The Epsilon School

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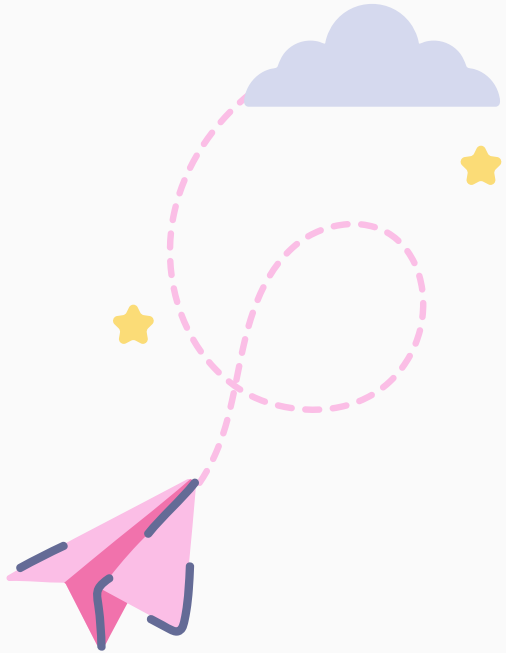
Problem

What’s up with the Epsilon School?

Problem Restatement

The Epsilon School of Mathematics and Science are expecting a greater number of sophomores compared to the previous years, increasing the school's population from 490 students to 630. To accommodate for this expansion, the school is planning on hiring 7 teachers. Given the current distribution of students for each class and the number of teachers in each department, how can the teachers be distributed fairly amongst all the departments?



Summary of the Process

Current Year

- Calculated the number of students each teacher teaches
- Computed the number of classes each student takes
- Determined the number of classes each teacher teaches
- Calculated the number of students in each class

Incoming Year

- Estimated the total numbers of students
- Estimated the distributions of the students for each class
- Found the appropriate student to teacher ratio for each subject for the new year

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Background Information

Assumptions, Variables, and Hypothesis

Assumptions

Assumption #1

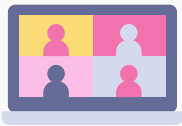
The same percentage of students takes a class each year per grade

Assumption #2

The Epsilon School is in Massachusetts, where it is mandatory to take an English class every year of high school

Assumption #3

The students dropout at a rate of 2.5% per year for a total dropout rate of 5%



Assumption #4

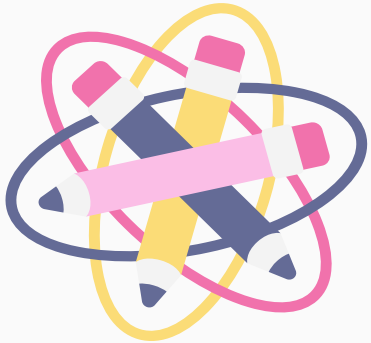
Teachers teach three classes while use the other three periods to prep

Variables

- Current class population
- Number of new hires
- The number of classes each student takes
- Student to teacher ratio
- The number of classes each teacher teaches

Hypothesis

The classes that currently have the most number of students is where the teachers should be distributed to.



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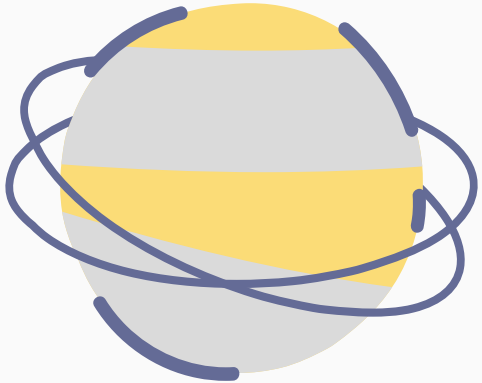
Model

Model Developed and Used



Initial Info

Department	Current 10th	Current 11th	Current 12th	Current Total Students
Art	31	33	35	99
Biology	198	95	26	319
Chemistry	59	126	109	294
English	183	155	152	490
French	41	32	49	122
German	19	22	10	51
Spanish	51	26	33	110
Mathematics	184	201	262	647
Music	50	56	49	155
Physics	50	58	183	291
Social Studies	183	131	59	373
Total Students per Grade	**183**	**155**	**152**	**490**

Estimating the Student Body

Procedure

- Found the new number of students in each grade
- Multiplied the percentage of students in each grade in each class by the new number of students in each grade

Explanation

- Calculated the number of students each year for the 10th and 11th graders assuming a 2.5% dropout rate each year for a total dropout rate of 5%.
- Found the number of the incoming 10th graders by adding the number of dropouts from 10th to 11th grade and from 11th to 12th grade to the.

