November 2006

TENTH-GRADE WASL IN SPRING 2006: ASSOCIATIONS AMONG SUBJECT AREAS

The 2006 Legislature directed the Washington State Institute for Public Policy (Institute) to conduct a "review and statistical analysis of Washington assessment of student learning data."[1] A previous report describes overall results for the 10th-grade Washington Assessment of Student Learning (WASL) in spring 2006.[2]

This report describes associations among subject-area results for the 78,020 10th-grade students who completed the WASL in spring 2006.

The analysis finds that the associations among subject-area results on the WASL are strong even though more 10th graders met standard in reading and writing than in math.

ASSOCIATIONS AMONG SUBJECT-AREA SCORES

As might be expected, students who do well in one subject typically do well in others. One method for examining associations among subject-area WASL results is to perform a correlational analysis. **Exhibit 1** presents correlations among reading, writing, and math scores.

Exhibit 1
Correlations Among Subject-Area Scores on the Spring 2006 WASL

	Reading	Writing
Writing Score	0.64	—
Math Score	0.69	0.62

Correlations measure the degree of linear association between scores. The statistic ranges between -1.0 and +1.0, where 0 represents no association and ±1.0 indicates a perfect linear association. By convention, correlations above 0.50 are considered to be strong.[3]

SUMMARY

This report describes associations among subject-area results for the 10th-grade WASL in spring 2006.

With respect to performance in **reading and math**, the analysis finds that:

• Students who met standard in math almost always met standard in reading as well.

• Most students who did not meet standard in reading did not meet standard in math.

• However, meeting standard in reading did not guarantee that students would also meet standard in math, nor were below-standard math scores always associated with substandard performance in reading.

Thus, in most cases, meeting standard in reading is a necessary but insufficient condition for meeting standard in math.

With respect to performance in **reading and writing**, the analysis finds that:

• Most students who met standard in reading also met standard in writing, and vise versa.

• On average, more than half of students with below-standard reading scores did not meet standard in writing; similarly, nearly half of students with below-standard writing scores did not meet standard in reading.

The relationship between writing and math is similar to that between reading and math.

In sum, the analysis suggests that students must be able to read in order to meet standard in writing and math, but the ability to read does not guarantee success in other subjects. Moreover, students who meet standard in math usually meet standard in reading and writing as well.

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[1] SSB 6618, Chapter 352, Laws of 2006.

[2] Wade Cole and Robert Barnoski. (2006). *Tenth-Grade WASL in Spring 2006: Summary Results.* Olympia: Washington State Institute for Public Policy, Document No. 06-10-2201.

[3] Jacob Cohen. (1988). *Statistical Power Analysis for the Behavioral Sciences.* Hillsdale, NJ: Lawrence Erlbaum.

Each correlation between subject-area results surpasses 0.60. That is, students with high or low scores in one subject tend to have correspondingly high or low scores in other subjects. The strongest correlation is between reading and math scores.

The ensuing analyses explain how subject-area scores can be strongly correlated and yet more students met standard in reading and writing than in math.

RELATIONSHIP BETWEEN READING AND MATH SCORES

Exhibit 2 demonstrates that, although math and reading scores are strongly correlated—that is, the relationship is roughly linear—reading scores consistently exceed math scores. The solid line plots average math scores for each reading score. The dashed line serves as a reference: for points falling below this line, average math scores are lower than average reading scores.

For example, among students with a reading score of 400,[4] the average math score is 370. On average, math scores increase 7.6 points for every 10-point increase in reading scores. Put differently, student performance in math does not keep pace with performance in reading.[5] All points fall below the dashed line, indicating that average reading scores always exceed average math scores.

RELATIONSHIP BETWEEN READING AND WRITING SCORES

Exhibit 3 shows that student performance in writing keeps pace with performance in reading until reading scores reach 450, at which point the slope declines appreciably.[6] Nevertheless, on average, a 10-point increase in reading scores is associated with a 0.6-point increase in writing scores—a noteworthy relationship given that writing scores range from 0 to 24 points, while reading scores vary between 225 and 550 points.

