

You're Hired!

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Problem Statement

Fermat's School of Math and Science is expanding. 140 more students are being added to the sophomore class, to raise the school population from 490 to 630 students. 7 more faculty will be hired. Determine which departments should receive how many new faculty to be the most *fair*.

Overarching Assumptions

- Every grade will take the same ratios of classes as the previous grade last year
- The dropout rate will not affect the enrollment ratios
- The class sizes do not even out: There will always be 1 grade 140 students larger than the other 2 (total population always 630)

There are currently ...

	Total Teachers	Total Enrollment
Mathematics	6	647
Chemistry	3	294
Physics	3	291
Biology	4	319
Social Studies	5	373
English	5	490
Foreign Language	3	183
Music	1	155
Art	1	99

Our Method

- Find the student:teacher ratios for each class.
- Figure out how much the ratios change from 2019.2020 to 2020.2021, assuming the fraction of people in each grade who take a specific class will remain the same: the number of sophomores who took the class 2019.2020 x (number of sophomores in 2020.2021/number of sophomores in 2019.2020)
- Find which classes have the highest student: teacher ratios and which classes have the largest increases in students.
- Add teachers to the departments that need the most help.

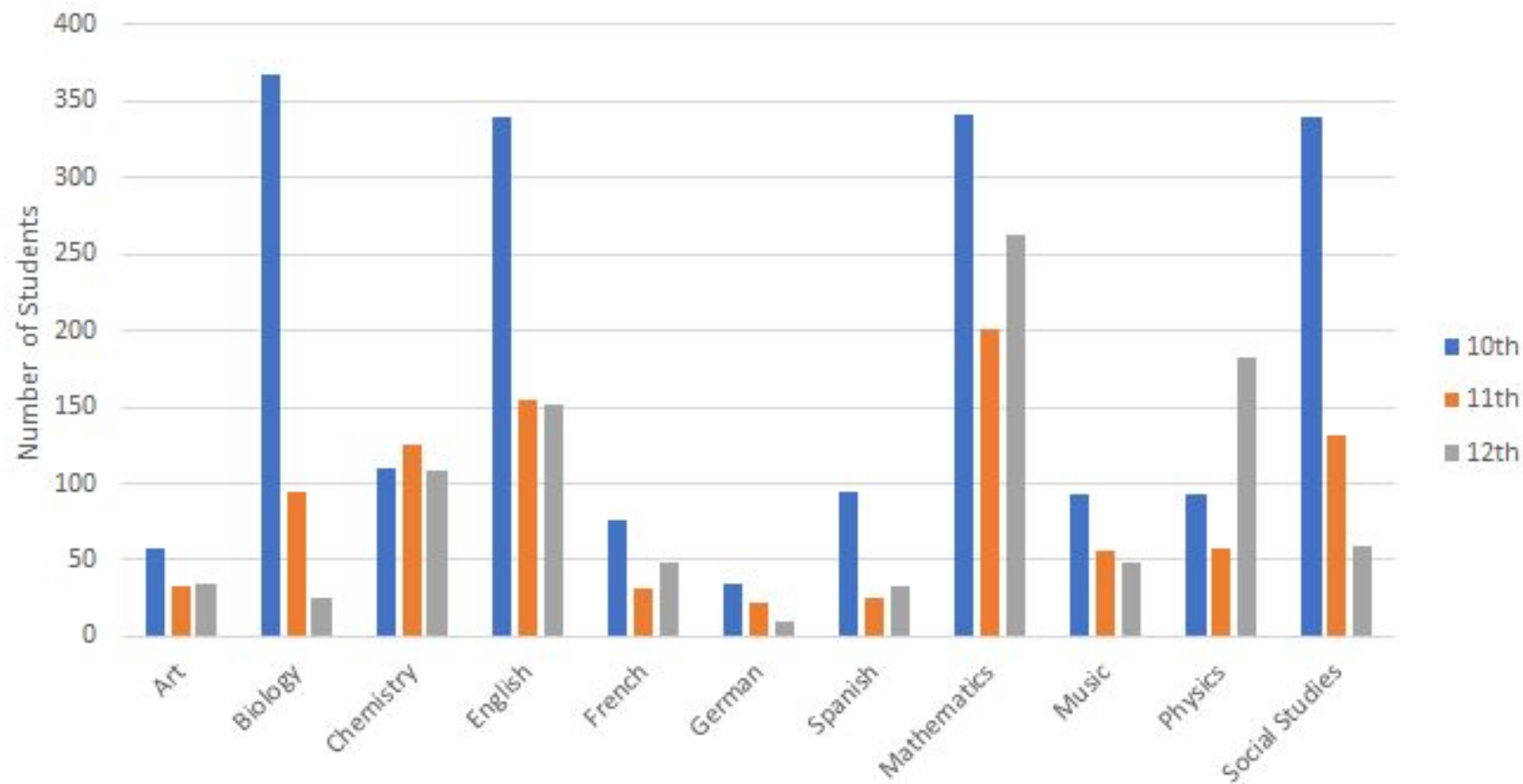
Student Faculty Ratio (2019.2020)

- Art: 99
- Bio: 80
- Chem: 98
- English: 98
- Foreign Language: 95
- Math: 108
- Music: 155
- Physics: 97
- Social Studies: 75

Amount of Students Enrolling for Each Class in September 2020

Department	10th	11th	12th	Total
Art	58	33	35	126
Biology	367	95	26	488
Chemistry	110	126	109	345
English	340	155	152	647
French	76	32	49	157
German	35	22	10	67
Spanish	95	26	33	154
Mathematics	342	201	262	805
Music	93	56	49	198
Physics	93	58	183	334
Social Studies	340	131	59	530

