Cobblestone Learning Centers

Student Performance Analysis and Recommendations

GROUP M

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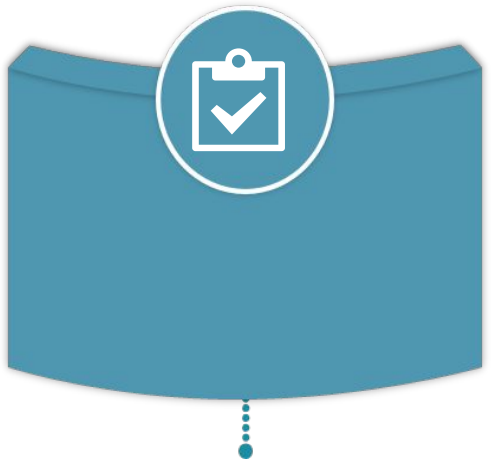
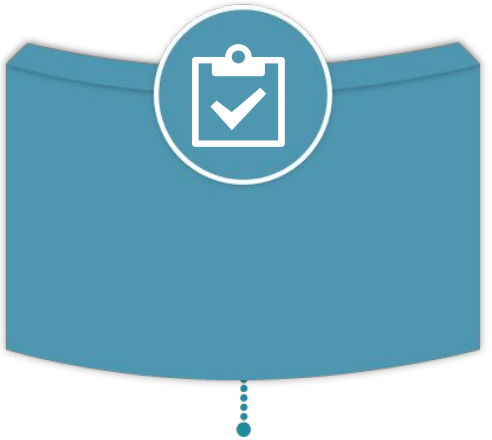
Objectives



To understand student's achievements and program outcomes

To generate insights on student trajectory and to understand the effect of program participation in students



To understand programs' effectiveness in center based vs online delivery modality

Assumptions

- All factors identified to be relevant have **linear relationship** with the score improvement.
- All factors **jointly influence** the students' progress on test scores.
- Students' initial performance impact their progress on test scores.
- Aggregated sum of students' scores on a scale of **100** should be sufficiently representative of their overall performance. All improvement scores are measured on a scale of 400.
- All of the students do not have learning sources other than CLC.

01

Objective 1

To understand student’s achievements and program outcomes

Factors That Affect Students' Performance

Program Selection:

- Tutoring
- Skills
- Refresh

Online Vs. Offline:

- is.Online

Initial Score:

- is.Upper

Program Duration:

- timediff

Initial Score' Effect On Improvement

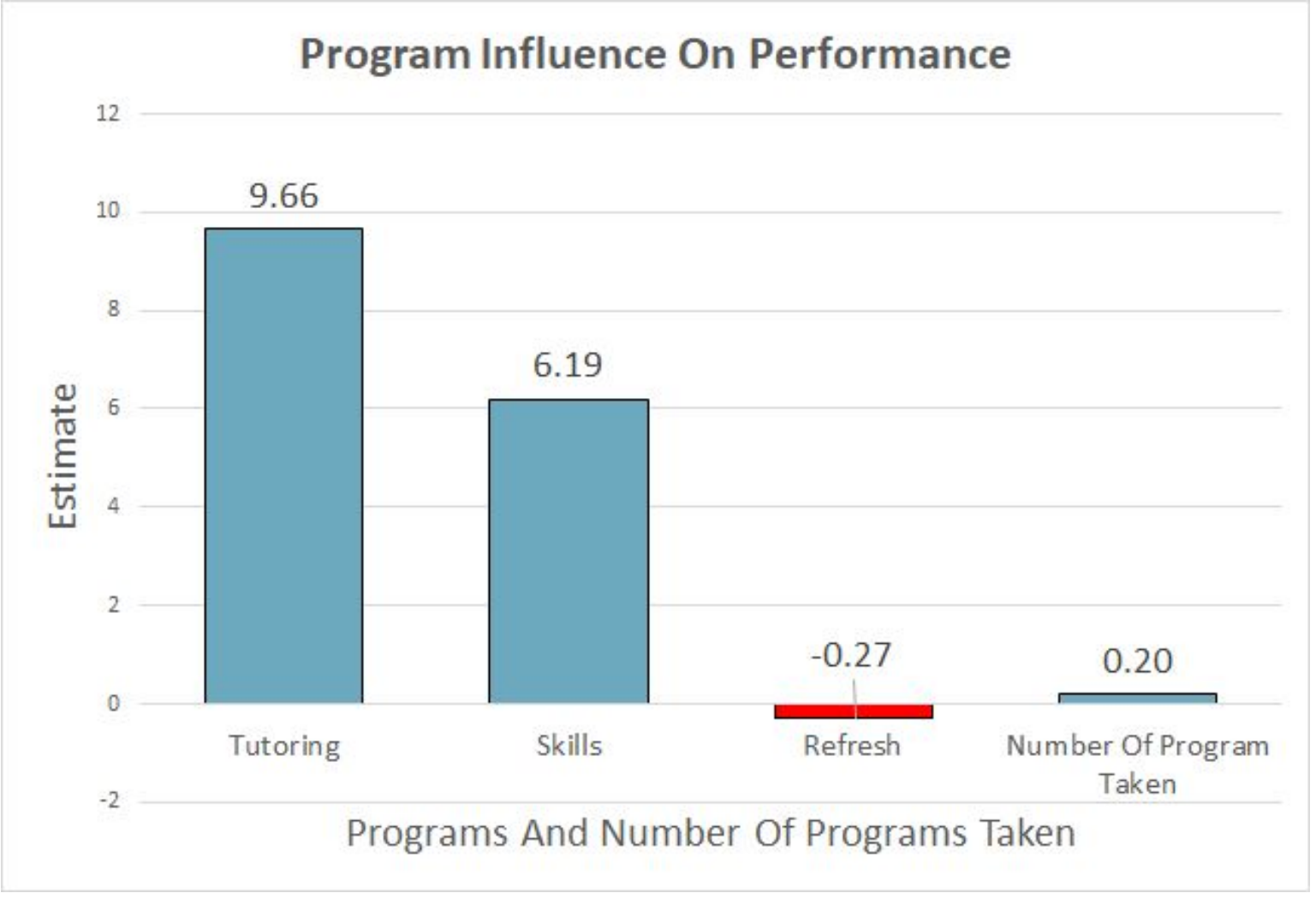
- Students from upper class (with an intake score higher than median :251.5) tend to have more improvement than those from lower class
- Based on the model, having a higher initial score will help **increase** the score by 1.35