The average writing score for students with a reading score of 400 is 17 points. Incidentally, students meet standard in reading when they achieve a score of 400 or higher, and in writing with a score of 17 or higher.[7]

Exhibit 2
Average Math Scores Given Reading Scores on the Spring 2006 WASL
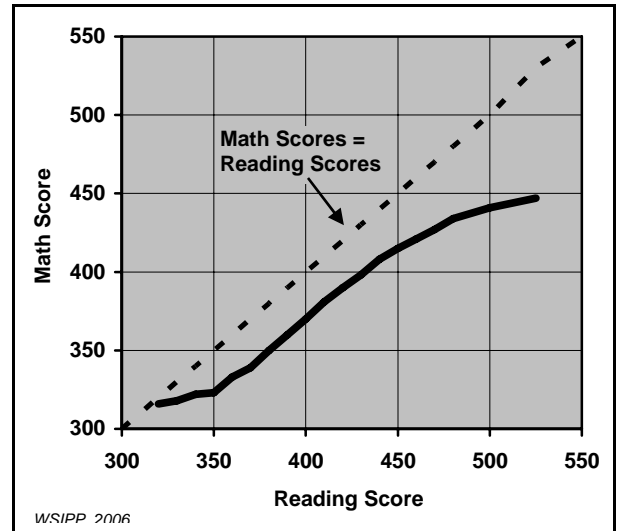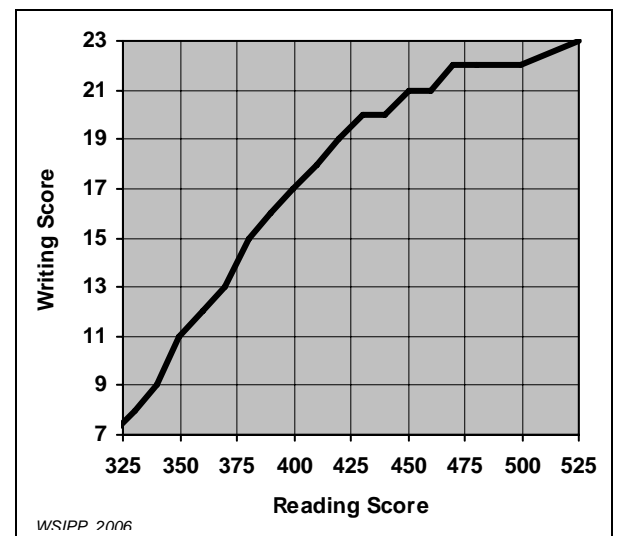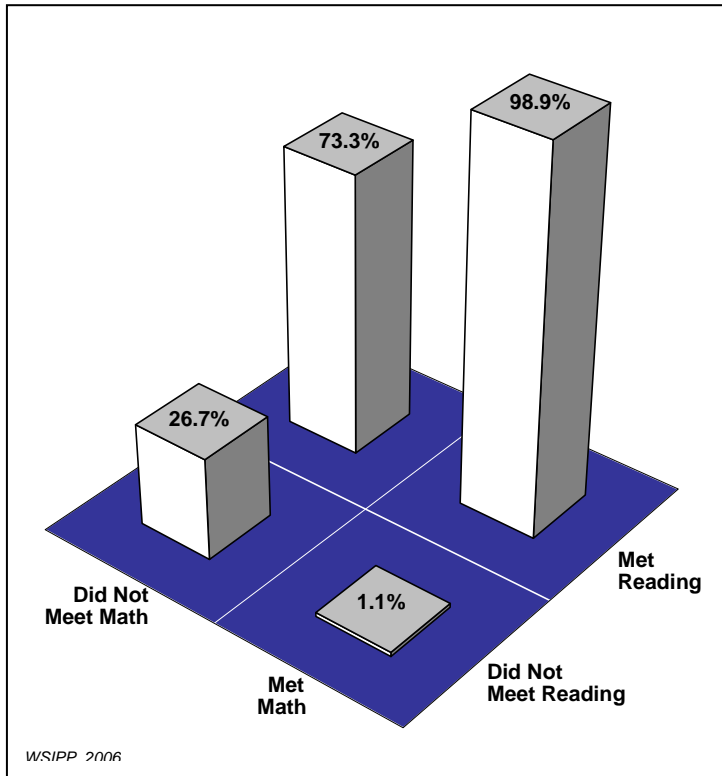

