RISHAB, ERICA, CECILIA, HEIDY

THE EPSILON SCHOOL

1.

PROBLEM

What do we need to apply math to?

The Epsilon School is going to receive significantly more students next year than will graduate this year. In order to account for this influx, they are hiring seven teachers. How can they fairly distribute these teachers across departments?

ENROLLMENT BY DEPARTMENT

	Teachers	Sophomores	Juniors	Seniors	Total
Art	1	31	33	35	99
Biology	4	198	95	26	319
Chemistry	3	59	126	109	294
English	5	183	155	152	490
French	1	41	32	49	122

ENROLLMENT BY DEPARTMENT

	Teachers	Sophomores	Juniors	Seniors	Total
German	1	19	22	10	51
Spanish	1	51	26	33	110
Mathematics	6	184	201	262	647
Music	1	50	56	49	155
Physics	3	50	58	183	291
Social Studies	5	183	131	59	373

KEY INFORMATION

- 490 → 630 students
- 140 more sophomores than graduated + those who dropped out
- 5% of incoming class drops out prior to graduation
- Seven new teachers
- Foreign language teachers can teach two languages
- Only full-year courses

2.

BACKGROUND

Our assumptions, considerations, and hypothesis

ASSUMPTIONS

- Dropout rates constant
- No teachers leaving
- Only integer numbers of students
- Each foreign language teacher is only teaching one language
- Every student is in exactly one English class
- Same percentage of each grade taking each course
- Percentage of Dropout Rates are split evenly between each grade

VARIABLES

- Degree of total population and per-department enrollments
- Dropout rate per year
- Student-Teacher Ratios - optimizing fairness by maintaining these

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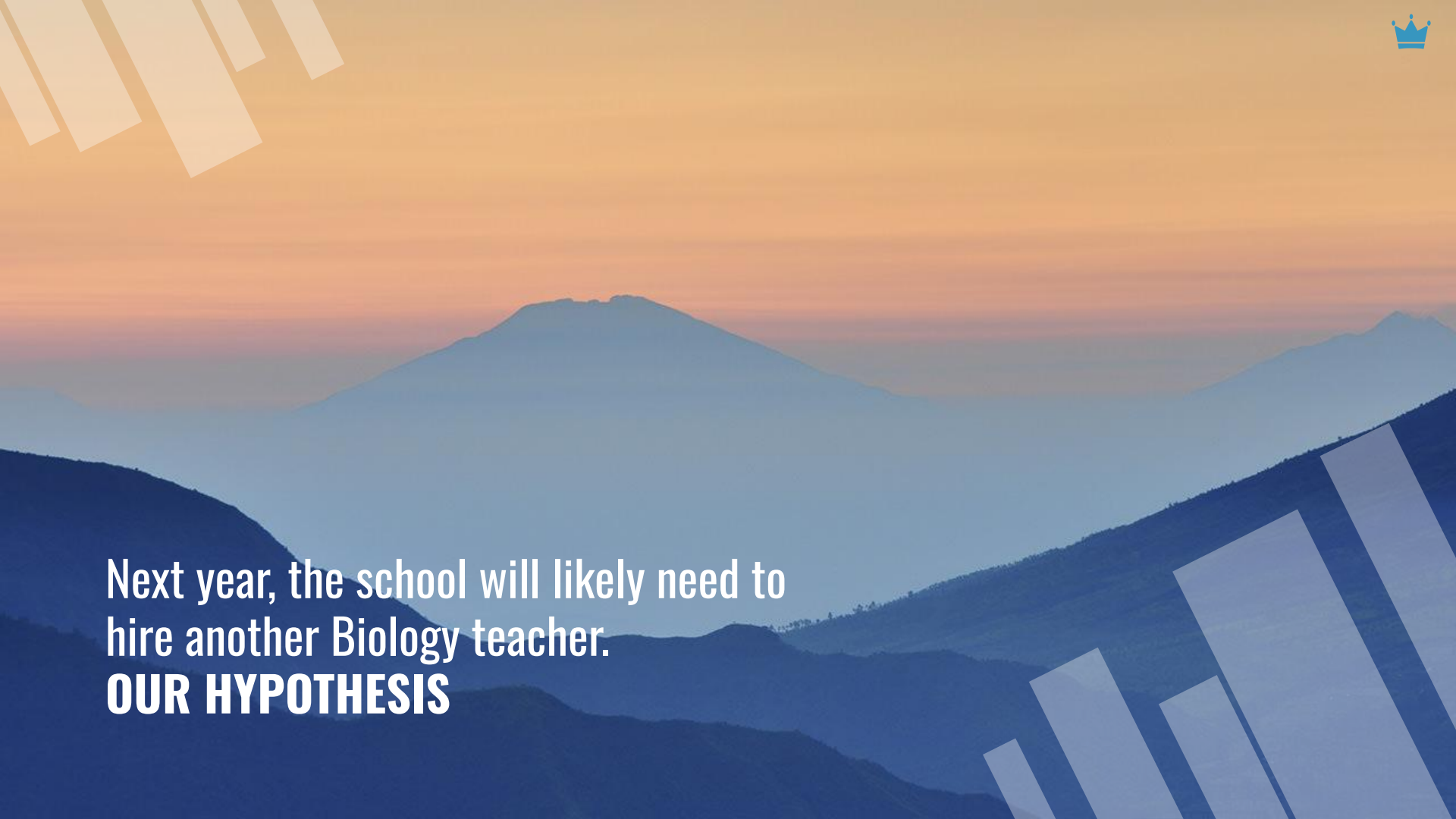
CONSIDERATIONS

