses

- We assumed that interest won't change
- Possibility of overfitting due to having data for one year
- Multiple changing variables
- Type of class and which classes have different ratios
- Mixed grade classes not considered



Future Steps / Next Questions

- How can the model account for
 - teachers that teach different classes within the subject?
 - have different expertise for specialized electives?
 - have different certifications (AP)
 - Teach different levels?
 - Students in different levels?
 - Mapping out where each student is in a period to make sure each one has a class?

Table of
Contents

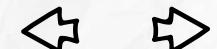
► Background

► Process

► Results

► Next Steps

► Credits



Thank you!

Questions?

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Table of Contents

► Background

► Process

► Results

► Next Steps

► Credits