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Exhibit 3
Average Writing Scores Given Reading Scores on the Spring 2006 WASL

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A correlational analysis explains only part of the story—it shows the association between subject-area scores, but makes it difficult to compare students who met standard in one subject but not in others. Reading and math scores are correlated, for instance, even though a substantially higher percentage of students met standard in reading than in math.[8]

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[4] 400 is the "cut score" for meeting standard in reading and math.

[5] For students with a reading score of 400, the "middle half" of math scores—that is, scores that fall between the 25th and 75th percentiles—ranges between 353 and 385 points, a 32 point spread. This variation in math scores increases as reading scores increase.

[6] This may be partially attributable to a ceiling effect, as raw writing scores do not exceed 24.

[7] http://www.k12.wa.us/Assessment/TestAdministration/ pubdocs/PerformanceLevel_CutScores2006WASL.pdf

[8] For met standard rates, see: Wade Cole and Robert Barnoski. (2006). *Tenth-Grade WASL in Spring 2006: Summary Results.* Olympia: Washington State Institute for Public Policy, Document No. 06-10-2201.

Exhibit 4a
Percentage Meeting Standard in Reading Given Performance in Math on the Spring 2006 WASL

73.3%

98.9%

26.7%

Did Not
Meet Math

1.1%

Met
Reading

Met
Math

Did Not
Meet Reading

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Exhibit 4b
Percentage Meeting Standard in Math Given Performance in Reading on the Spring 2006 WASL

95.3%

63.1%

4.7%

36.9%

Did Not
Meet Reading

Met
Math

Met
Reading

Did Not
Meet Math

WSIPP 2006

Explaining the relationships between subject-area results in terms of meeting standard requires a different kind of analysis.

RELATIONSHIP BETWEEN MEETING STANDARD IN READING AND MATH

Exhibits 4a and 4b illustrate the relationship between meeting standard in reading and math:

- Students who met standard in math also almost always met standard in reading.

- Most students with below-standard reading scores also scored below standard in math.

- Students who met standard in reading did not necessarily meet standard in math.

- The majority of students with below-standard math scores nevertheless met standard in reading.

Exhibit 4a displays the percentage of students who met standard in reading given their performance in math:
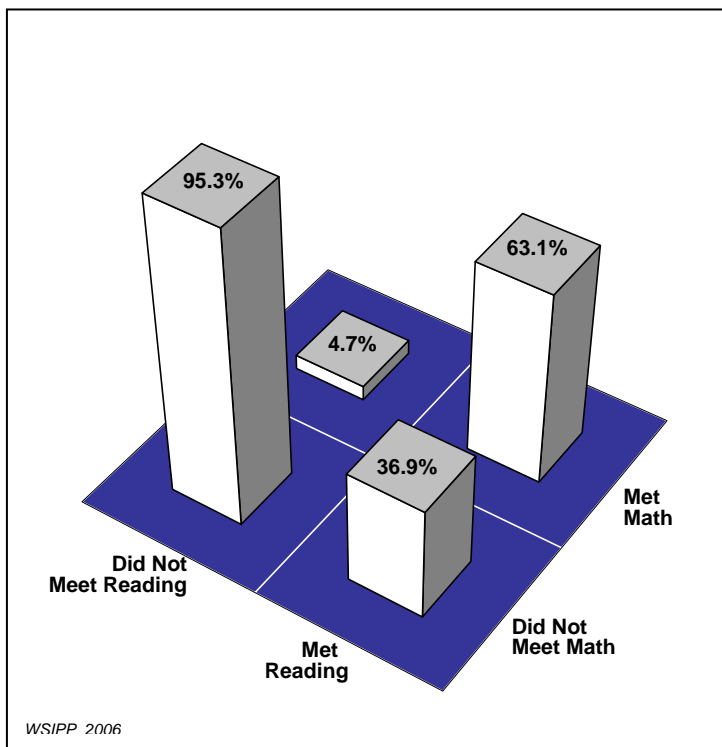
- 98.9 percent of students who met standard in math also met standard in reading.[9]

