Epsilon School

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Overview

Problem Background:

- Problem statement

- Variables
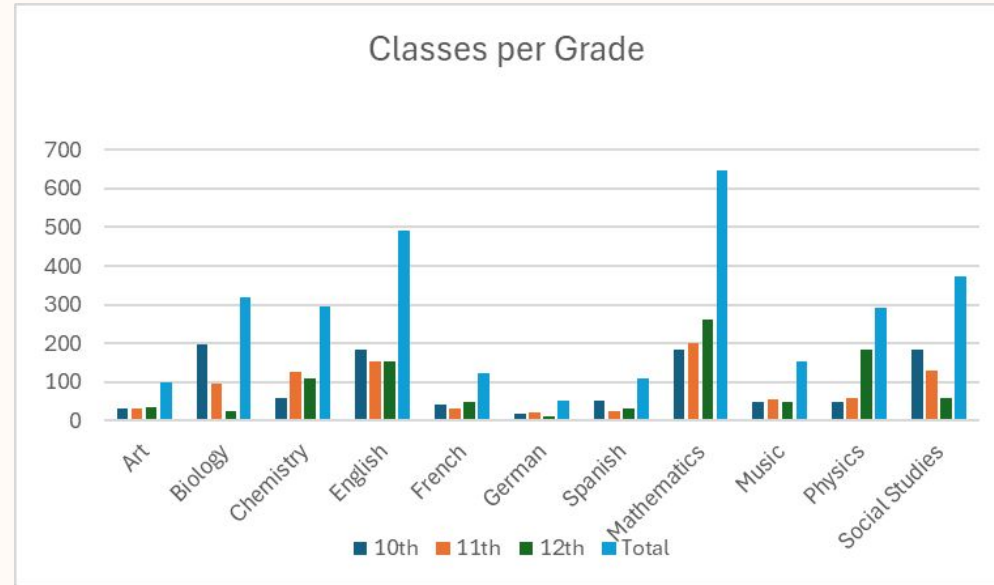
- Assumptions

Solution Process:

- Finding size of classes

- Predicting number of classes being taken for the incoming class

- Finding current student–teacher ratios

- Allocating teachers for new student–teacher ratios

- Conclusions

Understanding the problem

- Central Question: What classes should receive an extra teacher (or multiple) given the larger incoming grade?

- Givens:
  - 7 new teachers
  - 140 new students in the sophomore class (referred to as "incoming") compared to the graduating senior class

- What to consider:
  - Number of students taking a class→predicted number of classes taken next year
  - Student to teacher ratio→compare new to old
  - Where should new teachers be allocated based off new student–teacher ratios?

Current Student Distribution

- Total classes are taken by students in each subject

- Shows what classes Sophomores are likely to take.

- Shows classes of greater importance.

- Found that each student takes approximately 6 classes (6.022 each)

Classes per Grade

Assumptions and Variables

Assumptions:

- There are 6 periods in every day. Each class is 1 period long.

- Each student takes 1 class per period.

- Each teacher teaches 1 class every period.

- Advancing grades have the exact same spread of classes as the previous class of that year

- Current student : teacher ratio in classes is working for the school

Variables:

- Student Population per Grade

- Amount of classes taken per grade

- Old Student–Teacher Ratio

- New Student–Teacher Ratio

- New # of teachers in each class

Student count

By Year	# of Students
Incoming	295
Sophomores	172
Juniors	163
Seniors	155

Student Count
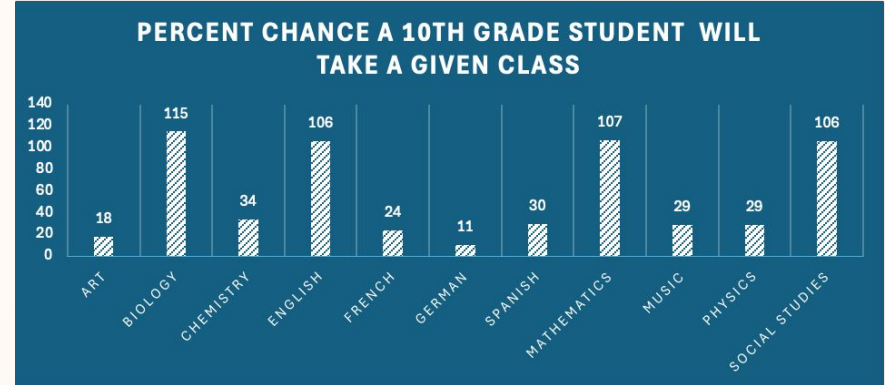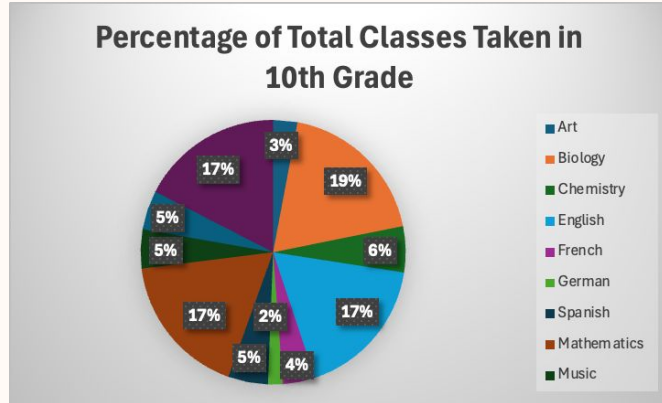
- Decrease of 5% every year (Geometric series)
- Incoming: # of seniors + 140
- Sophomores: X, Juniors: 0.95X and Seniors: 0.95^2*x
- Total number of students (sophomore – senior): 490