Estimating the Student Body

Senior class + 140, then add 7 students (from the dropped out juniors and sophomores) to get a total of 630 students in the school to get 299 sophomores

Dropouts (All the incoming sophr	292 sophomores	285 juniors	278 seniors
Dropouts (All the juniors):	155 juniors	152 seniors	
Dropouts (All the sophmores):	183 sopmores	179 juniors	174 seniors

Current sophomores and juniors

-2.5% each year

Estimated Student Body

Estimated distribution of the new sophmore class	Estimated distribution of the new junior class	Estimated distribution of the new senior class	Estimated Total Students
50.65027322	38.10967742	35	123.7599506
323.5081967	109.7096774	26	459.2178741
96.3989071	145.5096774	109	350.9085845
299	179	152	630
66.98907104	36.95483871	49	152.9439097
31.04371585	25.40645161	10	66.45016746
83.32786885	30.02580645	33	146.3536753
300.6338798	232.1225806	262	794.7564604
81.69398907	64.67096774	49	195.3649568
81.69398907	66.98064516	183	331.6746342
299	151.283871	59	509.283871
299	**179**	**152**	**630**

Number of Classes per Day

Current total students that take any class in school (because some students might double up)

Total Students	1049	935	967
# subjects / day	5.732240437	6.032258065	6.361842105
Total classes / da	6		

Students that take any class / actual # of students

Teacher to Student Ratio

Current Number of Teachers	Students per teacher	Number of students per class (Assuming 3 classes a day)	Rounded up
1	123.7599506	41.25331688	42
4	114.8044685	38.26815618	39
3	116.9695282	38.98984272	39
5	126	42	42
1	152.9439097	50.98130325	51
1	66.45016746	22.15005582	23
1	146.3536753	48.78455843	49
6	132.4594101	44.15313669	45
1	195.3649568	65.12165227	66
3	110.5582114	36.85273714	37
5	101.8567742	33.95225806	34

Cases 1 and 2

Department	Test Case 1 - Number of Teachers	Test Case 1 - Students per Teacher	Test Case 1 - Number of students per class	Rounded Up	Test Case 2 - Number of Teachers	Test Case 2 - Students per Teacher	Test Case 2 - Number of students per class	Rounded Up
Art	2	61.87997532	20.62665844	21	2	61.87997532	20.62665844	21
Biology	4	114.8044685	38.26815618	39	5	91.84357483	30.61452494	31
Chemistry	4	87.72714613	29.24238204	30	4	87.72714613	29.24238204	30
English	6	105	35	35	6	105	35	35
French	2	76.47195487	25.49065162	26	2	76.47195487	25.49065162	26
German	1	66.45016746	22.15005582	23	1	66.45016746	22.15005582	23
Spanish	2	73.17683765	24.39227922	25	2	73.17683765	24.39227922	25
Mathematics	7	113.5366372	37.84554573	38	8	99.34455755	33.11485252	34
Music	2	97.68247841	32.56082614	33	1	195.3649568	65.12165227	66
Physics	3	110.5582114	36.85273714	37	3	110.5582114	36.85273714	37
Social Studies	5	101.8567742	33.95225806	34	5	101.8567742	33.95225806	34
	In this test case, each subject in need was given 1 new teacher				In this test case, 1 french and spanish teacher was hired for both			
	Spanish and French were each given a different teacher				It was also assumed the music class would need a large class size			
								green indicates a class to v
			MAX Value	39			MAX Value	66
			MIN Value	21			MIN Value	21
			Range	18			Range	45