- 73.3 percent of students who did not meet standard in math met standard in reading. As such, 26.7 percent of students who did not meet standard in math also had below-standard reading scores.

Exhibit 4b charts the percentage of students who met standard in math given their performance in reading:

- 63.1 percent of students who met standard in reading also met standard in math. Put differently, 36.9 percent of students who met standard in reading did not meet standard in math.

- Conversely, 95.3 percent of students with below-standard reading scores did not meet standard in math.

The appendix to this report replicates this analysis by performance levels—Level 1 through Level 4.

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[9] Note that column totals ("Met Math" and "Did Not Meet Math") sum to 100 percent, such that a corresponding 1.1 percent of students who met standard in math did not meet standard in reading.

Percentage Meeting Standard in Reading Given Performance in Writing on the Spring 2006 WASL

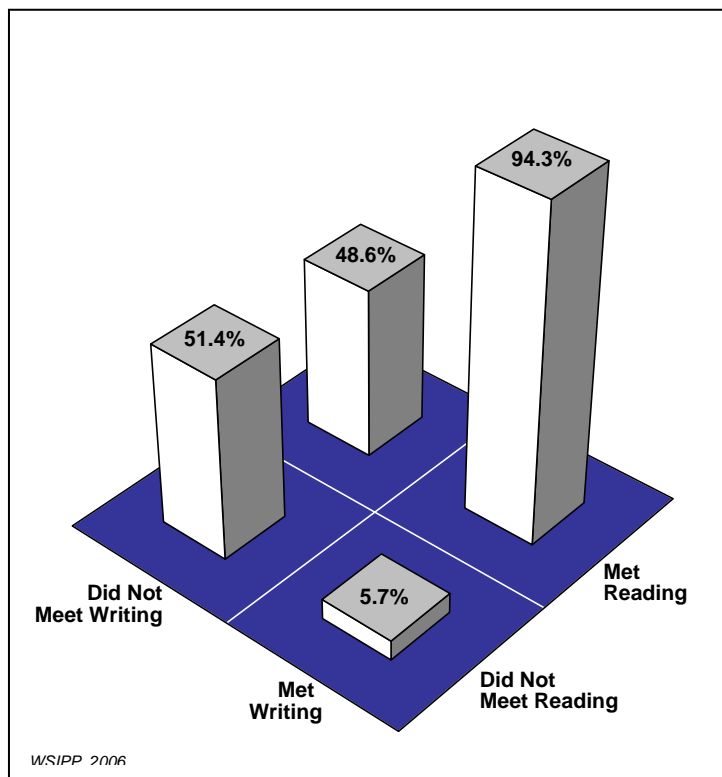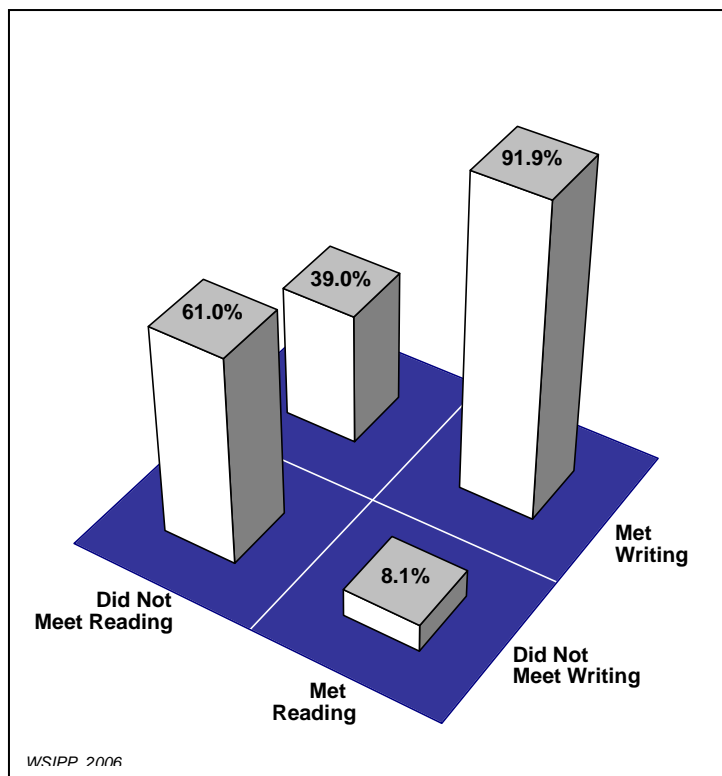## RELATIONSHIP BETWEEN MEETING STANDARD IN READING AND WRITING

