# Teacher Hiring Model for Magnet School

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## 1 Model Design

We need to create a model that allocates seven new teachers across different departments since a large number of students will be enrolling in the sophomore class. Our model aims to maintain a balanced student-to-teacher ratio and distribute teachers based on projected demand per department.

### 1.1 Calculate Current Student-to-Teacher Ratios

We calculate the current student-to-teacher ratios for each department using the formula:

$$\text{Current Ratio} = \frac{\text{Total Enrollment in Department}}{\text{Number of Teachers in Department}}$$

### 1.2 Project the Distribution of New Students

We will assume the 140 new sophomores will be distributed across departments in proportion to current 10th-grade enrollments. The new student projection for each department is calculated as:

$$\text{New Students for Department} = \left(\frac{\text{Current 10th-Grade Enrollment in Department}}{\text{Total 10th-Grade Enrollment}}\right) \times 140$$

### 1.3 Recalculate Future Student-to-Teacher Ratios

After adding the new students, the future student-to-teacher ratio for each department is calculated as:

$$\text{Future Ratio} = \frac{\text{Total Enrollment in Department} + \text{New Students}}{\text{Current Number of Teachers} + \text{New Hires}}$$

### 1.4 Determine Teacher Allocation

We allocate the seven new teachers based on which departments have the highest projected future ratios, ensuring that departments with the largest increase in enrollment receive enough teachers to bring their ratios back in line.

## 2 0.201541850Department Examples

### 2.1 Mathematics Department

- **Current Enrollment:** 647
- **Current Teachers:** 6
- **Current Ratio:**

$$\text{Current Ratio} = \frac{647}{6} \approx 107.83$$

- **Current 10th-Grade Enrollment:** 184
- **Total 10th-Grade Enrollment:**

$$184 + 198 + 59 + 183 + 51 + 50 + 183 = 908$$

- **New Sophomores for Mathematics:**

$$\text{New Students} = \left(\frac{184}{908}\right) \times 140 \approx 28.36$$

- **Future Enrollment:**

$$647 + 28.36 = 675.36$$

- **Future Ratio with 2 New Teachers:**

$$\text{Future Ratio} = \frac{675.36}{8} \approx 84.42$$

### 2.2 English Department

- **Current Enrollment:** 490
- **Current Teachers:** 5
- **Current Ratio:**

$$\text{Current Ratio} = \frac{490}{5} = 98$$

- **Current 10th-Grade Class Enrollment:** 183

- **New Sophomores for English:**

$$\text{New Students} = \left(\frac{183}{908}\right) \times 140 \approx 28.22$$

- **Future Enrollment:**

$$490 + 28.21 = 518.21$$

- **Future Ratio with 1 New Teacher:**

$$\text{Future Ratio} = \frac{518.21}{6} \approx 86.37$$

## 2.3 Biology Department

- **Current Enrollment:** 319
- **Current Teachers:** 4
- **Current Ratio:**

$$\text{Current Ratio} = \frac{319}{4} \approx 79.75$$

- **Current 10th-Grade Enrollment:** 198
- **New Sophomores for Biology:**

$$\text{New Students} = \left(\frac{198}{908}\right) \times 140 \approx 30.53$$

- **Future Enrollment:**

$$319 + 30.53 = 349.53$$

- **Future Ratio with 1 New Teacher:**

$$\text{Future Ratio} = \frac{349.53}{5} \approx 69.91$$

## 2.4 Physics Department

- **Current Enrollment:** 291
- **Current Teachers:** 3
- **Current Ratio:**

$$\text{Current Ratio} = \frac{291}{3} = 97$$

- **Current 10th-Grade Enrollment:** 50

- **New Sophomores for Physics:**

$$\text{New Students} = \left(\frac{50}{1049}\right) \times 140 \approx 6.67$$

- **Future Enrollment:**

$$291 + 6.67 = 297.67$$

- **Future Ratio with 1 New Teacher:**

$$\text{Future Ratio} = \frac{297.67}{4} \approx 74.42$$

### 2.5 Social Studies Department

- **Current Enrollment:** 373
- **Current Teachers:** 5
- **Current Ratio:**

$$\text{Current Ratio} = \frac{373}{5} = 74.6$$

- **Current 10th-Grade Enrollment:** 183
- **New Sophomores for Social Studies:**

$$\text{New Students} = \left(\frac{183}{1049}\right) \times 140 \approx 24.42$$

- **Future Enrollment:**

$$373 + 24.42 = 397.42$$

- **Future Ratio with 1 New Teacher:**

$$\text{Future Ratio} = \frac{397.42}{6} \approx 66.24$$

## 3 Final Allocation of New Teachers

- **Mathematics:** 2 additional teachers
- **English:** 1 additional teacher
- **Biology:** 1 additional teacher
- **Physics:** 1 additional teacher
- **Social Studies:** 1 additional teacher
- **Chemistry:** 1 additional teacher