



Exact Path Diagnostic and State of Arizona AzM2 Exam Correlational Study

Summary

This research study investigated the correlation between scores on the Exact Path diagnostic assessment and scores on the Arizona annual statewide test (AzM2). The findings in this study show strong correlations between the Exact Path diagnostic and AzM2 scores across content areas and grades, providing evidence that the assessments tend to measure the same skills and knowledge.



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Background

The Exact Path diagnostic assessment is a computer-adaptive test that can be administered up to four times a year in language arts, reading, and/or mathematics and which results in a scale score that ranges from 500 to 1500 regardless of grade level. A school district in Arizona who administered the Exact Path diagnostic provided student scores on the AzM2, the Arizona accountability assessment for students in grades three through eight, totaling 3161 student scores in reading, 3244 student scores in math, and 3134 student scores in language arts. This study investigates the strength of the relationship between scores on the Exact Path diagnostic and the AzM2 by investigating correlations between student scores on both tests. Correlations between two tests offer a source of validity evidence, with strong correlations providing evidence that the assessments tend to measure the same skills and knowledge.

Sample Description

Nine schools from an Arizona school district participated in this study by providing Edmentum with student demographic and performance data from the Spring 2021 AzM2 test. These data were then joined with Exact Path diagnostic data using a unique student identification number.

The primary users of Exact Path within the Arizona school district were students in grades 3-8. Table 1 shows the demographic composition of students in the sample compared to the overall state population of students. Student-level data for free/reduced price lunch was not available, but the district reported that over 90% of students were qualified, as compared to 45% of the statewide population. In general, the students in the study sample are more likely to be Hispanic while the students in the state sample are

more likely to be White. Students in the sample are also somewhat more likely to be English language learners than the overall state population.

Table 1. Student Characteristics

| Student Characteristic | Sample Percent (%) | State Percent (%) | Difference (%) |
|---------------------------------------|--------------------|-------------------|----------------|
| American Indian/Alaskan Native | 2.10 | 4.51 | 2.41 |
| Asian | 0.68 | 2.97 | 2.29 |
| Black | 4.32 | 5.87 | 1.55 |
| Hispanic | 85.20 | 46.00 | -39.20 |
| Two or More Races | 2.03 | 3.86 | 1.83 |
| White | 5.30 | 36.39 | 31.09 |
| Gender | | | |
| Female | 48.52 | 48.73 | 0.20 |
| Male | 51.48 | 51.27 | -0.20 |
| English Language Learner | | | |
| English Language Learner | 20.38 | 6.61 | -13.77 |
| Free/Reduced Lunch | >90.00 | 45.03 | -44.97 |
| Special Education | 10.60 | 9.80 | -0.80 |

Source: Arizona State Board of Education, 2021

AzM2 scores are divided into four performance levels: Minimally Proficient, Partially Proficient, Proficient, and Highly Proficient, with the latter two categories considered as passing (Arizona’s Statewide Achievement Assessment for English Language Arts and Mathematics, 2019a). Table 2 compares the proportion of students in the sample who obtained each proficiency level based on their state test scores, compared to the overall state population. Results show that, based on their state test scores, the study sample participants were more likely to be classified as 'Minimally Proficient' compared to the overall state population.