Exhibits 5a and 5b depict the relationship between meeting standard in reading and writing:

- Most students who met standard in writing also met standard in reading.

- Similarly, most students who met standard in reading also met standard in writing.

- Approximately half of students who did not meet standard in writing performed below standard in reading.

- More than half of students who did not meet standard in reading also received below-standard scores in writing.

Exhibit 5a depicts the percentage of students who met standard in reading given their performance in writing:

- 94.3 percent of students who met standard in writing also met standard in reading. This means that only 5.7 percent of students who met standard in writing performed below standard in reading.

- Slightly less than half (48.6 percent) of students who did not meet standard in writing, met standard in reading. Correspondingly, just over half (51.4 percent) of the students who did not meet standard in writing also performed below standard in reading.

Exhibit 5b displays aggregate student performance in writing given performance in reading:

- 91.9 percent of students who met standard in reading also met standard in writing.

- 61 percent of the students who did not meet standard in reading also performed below standard in writing. Put another way, 39 percent of students met standard in writing despite below-standard performance in reading.

Exhibit 5b
Percentage Meeting Standard in Writing Given Performance in Reading on the Spring 2006 WASL

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SUMMARY OF FINDINGS

This report examines the associations among reading, writing, and math results from the 10th-grade WASL in spring 2006.

With respect to **reading and math**, we conclude that students who met standard in math were almost always competent readers as well, and that students who did not meet standard in reading almost always received below-standard scores in math.

The converse, however, is not true: proficiency in reading did not guarantee that students would also meet standard in math, nor were below-standard math scores necessarily associated with substandard performance in reading.

In most cases, the ability to read well is therefore a necessary but insufficient condition for meeting standard in math.

With respect to **reading and writing**, we conclude that proficient readers tended also to be competent writers, and vise versa. However, on average, more than half of students with below-standard reading scores did not meet standard in writing. Similarly, nearly half of students with below-standard writing scores did not meet standard in reading.

Although not displayed in this report, the relationship between writing and math was similar to that between reading and math.

Overall, the analysis suggests that students must be able to read in order to meet standard in writing and math, but that the ability to read does not guarantee success in other subjects. Conversely, students who perform well in math are also competent readers and writers.