- Student-teacher ratios stay the same
- Enrollment data across grades
- Drop out rate across three years

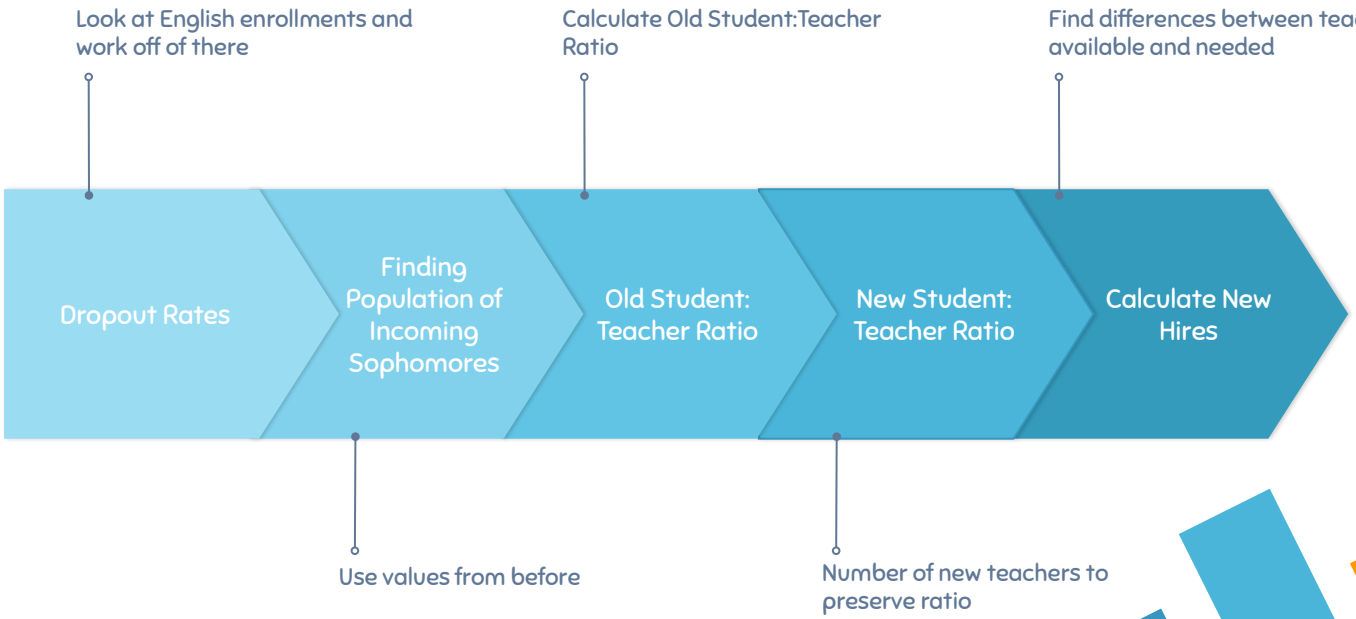

Next year, the school will likely need to hire another Biology teacher.
OUR HYPOTHESIS

3.