Table 2. Distribution Across Proficiency Levels for Study Sample and State

| Grade | Proficiency Level | Mathematics | | ELA | |
|-------|----------------------|---------------------------|--------------------------|---------------------------|--------------------------|
| | | Sample (% of students) | State (% of students) | Sample (% of students) | State (% of students) |
| 3 | Minimally Proficient | 71.12 | 38.0 | 82.44 | 52.0 |
| | Partially Proficient | 20.76 | 26.0 | 7.58 | 13.0 |
| | Proficient | 7.22 | 24.0 | 8.32 | 25.0 |
| | Highly Proficient | 0.90 | 12.0 | 1.66 | 10.0 |
| 4 | Minimally Proficient | 75.60 | 41.0 | 71.46 | 40.0 |
| | Partially Proficient | 17.01 | 24.0 | 12.10 | 15.0 |
| | Proficient | 7.02 | 25.0 | 14.56 | 33.0 |
| | Highly Proficient | 0.37 | 10.0 | 1.89 | 12.0 |
| 5 | Minimally Proficient | 80.31 | 42.0 | 67.59 | 34.0 |
| | Partially Proficient | 14.34 | 26.0 | 16.70 | 21.0 |
| | Proficient | 4.78 | 22.0 | 11.53 | 29.0 |
| | Highly Proficient | 0.57 | 10.0 | 4.17 | 17.0 |
| 6 | Minimally Proficient | 79.31 | 51.0 | 65.54 | 39.0 |
| | Partially Proficient | 13.03 | 19.0 | 21.98 | 24.0 |
| | Proficient | 6.32 | 19.0 | 10.30 | 31.0 |
| | Highly Proficient | 1.34 | 11.0 | 2.18 | 6.0 |
| 7 | Minimally Proficient | 75.71 | 52.0 | 67.32 | 43.0 |
| | Partially Proficient | 13.48 | 18.0 | 17.94 | 20.0 |
| | Proficient | 7.80 | 17.0 | 12.61 | 29.0 |
| | Highly Proficient | 3.01 | 13.0 | 2.13 | 8.0 |
| 8 | Minimally Proficient | 82.22 | 56.0 | 67.50 | 45.0 |
| | Partially Proficient | 10.00 | 17.0 | 16.92 | 21.0 |
| | Proficient | 5.93 | 15.0 | 11.92 | 23.0 |
| | Highly Proficient | 1.85 | 11.0 | 3.65 | 11.0 |

Source: Arizona Department of Education, 2021

Data and Methods

In this study, student academic performance within a subject is measured through two assessments: the Exact Path diagnostic and the AzM2. The Exact Path diagnostic assessments in mathematics, language arts, and reading result in scores on a vertical scale so that performance within a subject can be compared across grades. However, the vertical scale for each subject is distinct, so scores cannot be compared between subjects. The AzM2 assesses academic performance in mathematics and English Language Arts. While Exact Path assesses reading and language arts separately resulting in two separate scores, the AzM2 is focused on assessing the Arizona English Language Arts Standards (Arizona's Statewide Achievement Assessment for English Language Arts and Mathematics, 2019b).

To perform correlational studies, students must typically take both tests (e.g., the Exact Path diagnostic and the AzM2) within the same time frame. Ideally, both tests would be administered within two weeks of each other and then student scores from both tests would be correlated. Practically, however, administering multiple tests within a short time span can be unreasonable. Students in this study completed the Exact Path diagnostic in language arts, reading, and mathematics between April 26, 2021 and May 15, 2021. AzM2 for both language arts and mathematics was completed between April 5, 2021 and May 14, 2021. For this particular correlation study, it is important to note that schooling was interrupted during the 2020-2021 school year due to the COVID-19 pandemic. The federal government provided more flexibility in end-of-year testing than usual, and the opt-out rates were much higher than pre-COVID levels. This sample's participating school district, however, retained high participation rates, with an average participation rate of 95% across district schools (Arizona Department of Education, 2021).

The Arizona school district provided Edmentum with student data from the Spring 2021 AzM2, which Edmentum then merged with Exact Path diagnostic data from Spring 2021. AzM2 mathematics scores were merged with Exact Path diagnostic scores in mathematics, and AzM2 language arts scores were merged two ways: with Exact Path diagnostic scores in language arts and again with Exact Path diagnostic score in reading. Although the AzM2 language arts assessment is more focused on assessing language arts content, it is the Arizona assessment most closely related to the Exact Path reading diagnostic and the constructs assessed are similar. It is expected that student performance on AzM2 and the Exact Path language arts diagnostic will show a high degree of correlation. Table 3 shows the number of students in the merged sample by grade and content area.