APPENDIX

Exhibit A1
**Level of Achievement in Reading Given
Performance in Math on the Spring 2006 WASL**
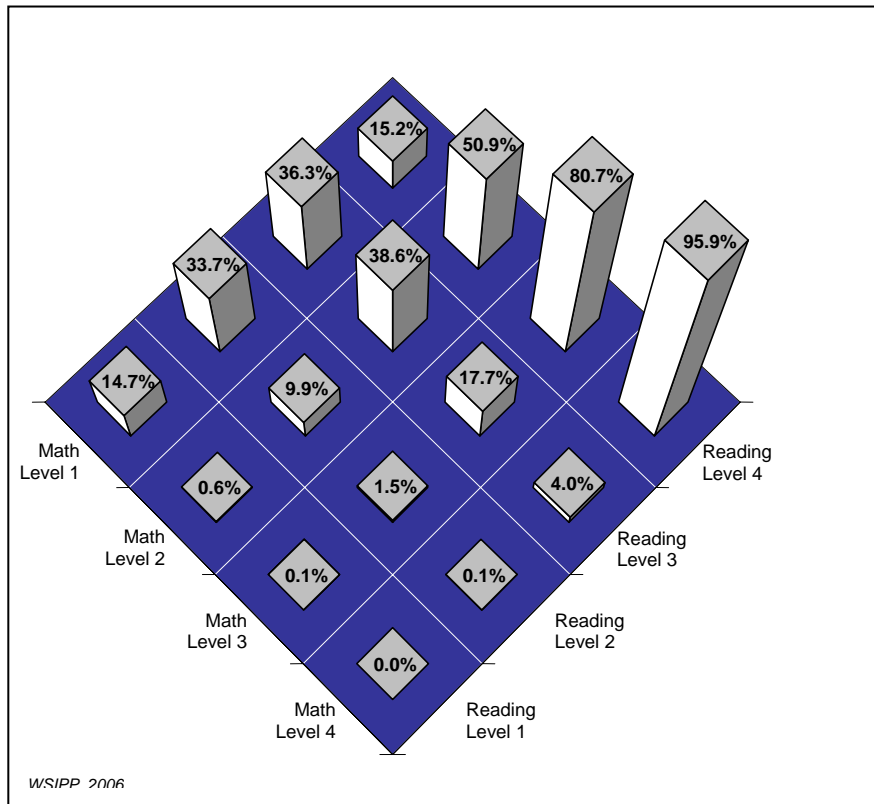
This appendix provides a more nuanced picture of the relationship between different subject areas of the WASL by disaggregating student performance into the following levels:

- Level 1 (Below Basic)

- Level 2 (Basic)

- Level 3 (Proficient)

- Level 4 (Advanced)

Students meet standard on the WASL when they receive Level 3 or Level 4 scores.

For example, Exhibit A1 displays the percentage of students who earned Level 1, 2, 3, or 4 scores in reading given their performance in math.

Among students who received a Level 1 score in math, performance in reading was as follows:

- 14.7 percent received Level 1 scores,

- 33.7 percent received Level 2 scores,

- 36.3 percent received Level 3 scores, and

- 15.2 percent received Level 4 scores.

Conversely, students who received Level 4 scores in math performed in reading as follows:

- 95.9 percent received Level 4 scores,

- 4.0 percent received Level 3 scores,

- 0.1 percent received Level 2 scores, and

- No one received Level 1 scores.

Thus, students who performed well in math also performed well in reading. However, students who performed poorly in math did not necessarily perform below standard in reading.