02

Objective 2

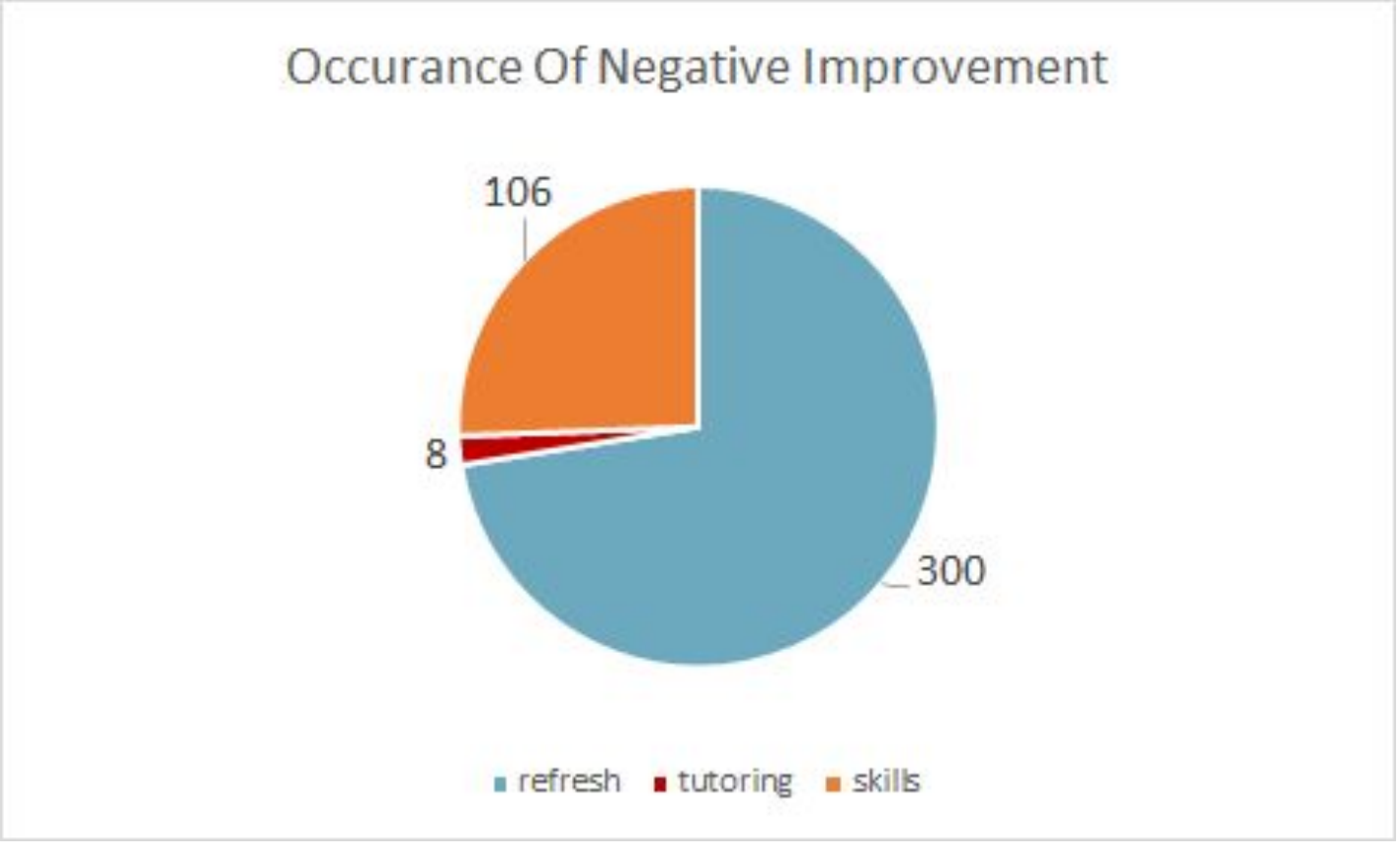
To generate insights on student trajectory and to understand effect of program participation on students

