Instruction Partners
Research Analyst Content Exercise

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## Introduction

The Instruction Partners pilot team has a partner-facing meeting and needs to share progress to inform delivery. They are seeking the answers to the following:

- What is the average breakdown of student scores on early literacy benchmark tests? What does this look like by grade?
- What is the percentage of students that grew out of the bottom quartile on the early literacy benchmark from Fall to Winter? What does this look like by grade? By teacher?
- Teachers are curious to know what difference, if any, progress monitoring on the universal screener had on Winter benchmark scores. For students who moved out of the bottom quartile, what percentage received at least 1 progress monitoring assessment on a literacy measure? Was there a relationship between the number of monitoring tests received and the winter score? What does this look like by teacher?

## Data

Instruction Partners has provided two sample datasets, one with fall scores and one with winter scores on universal screener assessments. Columns include teacher ID, student ID, student grade level, gender, ethnicity, period (fall or winter), measure name, and score, among others. Each row represents a universal screener assessment taken by a student.

Given that this exercise is focused on early literacy, all math-related measure scores were dropped from the dataset, and the following literacy-related measures were kept:

- Vocabulary
- Oral Reading Fluency
- Spelling
- Reading Comprehension
- Reading
- Early Literacy
- Listening Comprehension
- Letter Word Sounds Fluency
- Nonsense Word Fluency
- Phoneme Segmentation
- Word Reading Fluency
- Auditory Vocabulary
- Print Concepts
- Initial Sounds
- Letter Naming Fluency

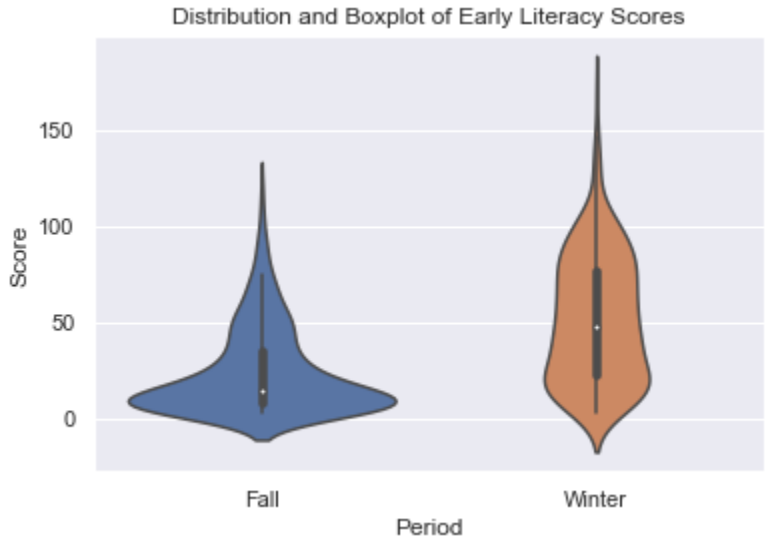
## Analysis and Findings

***What is the average breakdown of student scores on early literacy benchmark tests? What does this look like by grade?***

We began our analysis by filtering the dataset for measure names that were ‘Early Literacy’. We then looked at the breakdown of the scores of these early literacy benchmark tests by period. The results are shown in the table below.

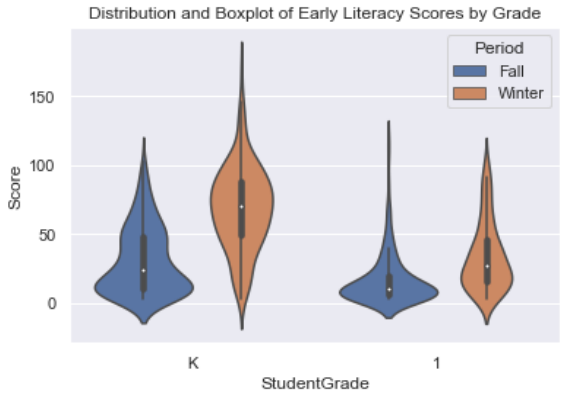
| Period | Count | Mean | Std. Dev. | Min | 25% | 50% | 75% | Max |
|---|---|---|---|---|---|---|---|---|
| **Fall** | 349 | 24.02 | 22.67 | 3 | 8 | 14 | 35 | 119 |
| **Winter** | 356 | 51.55 | 32.86 | 3 | 22 | 48 | 77 | 168 |

Immediately, we notice that the average score of the Winter period is significantly higher than that of the Fall period, specifically a 114% increase. Furthermore, the scores for each quartile have increased as well. To briefly explain these results, this indicates that among the Fall scores, 25% of the scores are 8 or below, 50% of scores are 14 or below, and so on. The distribution and boxplots of the scores of these two periods are shown in the violin plots below.