Exhibit A2
**Level of Achievement in Math Given
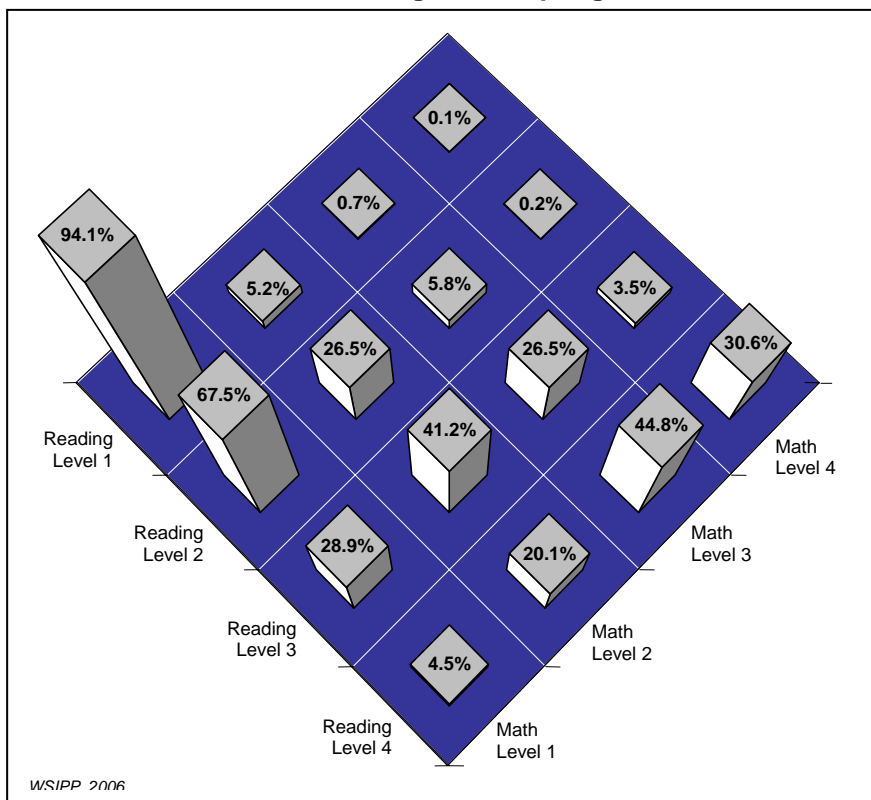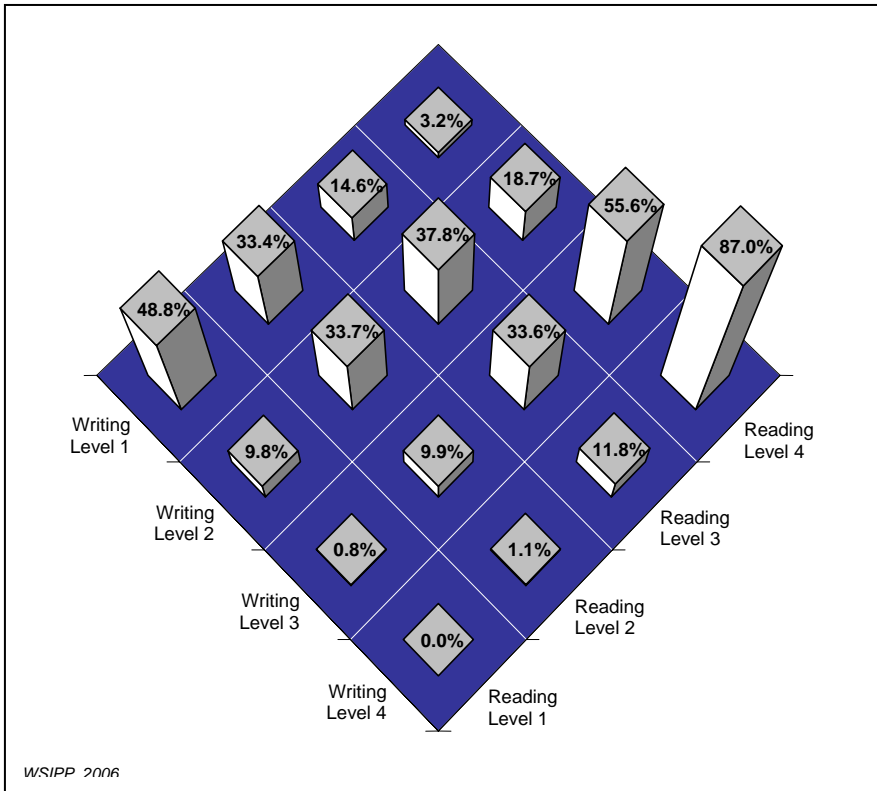Performance in Reading on the Spring 2006 WASL**