Program Outcomes & Student Achievements



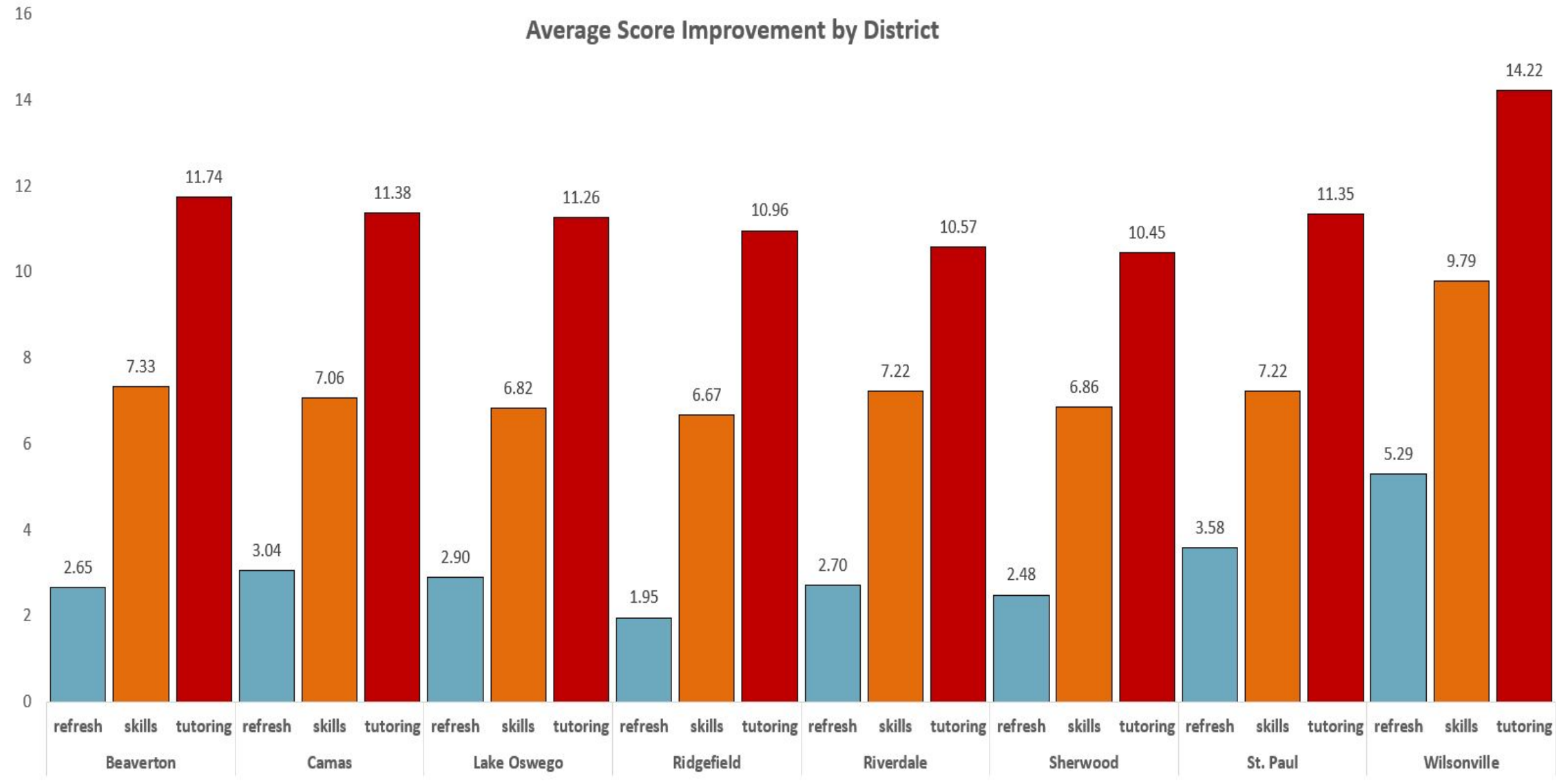
- Attending **tutoring** and **skills** programs will **increase** the score
- Attending **1 more program** will **increase** the score by 0.2. - diversified program choice is beneficial
- Attending **refresh** program will **decrease** the score - not necessarily applicable to all individual student