Cases 3 and 4

Department	Test Case 3 - Number of Teachers	Test Case 3 - Students per Teacher	Test Case 3 - Number of students per class	Rounded Up	Test Case 4 - Number of Teachers	Test Case 4 - Students per Teacher	Test Case 4 - Number of students per class	Rounded Up
Art	2	61.87997532	20.62665844	21	1	123.7599506	41.25331688	42
Biology	5	91.84357483	30.61452494	31	5	91.84357483	30.61452494	31
Chemistry	4	87.72714613	29.24238204	30	4	87.72714613	29.24238204	30
English	6	105	35	35	6	105	35	35
French	2	76.47195487	25.49065162	26	2	76.47195487	25.49065162	26
German	1	66.45016746	22.15005582	23	1	66.45016746	22.15005582	23
Spanish	2	73.17683765	24.39227922	25	2	73.17683765	24.39227922	25
Mathematics	7	113.5366372	37.84554573	38	8	99.34455755	33.11485252	34
Music	2	97.68247841	32.56082614	33	1	195.3649568	65.12165227	66
Physics	3	110.5582114	36.85273714	37	4	82.91865856	27.63955285	28
Social Studies	5	101.8567742	33.95225806	34	5	101.8567742	33.95225806	34
	In this test case, 1 french and spanish teacher was hired for both				In this test case, 1 french and spanish teacher was hired for both			
	It was not assumed that the music class would have to be larger				It was assumed that core classes would be more important			
	which a teacher was added							
			MAX Value	38			MAX Value	66
			MIN Value	21			MIN Value	23
			Range	17			Range	43

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Justification

Why Our Model is The Best Model Ever

Format & Assumptions

- The model was developed using Google sheets because we had the most experience with it, and because it could perform all the necessary calculations correctly and efficiently.

- We accounted for most, if not all, assumptions made throughout our calculations. If we were ever given more information, it would be easy to add that information where relevant.

Why It Makes Sense

- We calculated the teacher to student ratio and then added the new teachers to the classes that were most in need of them
- We also accounted for the 5% dropout rate
- We continued to recalculate the ratios to make sure that our numbers stayed consistent after adding new teachers

Success & Testing

- The main priority of our model was to make sure that all classes would have the appropriate student to teacher ratio, which our model can do successfully.

- To test our model, we can see if we can accurately calculate the enrollment for future years as well as further test the ratio of teachers to students for those future years

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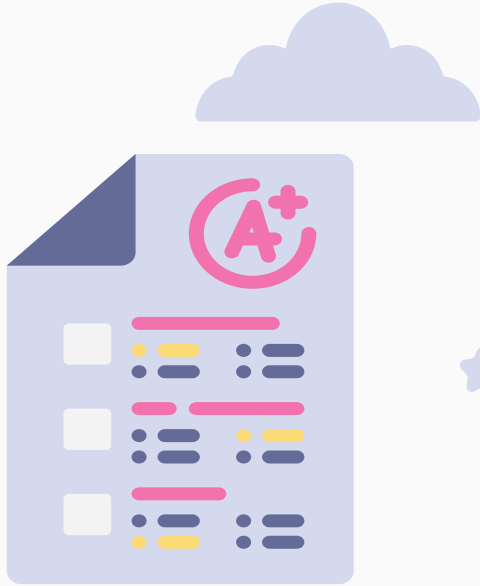
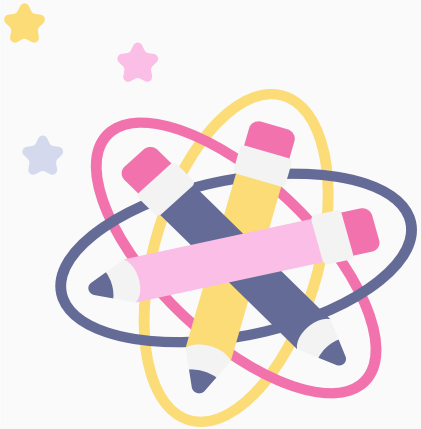
Solution

Our Final Answer



1 new teacher in Spanish/French, English, Physics, Bio, and Chem.
2 new teachers in Math.



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Reflections

Strengths & Weaknesses

Error Analysis

Strengths

Our model took all sorts of things into consideration, such as the logical number of students a teacher can teach as well as the number of prep periods a teacher would need. We also introduced an unbiased answer that was based almost entirely on the information that we were given.

Weaknesses

Our model did not produce whole number answers for things such as ratios and number of classes, so we had to round some numbers up as we could not have something like 0.283871 students. We also had to assume the dropout rate would be the same for each grade, which isn't necessarily true.

Thanks for listening!