Exhibit A3
Level of Achievement in Reading Given
Performance in Writing on the Spring 2006 WASL

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Exhibit A4
Level of Achievement in Writing Given
Performance in Reading on the Spring 2006 WASL

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Exhibits A3 and A4 illustrate the relationship between reading and writing.

For instance, Exhibit A3 displays the percentage of students who earned Level 1, 2, 3, or 4 scores in reading given their performance in writing.
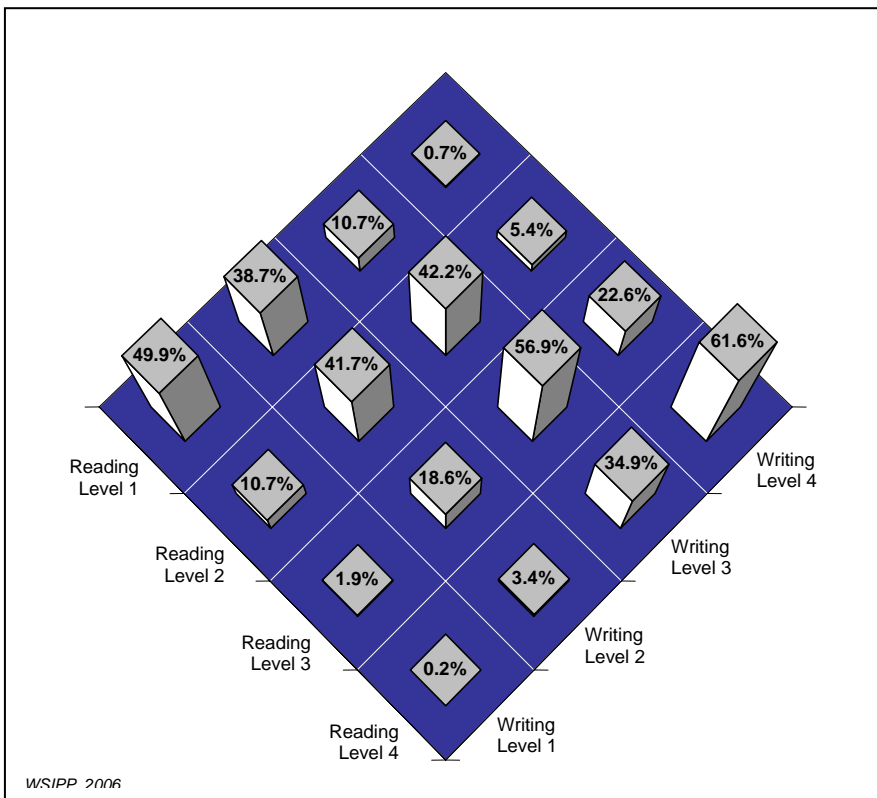
Among students who received a Level 1 score in writing, performance in reading was as follows:

- 48.8 percent received Level 1 scores,

- 33.4 percent received Level 2 scores,

- 14.6 percent received Level 3 scores, and

- 3.2 percent received Level 4 scores.

Conversely, students who received Level 4 scores in writing performed in reading as follows:

- 87.0 percent received Level 4 scores,

- 11.8 percent received Level 3 scores,

- 1.1 percent received Level 2 scores, and

- No one received Level 1 scores.

Students who performed well in reading also performed well in writing; similarly, students who performed well in writing also performed well in reading.

However, students with below-standard in reading did not necessarily perform below standard in writing, nor did students below-standard scores in writing necessarily perform below standard in reading.