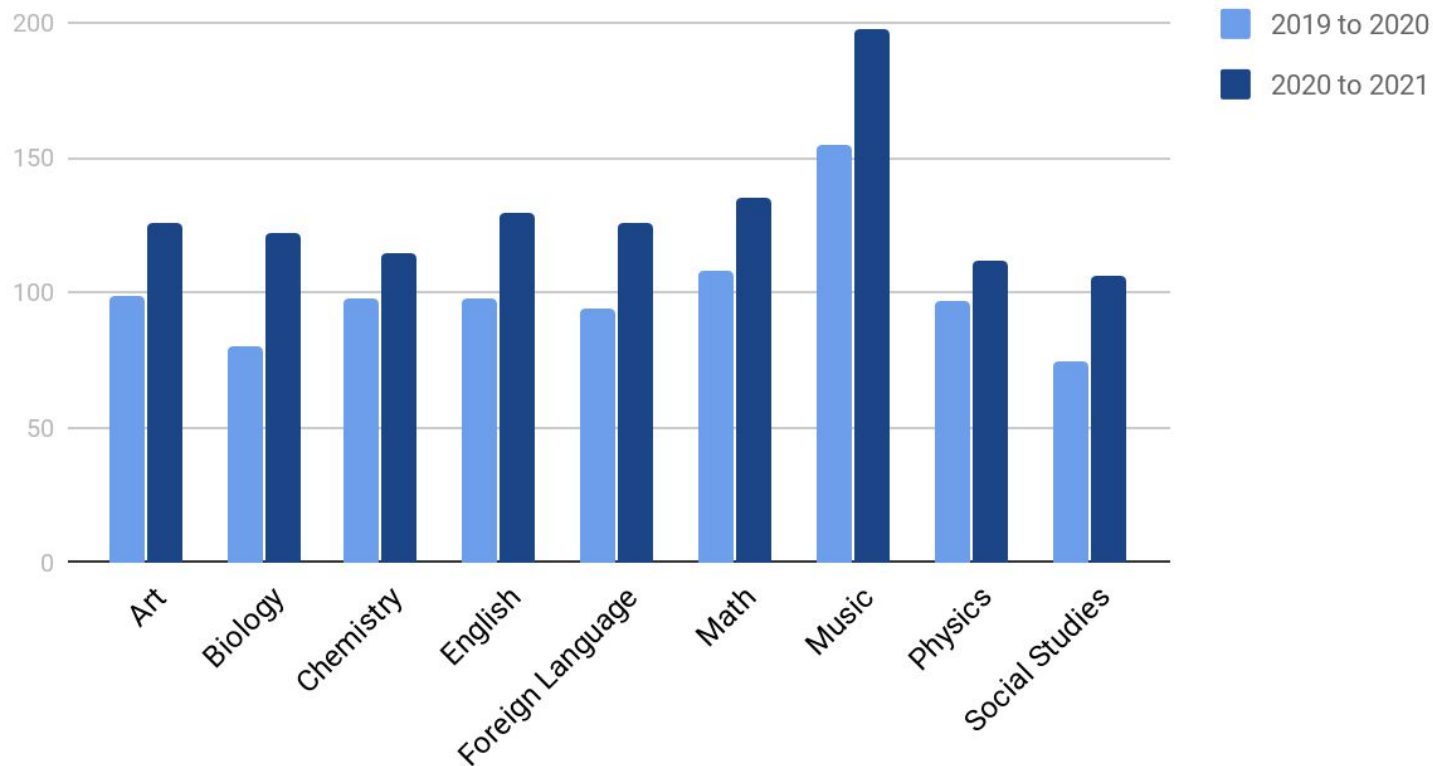
Projected Student Enrollment Per Class, September 2020



Student Faculty Ratio for 2020.2021 (Before Hiring Teachers)

- Art: 126
- Bio: 122
- Chem: 115
- English: 130
- Foreign Language: 126
- Math: 135
- Music 198
- Physics: 112
- Social Studies: 106

Ratio of students to teachers



Justifying/Testing the Model

- The assumptions we made regarding the ratios for enrollment per class could be confirmed through a survey
- The survey would ask the 2019-2020 10th grade what classes they plan on taking for the 2020-2021 school year
- Using the survey results, the projected enrollment numbers for the 2020-2021 school year could be proven to be accurate or inaccurate

Who is Hired?

1 Music Teacher

2 Math Teachers

1 English Teacher

1 Foreign Language (French & Spanish)

1 Biology Teacher

1 Social Studies Teacher

New faculty ratios

- Music: 99
- Math: 101
- English: 108
- Foreign Language: 95
- Biology: 98
- Social Studies: 89
- Physics: 112
- Chemistry: 115

A Comparison of Ratios

	2019.2020	2020.2021 (before hirings)	2020.2021 (after hirings)	Change from 2019.2020 to 2020.2021
Art	99	126	126	+ 27
Biology	80	122	98	+ 18
Chemistry	98	115	115	+ 17
English	98	130	108	+ 10
Foreign Language	95	126	95	+ 0
Math	108	135	101	- 7
Music	155	198	99	- 56
Physics	97	112	112	+ 15
Social Studies	75	106	89	+ 14

Model Strength

- We did not account for the 5% dropout rate
 - Assumed dropouts would do average classes so ratios would not become disproportionate
- Class preferences per grade could vary by year or change over time
 - Model could become inaccurate if preferences shift
 - Model is flexible so could change in the future to accommodate these changes
- Since the large grade can be 10th, 11th, or 12th depending on the year, using the total ratios across all 3 years gets the most even distribution of teachers
- Since people can double up on classes ratios of class/total enrollment is stronger than percentile of the student population (enrollment > population)