Table 3. Sample Size (Number of Students)

| | Mathematics | Language Arts | Reading |
|---------|-------------|---------------|---------|
| Grade 3 | 554 | 533 | 541 |
| Grade 4 | 541 | 525 | 529 |
| Grade 5 | 523 | 500 | 503 |
| Grade 6 | 522 | 498 | 505 |
| Grade 7 | 564 | 551 | 563 |
| Grade 8 | 540 | 527 | 520 |

Results

The analysis begins by considering the relationship between Exact Path diagnostic scores and AzM2 proficiency levels, with the expectation that the median Exact Path scores will increase with each proficiency level. The distribution of Exact Path diagnostic scores by AzM2 proficiency category (Arizona's Statewide Achievement Assessment for English Language Arts and Mathematics, 2019a) and by subject area are displayed in the box plots in Figures 1-3. The boxes represent the distribution of Exact Path scores from the first quartile to the third quartile, with a horizontal line intersecting the box at the median. Based on the vertical progression of the box plots across performance levels, these figures show that within each subject, there is a clear relationship between the AzM2 proficiency levels and Exact Path diagnostic scores. Within each grade and subject area, median Exact Path diagnostic scores are consistently greater with increasingly higher proficiency levels. This suggests a strong relationship between AzM2 performance levels and Exact Path diagnostic scores. Median and mean scale scores by AzM2 performance level should not be interpreted as proficiency level predications or cut scores but rather provide evidence that students that scored higher on the Exact Path diagnostic also received AzM2 scores corresponding to higher performance levels and vice versa. Tables with descriptive statistics reporting this data are included in Tables A1-A3 in the appendix.

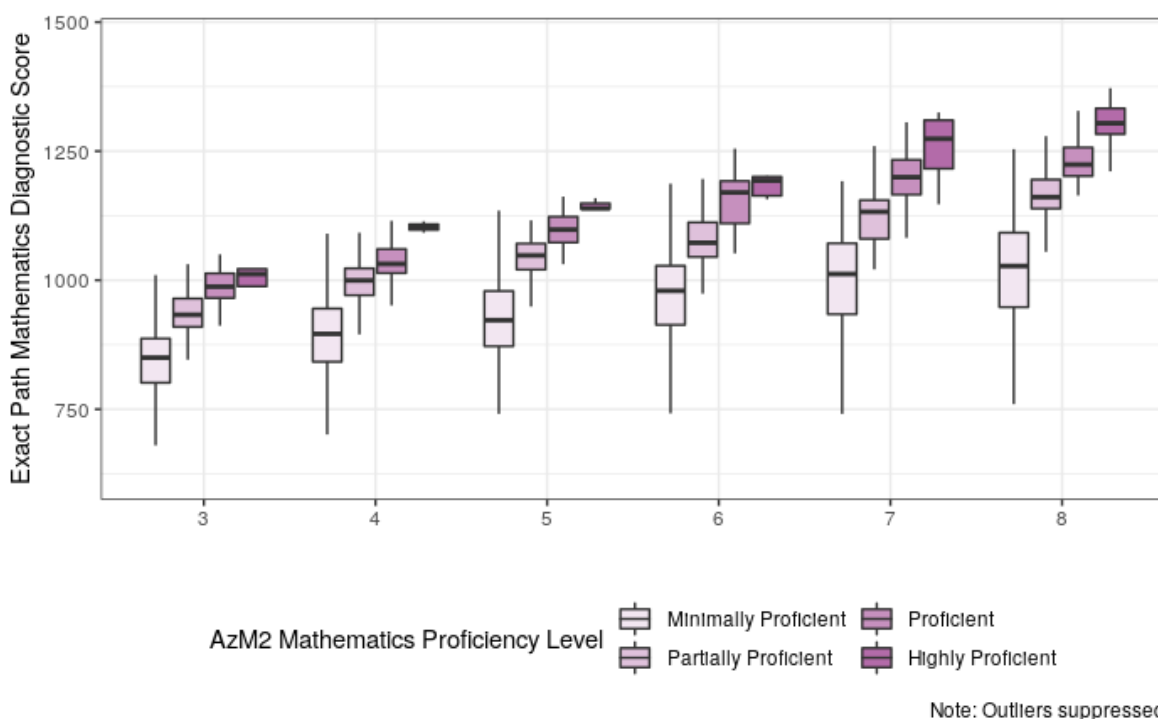
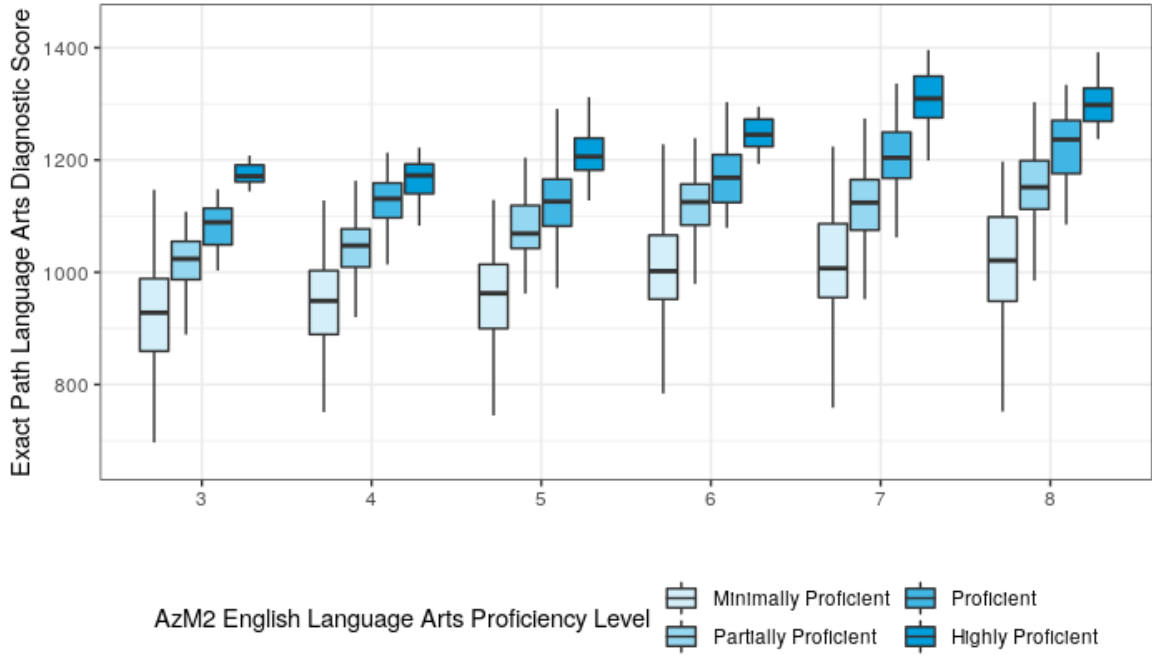