Program Outcomes & Student Achievements

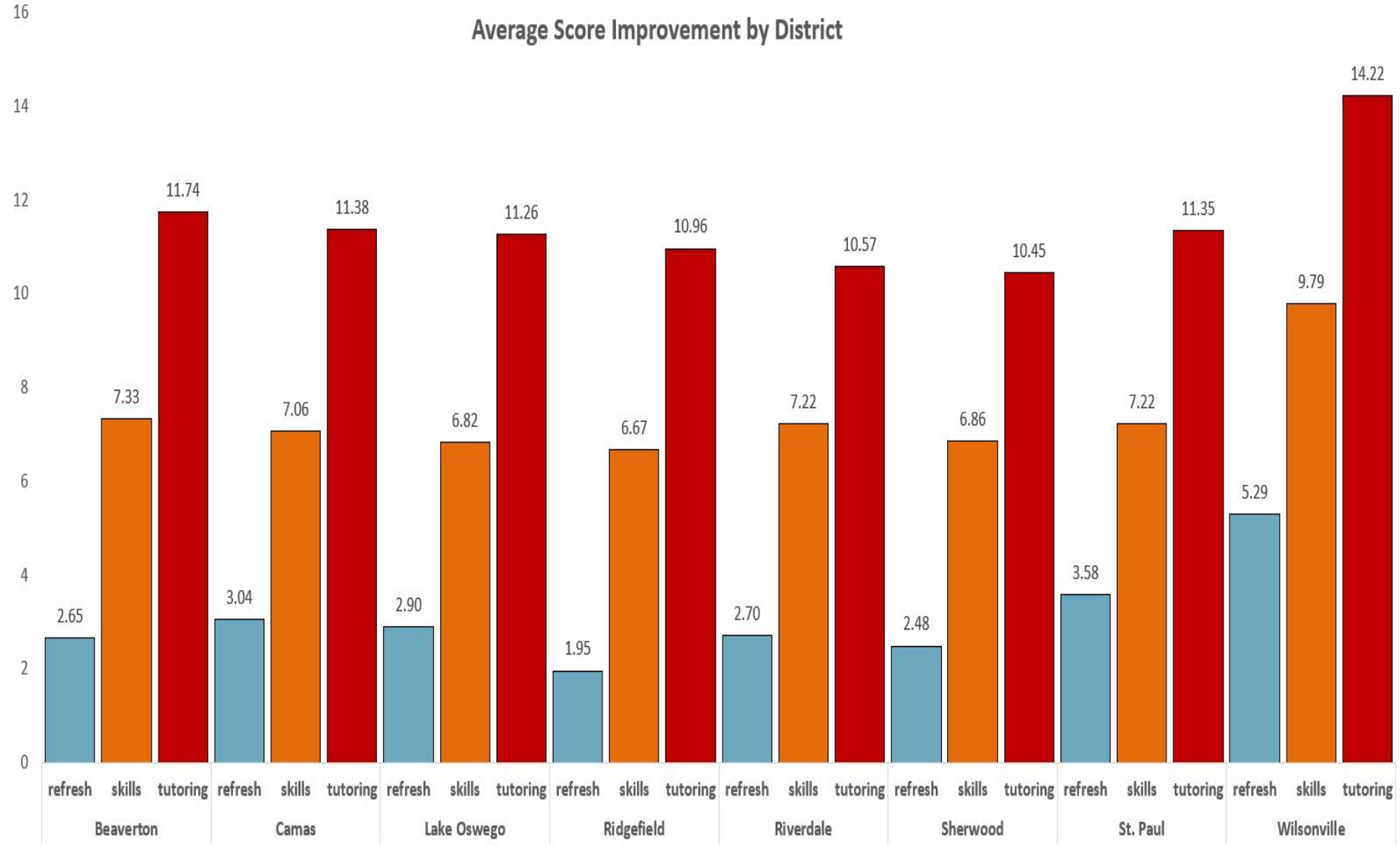


- Most of the observed decreased scores occurred after the attendance of refresh program.
- Need to examine refresh programs for its course design, instructor profile, syllabus details, etc to find out the problems.