Class Count

- Simply the total number of classes that each grade is taking
- The classes that majority of sophomores take will increase by more

Percentage of Sophomores

–Focus on sophomore year increase of students

Left graph: –% of total classes taken = **# of classes taken** in subject by 10th graders / **total # of classes** taken by 10th graders
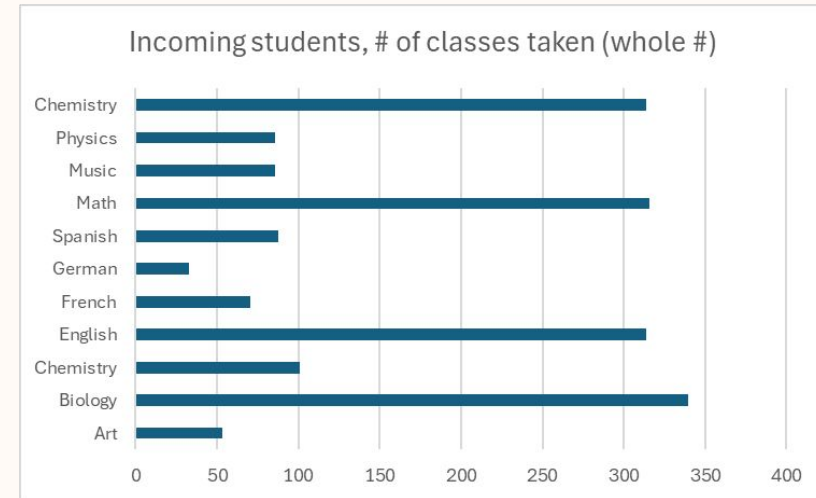
– % of each class taken will be same for current 10th graders + incoming students (just with more students)

Right graph: –% of total classes taken = # of classes taken by 10th graders (in subject) / total # of students in grade 10.

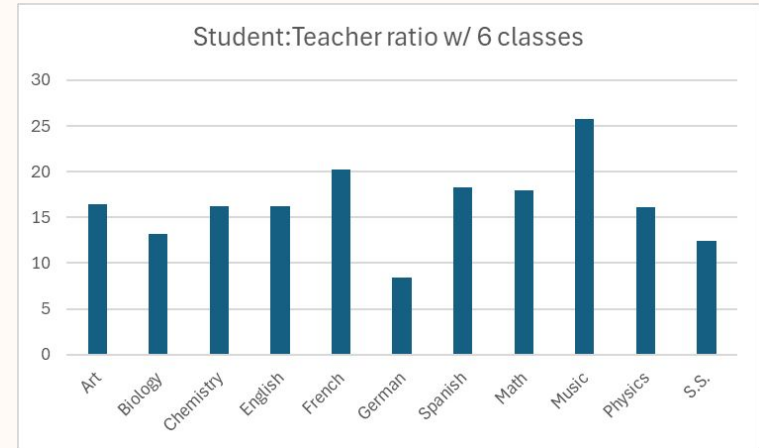– Percentages above 100: students are (on average) taking more than one class in that subject

New student classes

–Using our percentages from before we took that percentage and multiplied it by the size of the new sophomore class.

–This allowed us to get the total amount of student predicted to take a certain class next year