Figure 1. Exact Path Mathematics diagnostic Score Distribution by AzM2 Exam Mathematics Proficiency Level



Note: Outliers suppressed

Figure 2. Exact Path Language Arts Diagnostic Score Distribution by AzM2 Exam Language Arts Proficiency Level

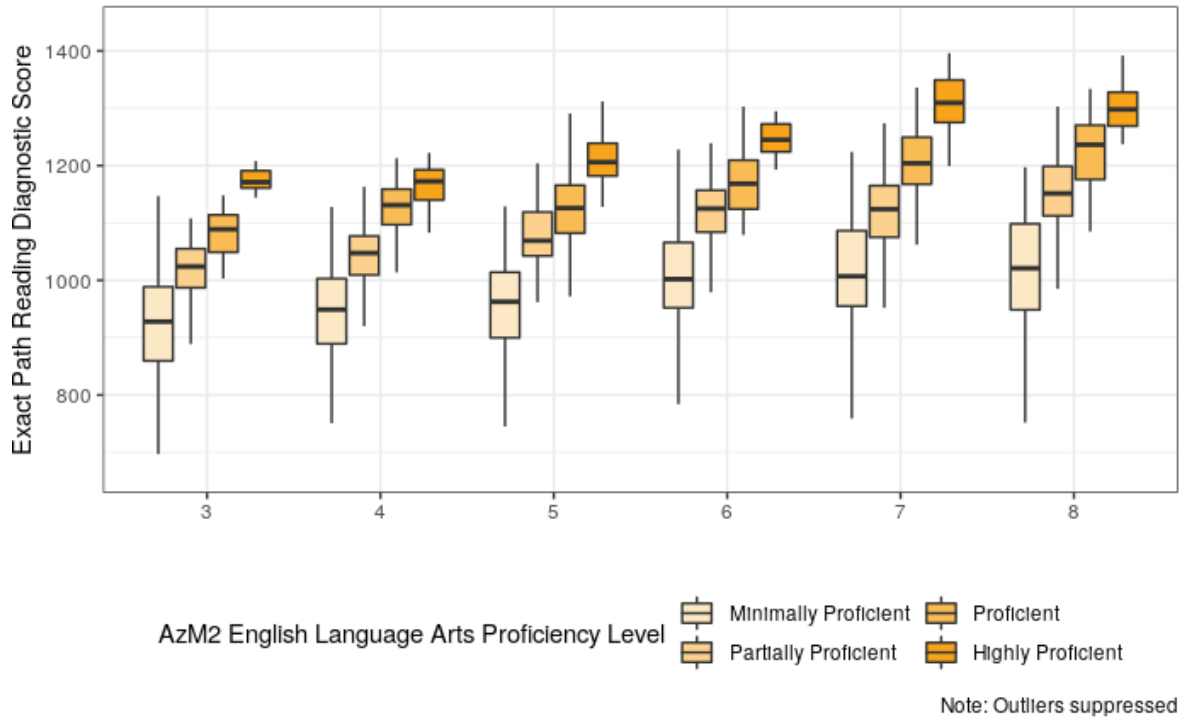


Figure 3. Exact Path Reading Diagnostic Score Distribution by AzM2 Exam Language Arts Proficiency Level

Table 4 shows correlation coefficients between Spring 2021 AzM2 scale scores and Spring 2021 Exact Path diagnostic scores, by grade level and content area. The correlation coefficient measures the linear correlation between two variables, and ranges from 0 to +/-1, where the larger the absolute value of the correlation coefficient, the stronger the association between the two measures.

All correlations show a strong positive relationship between the Exact Path diagnostic and the AzM2. To understand the magnitude of the association, Cohen, Cohen, West, & Aiken (2003) provided a standard or rule of thumb for interpreting the strength of the relationship. Correlation coefficients between 0.10 and 0.29 represent a small association, coefficients between 0.30 and 0.49 represent a medium association, and coefficients of 0.50 and above represent a large association or relationship.

Scatter plot by grade in Figures A1-A6 in the appendix also show the relationship between student performance on each test, again by grade and content area. These figures and correlations demonstrate that students who score high on the Exact Path diagnostic tend to score higher on the AzM2 and vice versa.

Table 4. Correlation Between 2021 AzM2 Exam Scores and Exact Path diagnostic Scores

| | Mathematics | Language Arts | Reading |
|---------|-------------|---------------|---------|
| Grade 3 | 0.706 | 0.715 | 0.714 |
| Grade 4 | 0.787 | 0.751 | 0.739 |
| Grade 5 | 0.737 | 0.746 | 0.777 |

| | | | |
|---------|-------|-------|-------|
| Grade 6 | 0.772 | 0.703 | 0.737 |
| Grade 7 | 0.743 | 0.723 | 0.762 |
| Grade 8 | 0.727 | 0.779 | 0.801 |

Conclusion

Results indicated that performance on the Exact Path diagnostic is highly correlated with performance on the AzM2. In other words, students that score high on the AzM2 also score high on the Exact Path diagnostic and vice versa. These results suggest that both the AzM2 and the Exact Path diagnostic measure similar constructs and provide predictive validity evidence for the Exact Path diagnostic.

References

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Appendix

Table A1. Mean and Standard Deviation of Exact Path Mathematics Score by AzM2 Exam Mathematics Proficiency Level

| AzM2 Exam Level | Grade 3 | | Grade 4 | | Grade 5 | |
|-----------------------------|---------------|-----|---------------|-----|---------------|-----|
| | Mean (SD) | N | Mean (SD) | N | Mean (SD) | N |
| Minimally Proficient | 843.6 (68.5) | 394 | 893.0 (70.9) | 409 | 921.8 (77.1) | 420 |
| Partially Proficient | 932.3 (48.7) | 115 | 995.9 (46.3) | 92 | 1042.5 (53.0) | 75 |
| Proficient | 988.3 (36.2) | 40 | 1040.7 (48.0) | 38 | 1098.2 (34.9) | 25 |
| Highly Proficient | 1005.6 (65.6) | 5 | 1103.0 (15.6) | 2 | 1145.3 (11.8) | 3 |