OUR WORK

Outline of how we solved the problem

OUTLINE


Look at English enrollments and work off of there
Calculate Old Student:Teacher Ratio
Find differences between teachers available and needed
Dropout Rates
Finding Population of Incoming Sophomores
Old Student: Teacher Ratio
New Student: Teacher Ratio
Calculate New Hires
Use values from before
Number of new teachers to preserve ratio

1. DROPOUT RATE: NEW JUNIORS

Currently 183 Sophomores in English

1. 183 x (295/300) = 180

2. Multiply it by current junior percentages to predict next year

Percentage Calculations
295/300 = .983
1.00 - .983 = .017
.017 = Drop out rate for each class size
.983 = Remaining Percentage of Students

Class	Sophomores
Art	31
Biology	198
Chemistry	59
English	183
French	41
German	19
Spanish	51
Mathematics	184
Music	50
Physics	50
Social Studies	183

Class	Juniors
Art	38
Biology	110
Chemistry	146
English	180
French	37
German	26
Spanish	30
Mathematics	233
Music	65
Physics	67
Social Studies	152

1. DROPOUT RATE: NEW SENIORS

Currently 155 Juniors in English

1. 155 × (300/295) × (290/300) = 152

2. Multiply by current senior percentages to predict next year

Percentage Calculations

(300/295) × (290/300)=290/295

155 × (300/295): The original size of the junior class- reversing dropout

290/300=.967: Remaining percentage of students based on original size

Class	Juniors
Art	33
Biology	95
Chemistry	126
English	155
French	32
German	22
Spanish	26
Mathematics	201
Music	56
Physics	58
Social Studies	131

Class	Seniors
Art	35
Biology	26
Chemistry	109
English	152
French	49
German	10
Spanish	33
Mathematics	263
Music	49
Physics	183
Social Studies	59

2. INCOMING SOPHOMORES

Review

Incoming Junior Class: 180

Incoming Senior Class: 152

Students: 630

Incoming Sophomores

630 - (180+152) = 298

Multiply by current sophomore department enrollment rates to predict next year

PROJECTED SOPHOMORES

Class	Sophomores
Art	50
Biology	322
Chemistry	96
English	298
French	67
German	31
Spanish	83
Mathematics	300
Music	81
Physics	81
Social Studies	298

3. OLD STUDENT:TEACHER RATIO

Department	Teachers	Students	Student:Teacher
Art	1	99	99:1
Biology	4	319	80:1
Chemistry	3	294	98:1
English	5	490	98:1
French	1	122	122

3. OLD STUDENT:TEACHER RATIO (CONT.)

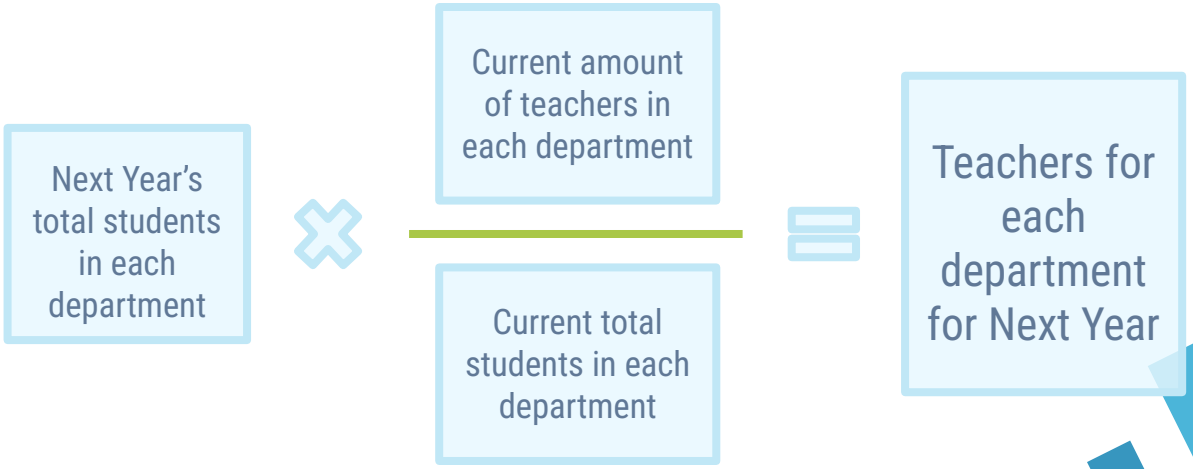
Department	Teachers	Students	Student:Teacher
German	1	51	51:1
Spanish	1	110	110:1
Mathematics	6	647	108:1
Music	1	155	155:1
Physics	3	291	97:1
Social Studies	5	373	75:1