–We found that each class had a 171.5% increase from last year

Old Student Ratios

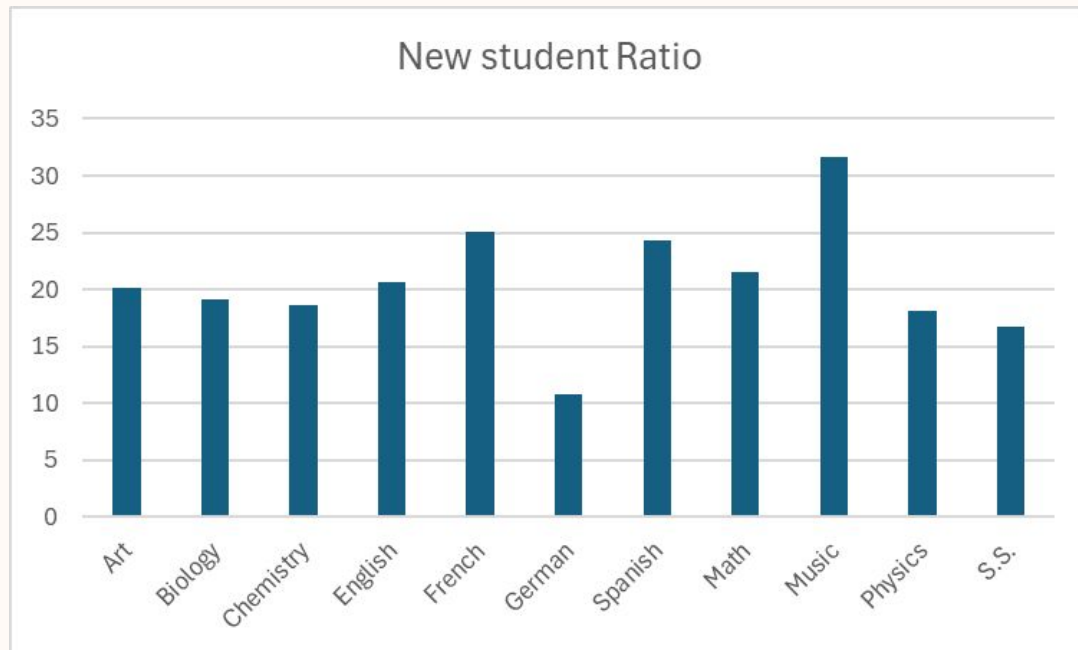–We wanted to find the current student to teacher ratio

–See which teachers were having to teach the most and needed help

–We took the total number of classes and divided that by how many classes each student can take (~6.022), then divided it by number of teachers

Student:Teacher ratio w/ 6 classes

New Student Ratios

Using our new size of our sophomore class, we re–calculated our ratio

Desired Student Ratios

Wanted Ratio

Assumption: old class sizes were working for the school

Goal: all the ratios to be similar or better (less student : teacher) than the old ratios

Measuring: we can measure the success by subtracting the new student : teacher ratio from the old student : teacher ratio

Results: Statistic from measuring: negative is bad (increased student : teacher ratio – red), positive is good (decreased student : teacher ratio – green)

Additional Factors:
- Teacher teaches >10 students/class and <20 students/class (not fair to teachers)

Factors for choosing teachers

Factors

- Wanted all teacher to teach less than 20 kids per class

- No teachers should be teaching less than 10 students per class

- No outliers (10 student range)

Ratio Analysis

Our Solution	Old Student:Teacher Ratio	New Student:Teacher Ratio	New proposed teachers	New Ratio with Extra Teachers	Old ratio-new ratio
Art	16.44	20.12	1	10.06	6.38
Biology	13.24	19.12	1	15.30	-2.05
Chemistry	16.27	18.61		18.61	-2.34
English	16.27	20.62	1	17.18	-0.91
French	20.26	25.13	0.5	16.75	3.51
German	8.47	10.72		10.72	-2.26
Spanish	18.26	24.32	0.5	16.21	2.05
Math	17.91	21.55	1	18.47	-0.56
Music	25.74	31.67	1	15.84	9.90
Physics	16.11	18.09		18.09	-1.98
S.S.	12.39	16.73	1	13.94	-1.56

We looked at the new student ration and saw that 6 teachers had over a 20 ratio.
We added one teacher to those classes and then got new ratio that were all under 20
We also made sure that there wasn't too big of a difference between the old ratio and new ratio

Justification of our model

- All teachers now have classes with similar sizes to the old ratio.

- All teachers have a ratio around 10–20.

- Incorporates all existing teachers (nobody is fired)

- Doesn't force any teachers to teach more than 3 kids / class than before (red data)

- Low negative total of classes with increasing class size (Total Neg)

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				Total Neg:	
					-11.65

11.65/7=1.66 avg. extra students in neg classes

Alternative Settup:	New Student:Teacher Ratio	New proposed teachers	New Ratio with Extra Teachers	Old ratio-new ratio
Art	20.12		20.12	-3.68
Biology	19.12	2	12.75	0.50
Chemistry	18.61	1	13.96	2.32
English	20.62	2	14.73	1.55
French	25.13		29.28	-9.02
German	10.72	-1	0.00	0.00
Spanish	24.32		28.64	-10.37
Math	21.55	2	16.16	1.75
Music	31.67		31.67	-5.94
Physics	18.09	1	13.56	2.54
S.S.	16.73		16.73	-4.35
		(Fire German Teacher)		Total Neg:
		Add teachers to major classes		-33.36
		German students split between french/spanish		

33.36/5=6.67 avg. extra students in neg classes

Our Solution

	Art	Bio	Chem	English	French	German	Spanish	Math	Music	Physics	Social Studies
Teachers Added	1	1	0	1	0.5	0	0.5	1	1	0	1

Strengths and Weaknesses

Strengths	Weaknesses

- Matches the old ratios well
- Easy to change data if more teachers can be added
- We have no outlier teacher ratios

- The assumptions have to hold true
- We didn't factor in a prep class for teacher
- We assume that all classes (within each subject) are the same size

Thank You

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