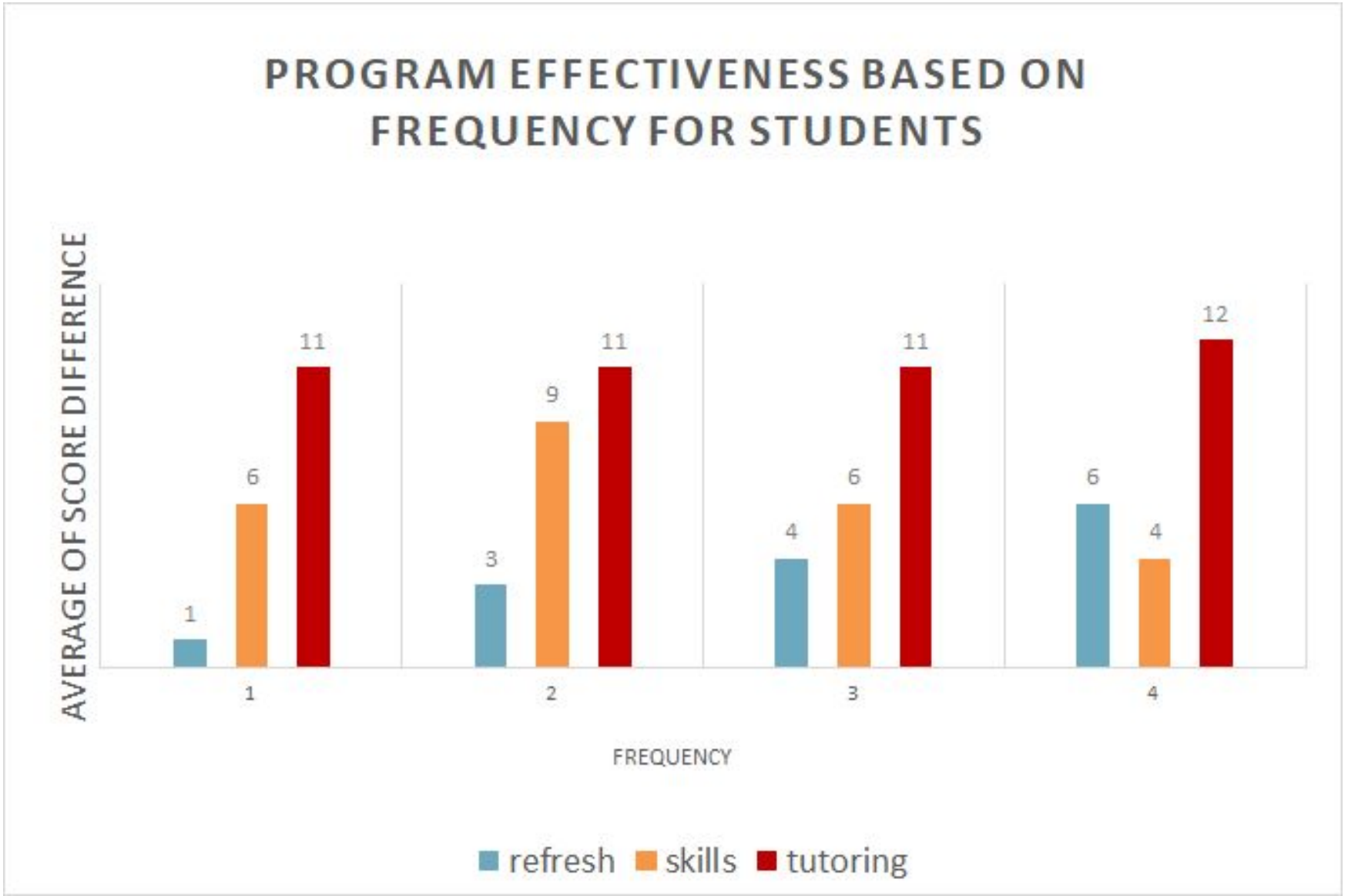
Student Improvement by District



Student Improvement by District



Student Improvement by Frequency of Programs



03

Objective 3

To understand programs’ effectiveness in center based vs online delivery modality

Online VS. Offline decision

- Attending programs online will have a **positive effect** on student's performance
- Based on the model, attending program online should **increase the aggregated score by 2.91**

Recommendations

Examine Refresh Program

- Examine Refresh program's course design, instructors' profile, or conduct secondary research to analyze and improve the program's effectiveness

Pre-course Survey

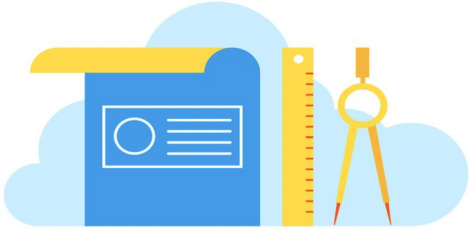
- Conduct to Pre-course surveys to recommend study plan as well as program selection for optimal results

Solver-Human Recommendation

- Use solver to get a general outlook of the optimal study plan and design the final plan with human efforts

Recommendations

- Conduct pre-course survey to recommend programs and study plan for students
- Use collected information to improve performance and course designs



COBBLESTONE LEARNING CENTERS

Date: 11/2021

Overview & Purpose

CLC offers tutoring services and test preparation courses to students in grades 7-12 across our metropolitan area. We have multiple centers at which students can enroll in classes or receive one-on-one-tutoring. Some services are also offered on-line.