4. NEW STUDENT:TEACHER RATIO

1. Find the new amount of teachers for each department according the old student to teacher ratio
2. Round values to find amount of teachers in each department
3. Calculated the New Student to Teacher ratio for next year

4. NEW STUDENT:TEACHER RATIO

Adjust based on the old student:teacher ratio



Department	Students (Now)	Students (Next Year)	Teachers (Now)
Art	99	123	1
Biology	319	458	4
Chemistry	294	351	3
English	490	630	5
French	122	153	1
German	51	67	1
Spanish	110	146	1
Mathematics	647	796	6
Music	155	195	1
Physics	291	331	3
Social Studies	373	509	5

TEACHERS NEXT YEAR

Department	Teachers
Art	1.24
Biology	5.74
Chemistry	3.58
English	6.42
French	1.25
German	1.31
Spanish	1.32
Mathematics	7.37
Music	1.26
Physics	3.41
Social Studies	6.82

*Round each value in Teachers to the nearest whole number

TEACHERS NEXT YEAR (ROUNDED)

Class	Sophomores
Art	1
Biology	6
Chemistry	4
English	6
French	1
German	1
Spanish	1
Mathematics	7
Music	1
Physics	3
Social Studies	7

4. NEW STUDENT:TEACHER RATIO

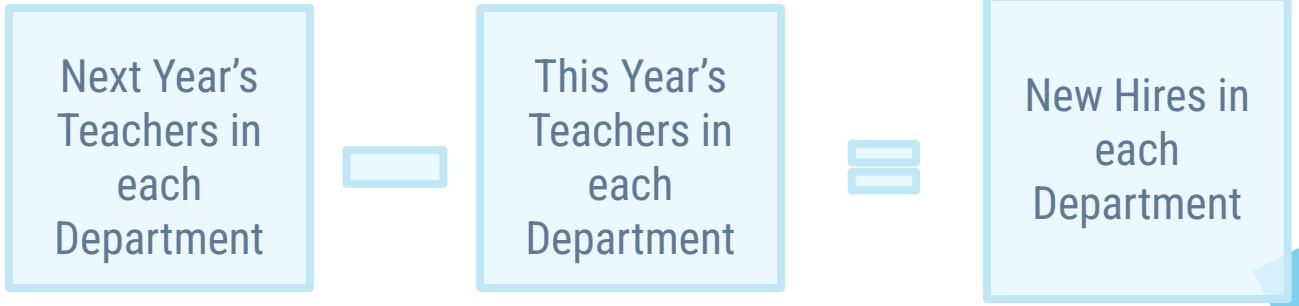
	Teachers	Students	Student:Teacher
Art	1	123	123:1
Biology	6	458	76:1
Chemistry	4	351	88:1
English	6	630	105:1
French	1	153	153:1

4. NEW STUDENT:TEACHER RATIO (CONT.)

	Teachers	Students	Student:Teacher
German	1	67	67:1
Spanish	1	146	146:1
Mathematics	7	796	114:1
Music	1	195	195:1
Physics	3	331	110:1
Social Studies	7	509	73:1

5. Calculating New Hires

Subtract this year's teachers from next year's teachers (by department)



NEW HIRES BY DEPARTMENT

7 Total New Hires

Class	New Hires
Art	0
Biology	2
Chemistry	1
English	1
French	0
German	0
Spanish	0
Mathematics	1
Music	0
Physics	0
Social Studies	2

4.

REASONING

Why our work makes sense

IN SUMMARY

- Found next year’s student:teacher ratios
- Determined number of teachers necessary for similar ratio
- Added teachers to most in-demand departments
- Recalculated ratios to confirm fairness

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5.

JUDGEMENT

What are the limitations of our solution?

PROS

- Student:Teacher ratios as close to original as possible
- Unbiased
- Based on student data

CONS

- Ratios still not good
- Fine arts overwhelmed*
- Doesn't account for difficulty of teaching by class*
- Purely data-based

So in Conclusion...

The **NEW HIRES** for each Department are:

BIOLOGY: 2 CHEMISTRY: 1 ENGLISH: 1
MATHEMATICS: 1 SOCIAL STUDIES: 2

THANKS!

Any questions?

Sources for Theme:

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Roboto Oswald

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