The breakdown of these scores within each grade is shown in the table below, with the corresponding violin plot as well.

| StudentGrade | Period | Count | Mean | Std. Dev. | Min | 25% | 50% | 75% | Max |
|---|---|---|---|---|---|---|---|---|---|
| **K** | **Fall** | 177 | 30.74 | 24.22 | 3 | 10 | 24 | 48 | 103 |
| | **Winter** | 179 | 69.05 | 30.29 | 3 | 49 | 70 | 88 | 168 |
| **1** | **Fall** | 172 | 17.10 | 18.63 | 3 | 6 | 10 | 20 | 119 |
| | **Winter** | 177 | 33.85 | 24.98 | 3 | 16 | 27 | 46 | 102 |



On average, both Kindergarteners and 1st graders experienced growth in the early literacy benchmark assessments from Fall to Winter. The Kindergarten mean score increased from 30.74 to 69.05, which is a 125% increase. The 1st grade mean score increased from 17.10 to 33.85, which is a 98% increase. Nearly all of the quartile scores increased from Fall to Winter as well, the only exception being that the max score for 1st graders actually *decreased* from Fall to Winter.

***What is the percentage of students that grew out of the bottom quartile on the early literacy benchmark from Fall to Winter? What does this look like by grade? By teacher?***

In the fall, there were 105 students in bottom quartile (8 or below). Of these students, 34 of them had exceeded the bottom quartile in the Winter assessment (greater than 22), which amounts to 32.38%.

The following table shows the number and percentage of students that grew out of the bottom quartile in Early Literacy by grade.

| Grade | Number of students in bottom quartile in Fall | Number of students exceeded bottom quartile in Winter | Percentage |
|---|---|---|---|
| K | 32 | 20 | 62.5% |
| 1 | 73 | 14 | 19.18% |

The following table shows the number and percentage of students that grew out of the bottom quartile in Early Literacy by teacher ID.

| Teacher ID | Number of students in bottom quartile in Fall | Number of students exceeded bottom quartile in Winter | Percentage |
|---|---|---|---|
| 4 | 2 | 2 | 100% |
| 5 | 7 | 2 | 28.57% |
| 6 | 3 | 2 | 66.67% |
| 7 | 2 | 1 | 50% |
| 9 | 3 | 1 | 33.33% |
| 10 | 57 | 12 | 21.05% |
| 11 | 2 | 1 | 50% |
| 14 | 7 | 0 | 0% |
| 17 | 2 | 0 | 0% |
| 18 | 2 | 2 | 100% |
| 22 | 4 | 2 | 50% |
| 23 | 14 | 9 | 64.29% |

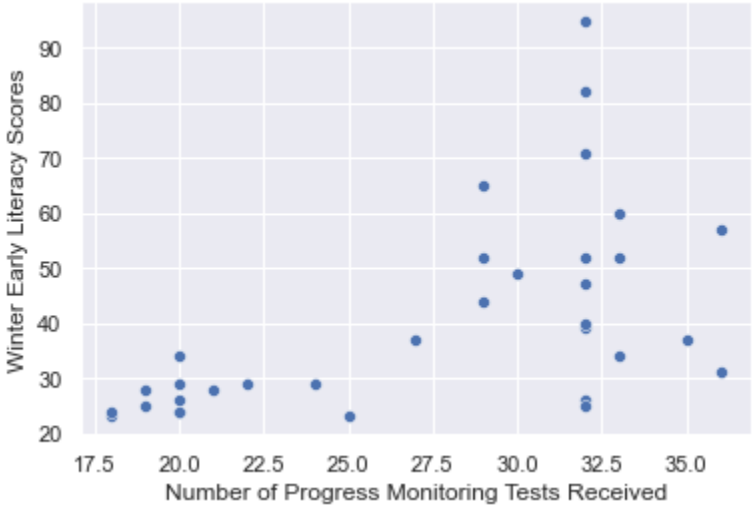
While there are some teachers who have 100% of students that were in the bottom quartile in the Fall that grew out of the bottom quartile in the Winter, those teachers only have 2 students, so this may not necessarily be a strong indicator of performance for those teachers. With that said, there are a few other teachers that are worth highlighting.