Programs offered

1. SkillAdvantage
2. Cobblestone Refresh
3. One-on-one Tutoring

Objectives

In order to better understand your needs and which of our programs can bring you the optimum results, please fill out the following survey and select the best choice that describes your needs.

Part 1

1. **What are your intake scores?**

Writing: _____

Math (No-calculator): _____

Math (calculator): _____

Reading: _____

2. **What are your ideal scores in the future?**

Writing: _____

Math (No-calculator): _____

Math (calculator): _____

Reading: _____

3. **How many days do you wish to learn in Cobblestone Learning Centers?**

_____

4. **What is your preferred way of learning? (Please tick one or two)**

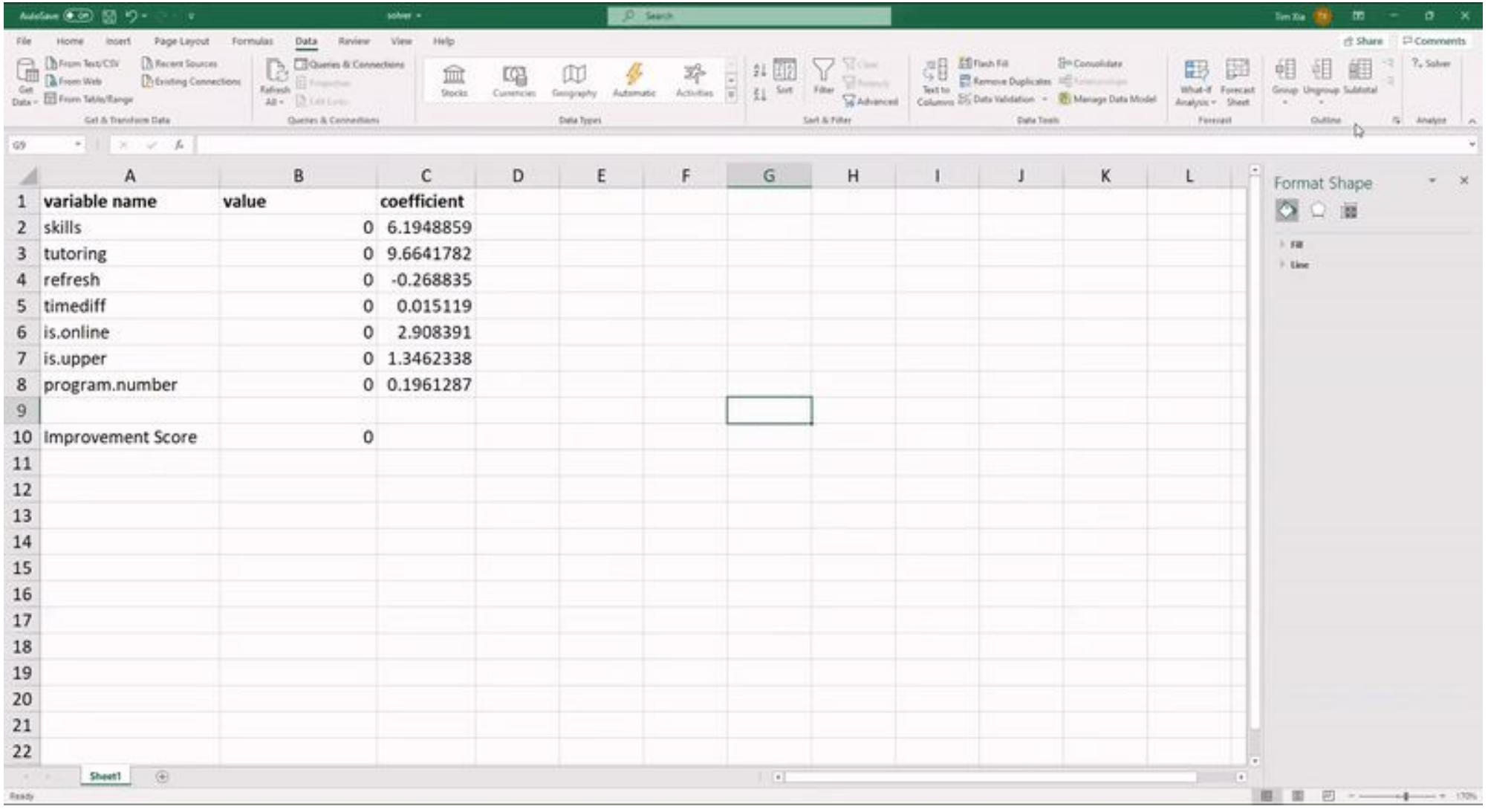
Center-based offline learning	Online learning

5. **What is your preferred program? (Please tick all that fit your needs)**

SkillAdvantage 2 hr / week for 6 weeks	Cobblestone Refresh 1 hr session	One-on-One Tutoring 1 hr session 1 or 2/ week