| AzM2 Exam Level | Grade 6 | | Grade 7 | | Grade 8 | |
|-----------------------------|---------------|-----|---------------|-----|-------------------|-----|
| | Mean (SD) | N | Mean (SD) | N | Mean (SD) | N |
| Minimally Proficient | 968.0 (85.8) | 414 | 998.0 (99.6) | 427 | 1017.2 (103.9) | 444 |
| Partially Proficient | 1076.7 (53.0) | 68 | 1121.4 (65.4) | 76 | 1173.5 (54.9) | 54 |
| Proficient | 1154.0 (58.5) | 33 | 1197.7 (55.9) | 44 | 1230.6 (63.8) | 32 |
| Highly Proficient | 1193.0 (40.0) | 7 | 1265.5 (75.3) | 17 | 1313.4 (60.9) | 10 |

Table A2. Mean and Standard Deviation of Exact Path Language Arts Score by AzM2 Exam Language Arts Proficiency Level

| AzM2 Exam Level | Grade 3 | | Grade 4 | | Grade 5 | |
|-----------------------------|---------------|-----|---------------|-----|---------------|-----|
| | Mean (SD) | N | Mean (SD) | N | Mean (SD) | N |
| Minimally Proficient | 880.3 (83.0) | 439 | 902.1 (88.4) | 374 | 915.2 (85.7) | 337 |
| Partially Proficient | 981.8 (52.8) | 40 | 995.2 (62.4) | 65 | 1033.1 (60.6) | 84 |
| Proficient | 1039.3 (36.9) | 45 | 1069.3 (59.2) | 76 | 1075.5 (71.7) | 58 |
| Highly Proficient | 1103.4 (48.7) | 9 | 1133.0 (39.8) | 10 | 1155.2 (67.7) | 21 |

| AzM2 Exam Level | Grade 6 | | Grade 7 | | Grade 8 | |
|-----------------------------|---------------|-----|----------------|-----|---------------|-----|
| | Mean (SD) | N | Mean (SD) | N | Mean (SD) | N |
| Minimally Proficient | 954.8 (91.3) | 328 | 973.1 (100.0) | 375 | 978.6 (98.8) | 354 |
| Partially Proficient | 1046.8 (83.9) | 106 | 1075.4 (88.3) | 96 | 1104.0 (66.4) | 92 |
| Proficient | 1125.1 (71.2) | 53 | 1154.1 (67.1) | 68 | 1173.7 (71.9) | 63 |
| Highly Proficient | 1211.4 (39.4) | 11 | 1209.5 (102.4) | 12 | 1254.3 (72.3) | 18 |

Table A3. Mean and Standard Deviation of Exact Path Reading Score by AzM2 Exam Language Arts Proficiency Level

| | Grade 3 | | Grade 4 | | Grade 5 | |
|-----------------------------|---------------|-----|---------------|-----|---------------|-----|
| AzM2 Exam Level | Mean (SD) | N | Mean (SD) | N | Mean (SD) | N |
| Minimally Proficient | 925.0 (88.8) | 446 | 944.5 (89.6) | 378 | 956.6 (79.9) | 340 |
| Partially Proficient | 1023.2 (65.6) | 41 | 1042.9 (60.3) | 64 | 1072.6 (60.1) | 84 |
| Proficient | 1085.8 (47.2) | 45 | 1124.7 (51.9) | 77 | 1119.8 (76.0) | 58 |
| Highly Proficient | 1169.7 (33.5) | 9 | 1155.5 (56.8) | 10 | 1212.3 (61.6) | 21 |

| | Grade 6 | | Grade 7 | | Grade 8 | |
|-----------------------------|---------------|-----|---------------|-----|---------------|-----|
| AzM2 Exam Level | Mean (SD) | N | Mean (SD) | N | Mean (SD) | N |
| Minimally Proficient | 1000.6 (85.7) | 331 | 1014.4 (95.7) | 379 | 1016.2 (97.3) | 351 |
| Partially Proficient | 1112.0 (64.2) | 111 | 1117.9 (75.5) | 101 | 1151.5 (78.4) | 88 |
| Proficient | 1164.1 (64.2) | 52 | 1204.5 (68.6) | 71 | 1220.6 (69.3) | 62 |
| Highly Proficient | 1246.2 (33.2) | 11 | 1300.9 (69.3) | 12 | 1300.6 (62.7) | 19 |