Out of the 57 students of teacher ID 10 that were in the bottom quartile in the fall, 12 of them (21%) grew out of the bottom quartile in the winter. Out of the 14 students of teacher ID 23 that were in the bottom quartile in the fall, 9 of them (64%) grew out of the bottom quartile in the winter. It is also worth noting that for teacher 14, out of the 7 students that were in the bottom quartile in the fall, none of them grew out of the bottom quartile in the winter.

***For students who moved out of the bottom quartile, what percentage received at least 1 progress monitoring assessment on a literacy measure? Was there a relationship between the number of monitoring tests received and the winter score? What does this look like by teacher?***

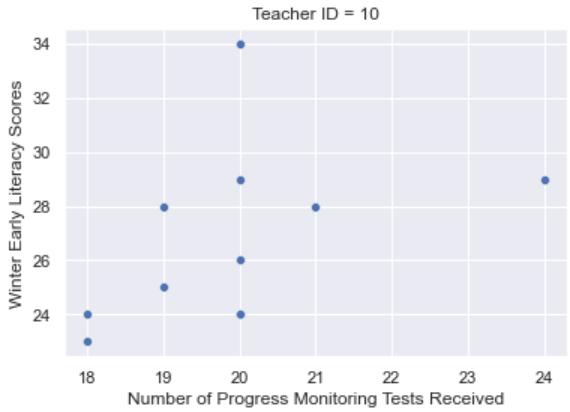
Among the 34 students who moved out of the bottom quartile, we counted the number of additional literacy measure assessments (outside of 'Early Literacy') that each student received. Out of these 34 students, all 34 (100%) received at least 1 other progress monitoring assessment on a literacy measure.

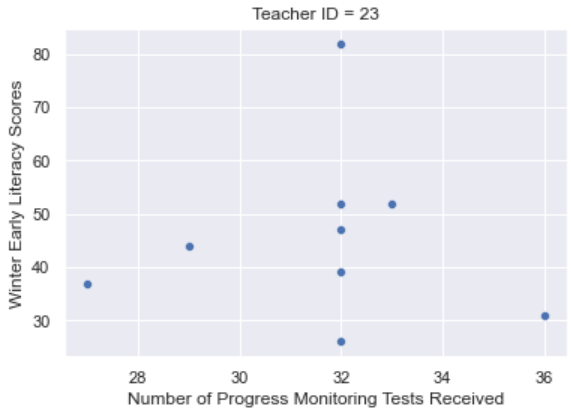
To determine whether there was a relationship between the number of monitoring tests received and the winter score, we plotted the Winter Early Literacy Scores against the number of progress monitoring tests received for those 34 students that moved out of the bottom quartile. The scatter plot is shown below.




When looking at the scatter plot, we can certainly see a positive trend. As the number of progress monitoring tests received increases, it seems that the mean and the variance of the Winter Early Literacy Scores both increase. We can argue that for students who start out in the bottom quartile in the Fall, receiving more progress monitoring tests can increase their potential for higher scores in the winter. For future work, we can also try fitting a linear regression model, or perhaps even using a log scale on the y-axis for an exponential model.

When analyzing the results by teacher, we specifically chose to look at the scatter plots of teacher ID 10 and 23. Those two teachers had a significantly higher number of students out of the 34 than the rest of the teachers. These two teachers, respectively, had 12 and 9 students, while the rest of the teachers had 2 or fewer students. The scatter plots for these two teachers are shown below:




Given the limited sample size, it is difficult to assume that the patterns shown in these graphs are indicative of a real trend. With that said, we do see both graphs trending positively as the number of progress monitoring tests received increases.

Based on these two graphs, and the graph above, we can argue that for those students that moved out of the bottom quartile from Fall to Winter, receiving more progress monitoring tests is correlated with higher winter scores.