Recommendations

- Use solver to draft customized study plan based on collected data



	A	B	C
1	variable name	value	coefficient
2	skills	0	6.1948859
3	tutoring	0	9.6641782
4	refresh	0	-0.268835
5	timediff	0	0.015119
6	is.online	0	2.908391
7	is.upper	0	1.3462338
8	program.number	0	0.1961287
9			
10	Improvement Score	0	

Pros & Cons with Solver

Pros:

- Convenient, auto-generate study plan parameter
- Close - to - accurate prediction of improvement score

Cons:

- May not always generate result given the constraints
- Some variables may not have reasonable value (e.g. need to take 600 days of lessons)

Conclusion:

- Use solver as a draft of customized study plan based on student's input from the survey
- Examine the solver results and adjust the plan based on other consideration and constraints (e.g. preferred time slot, preferred instructor)

Cobblestone Learning Centers

Student Performance Analysis and Recommendation

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Appendix

Analysis Process

- **Calculate the aggregate score for the four subjects using the formula:**

aggregated score =
score_reading/8 + score_writing + score_mathNoCalc/8 + score_mathCalc/8

- **Find the median score of students, divide students into 2 groups** based on intake scores : below the median **(lower)** and above the median **(upper)**

Minimum	1st Qu.	Median	Mean	3rd Qu.	Maximum
133.6	229.9	251.1	250.8	272.8	365.8

- Created a **binary variable is.upper** to distinguish whether students are in the upper or lower groups.

```
> score.improvement[, 12]
# A tibble: 17,657 × 1
   is.upper
      <dbl>
 1        0
 2        0
 3        1
 4        1
 5        1
 6        0
 7        0
```

- Convert program participation and location(Center/Online) **to dummy variables** to perform regression analysis
- 0 stands for FALSE for that value and 1 stands for TRUE for that value.

skills	tutoring	refresh	is.online
0	0	1	1
1	0	0	0
0	0	1	1
1	0	0	0
0	0	1	0
0	1	0	0

- **Score difference** =
  the aggregated score after taking **each** class - the aggregated score before the class

	student_id	program	diff
	<int>	<chr>	<dbl>
1	128368	intake	0
2	128368	skills	8.75
3	128374	intake	0
4	128374	skills	5.88
5	128375	intake	0
6	128375	skills	5.88
7	128375	skills	13.9
8	128375	skills	-1.62
9	128387	intake	0
10	128387	tutoring	8.38

- **Program number** is used to calculate how many different programs students enroll.
  - Program number = the number of unique programs - 1 (excluding the intake)

program.number
1
1
0
0
2
2
2
0
0
1

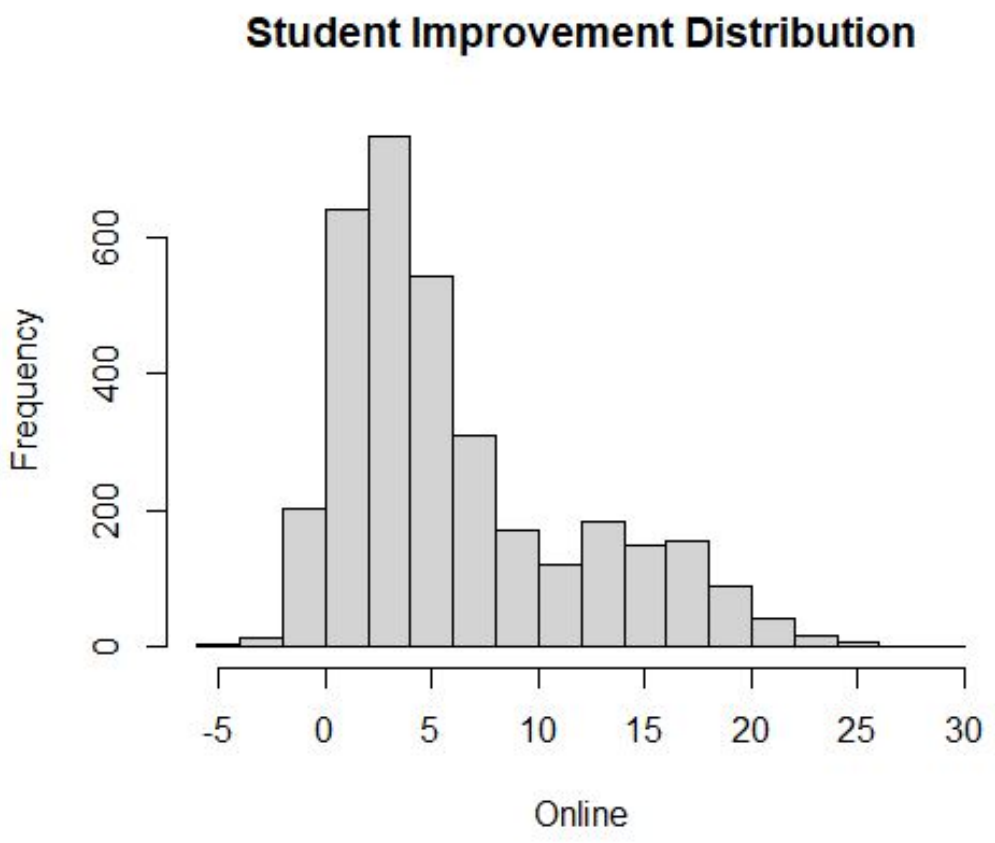
- Run the multivariate linear regression and see how each variables affect the improvement of students