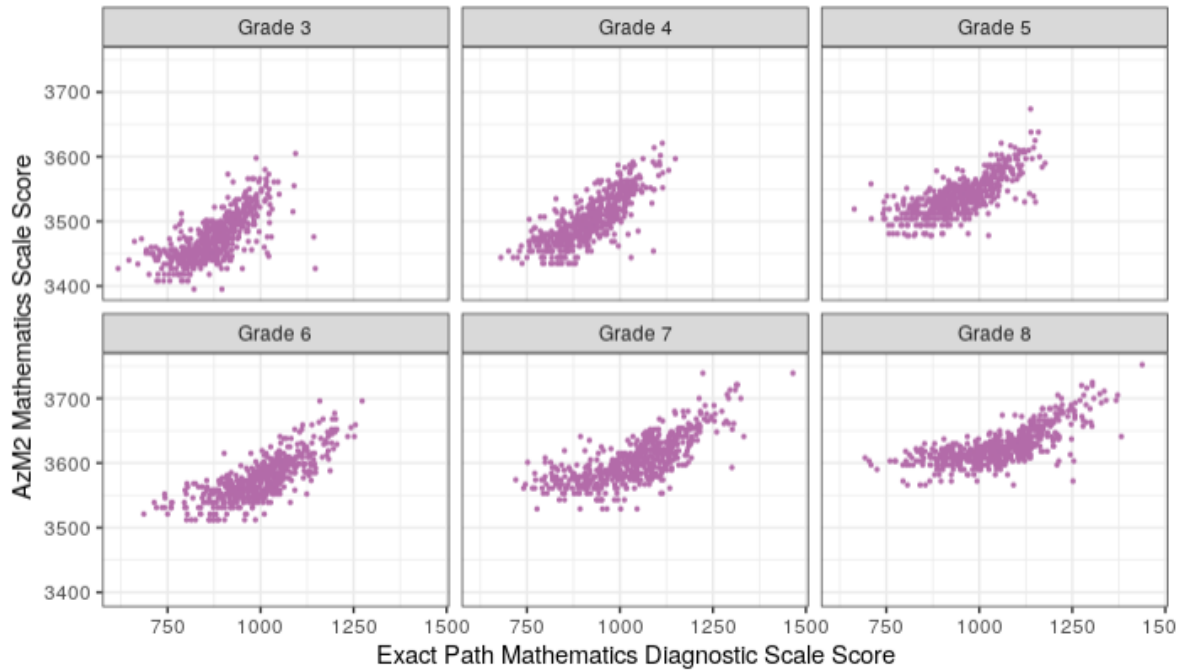


Figure A1. Scatterplot of Exact Path Mathematics Score and AzM2 Mathematics Score