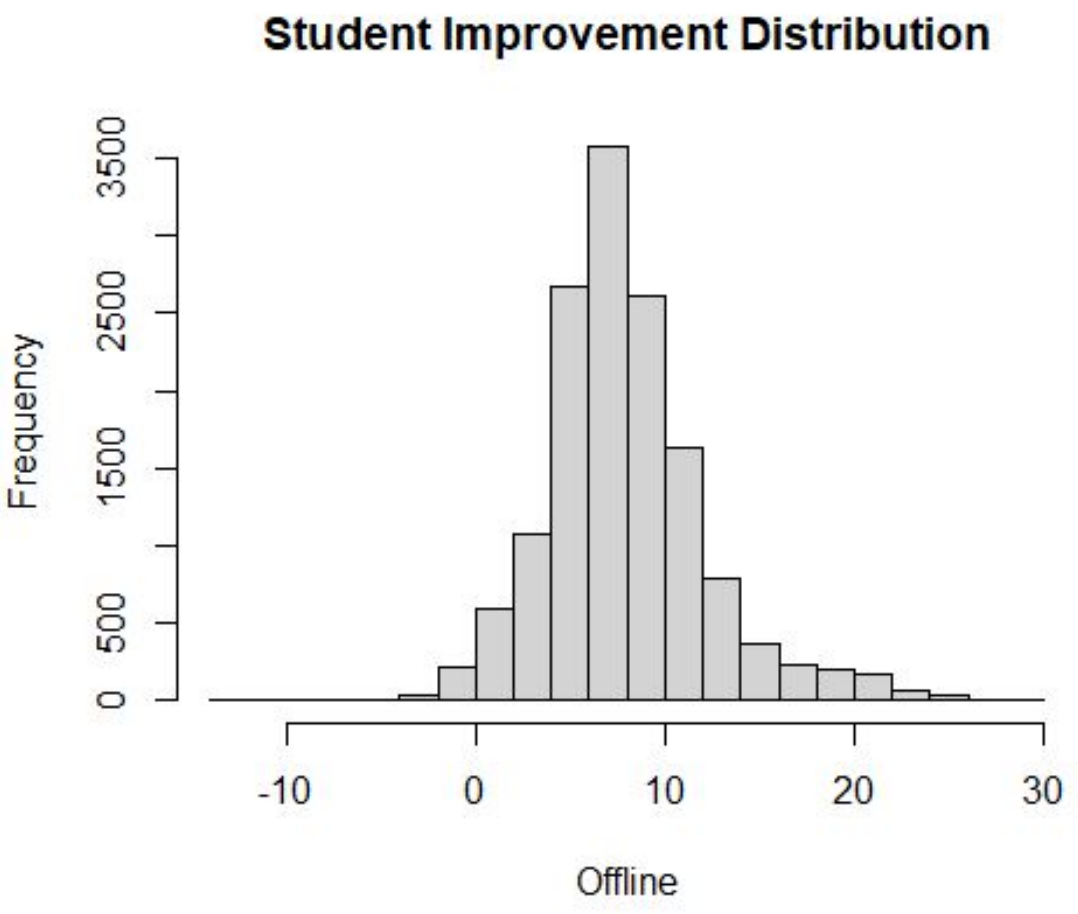
```
Coefficients:
                Estimate Std. Error t value Pr(>|t|)
skills          6.194886   0.086612  71.524  < 2e-16 ***
tutoring        9.664178   0.105815  91.331  < 2e-16 ***
refresh        -0.268835   0.129024  -2.084   0.0372 *
timediff        0.015119   0.001929   7.837 4.87e-15 ***
is.online       2.908391   0.092949  31.290  < 2e-16 ***
is.upper        1.346234   0.052037  25.871  < 2e-16 ***
program.number  0.196129   0.040782   4.809 1.53e-06 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 3.45 on 17650 degrees of freedom
Multiple R-squared:  0.8495,    Adjusted R-squared:  0.8494
F-statistic: 1.423e+04 on 7 and 17650 DF,  p-value: < 2.2e-16
```

Improvement Distribution

online vs. offline





Improvement Distribution

online vs. offline