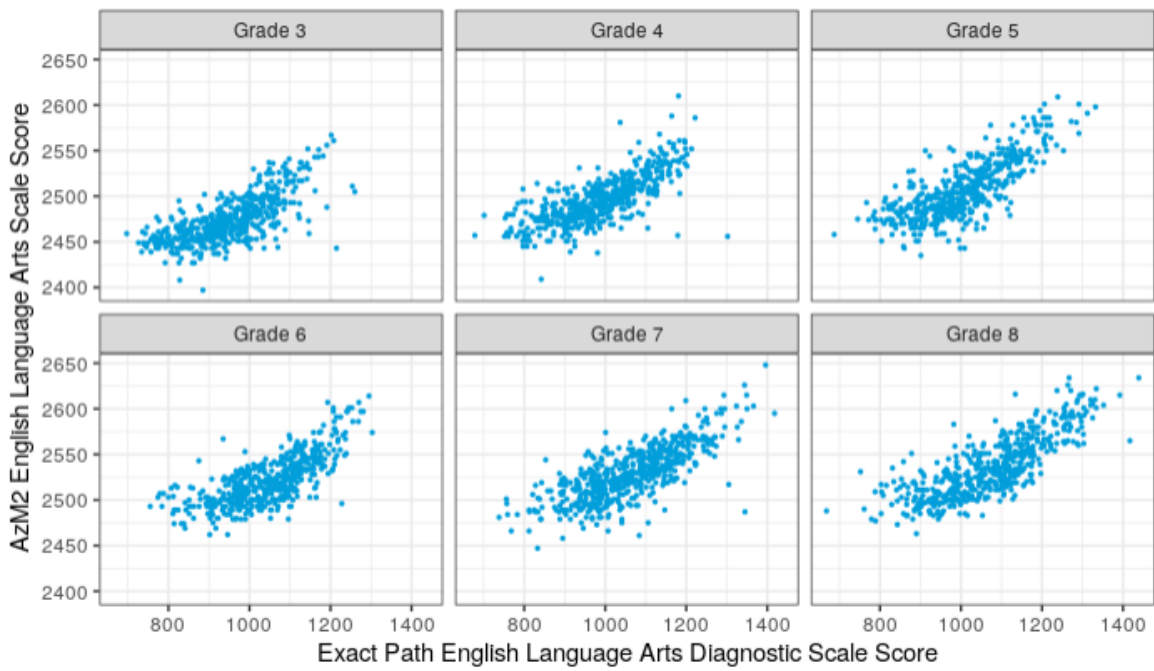


Figure A2. Scatterplot of Exact Path Language Arts Score and AzM2 English Language Arts Score

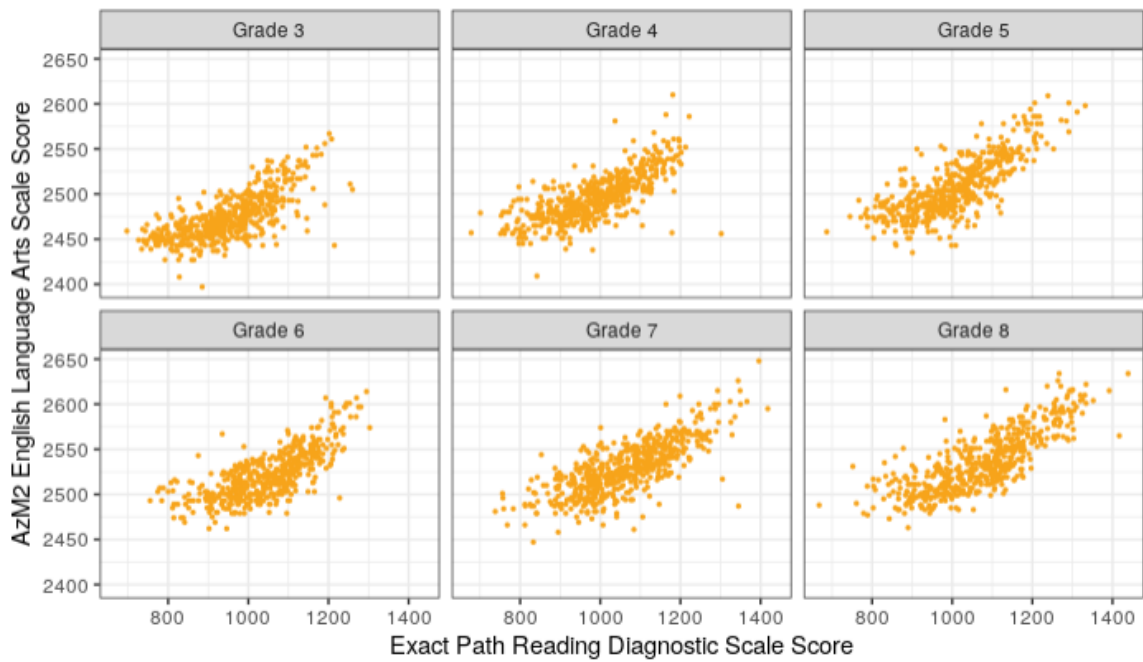


Figure A3. Scatterplot of Exact Path Reading Score and AzM2 English Language Arts Score