Washington School Research Center

The Power of Early Success 1998-2004

A Follow-Up Study on the Determinants of Student Performance

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The Washington School Research Center (WSRC) is an independent research and data analysis center within Seattle Pacific University. The Center began in July 2000, funded through a gift from the Bill & Melinda Gates Foundation. Our mission is to conduct sound and objective research on student learning in the public schools, and to make the research findings available for educators, policy makers, and the general public for use in the improvement of schools. We believe that sound data and appropriate data analysis are vital components for the identification of school and classroom practices related to increased student academic achievement.

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A FOLLOW-UP STUDY ON THE DETERMINANTS OF STUDENT PERFORMANCE

INTRODUCTION

In April 2002, Jeffrey Fouts (2002) presented a longitudinal study of student performance in Washington using Washington Assessment of Student Learning (WASL) results from 1998 to 2001. Although constrained by the lack of individual student identification numbers at that time, he concluded that success on the WASL in the 4th grade was a strong predictor of achieving success in later grades. The opposite was also true; starting at the lowest levels of the WASL in the 4th grade strongly predicted less success in meeting the standards in later testing. According to Fouts, "A 4th grade Level 4 reading student was 28 times more likely to have met the reading standard three years later than was a 4th grade Level 1 reading student" (p. 20). Results were similar for math testing. These dramatic findings highlighted the need for assisting students early in their academic experience. However, according to Fouts the current education system did not "appear to be serving these students adequately" (p. 21).

In the current study, we linked 10th grade (2004) WASL scores to student performance in the 4th (1998) and 7th grades (2001). Fouts' study did not have linked information from the 10th grade, so he predicted future performance from past data to support his findings. At this writing, Washington has implemented an individual student identification number so that students' performance can be tracked over time more reliably. While this system will be important when analyzing future data, researchers must rely on older methods to track students across study years that do not include these numbers. In this study, we were able to identify student test scores from 4th to 10th grade; however, we were limited in this process by the lack of identification numbers from previous years.

This study is an attempt to replicate and extend Fouts' 2002 study using the most recent data. Whereas Fouts used data from 4th and 7th grades to predict 10th grade achievement, the current study follows student progress from 4th through 10th grades. The following questions encompass Fouts' questions, but extend the findings through the more recent data.

1. How did students who took the 2001 7th grade reading and math WASL perform three years later on the 2004 10th grade WASL?
2. How did students in different levels on the WASL in 1998 4th grade perform in 2001 7th and 2004 10th grades?

3. What percentage of students scoring at various levels on the 4th grade WASL in 1998 met the WASL standard in the 10th grade in 2004?
4. Are there student factors that are related to student performance over time?

We intended for these analyses to describe student performance over time and to provide insights into whether or not there have been changes in this performance since Fouts conducted his study. Many changes have occurred over the last few years both nationally and state-wide that may have bolstered or diminished student performance. While we cannot tie the findings of this study to any specific program or change, perhaps the results can provide insight that may be helpful to researchers and practitioners in their attempt to ensure student success.

DESIGN OF THE STUDY

We used student level databases from the Office of the Superintendent of Public Instruction (OSPI) for the data analyses presented in this report.[1] OSPI researchers transform raw test scores on the Washington Assessment of Student Learning (WASL) into scale scores and level scores, both of which were used in this study. Scale scores are interval in nature and can be used as a continuous variable. In contrast, level scores are ordinal in nature and can be used as categories of achievement. A standard-setting procedure was used by OSPI researchers to determine a criterion that represents passing or meeting the standard (see Taylor, 2000a; 2000b; 2000c). The following four categories were established to represent different levels of achievement:

- Level 1-Below Standard, scale scores below 375
- Level 2-Below Standard, scale scores 375 to 399
- Level 3-Meets Standard, scale scores 400 to 421
- Level 4-Exceeds Standard, scale scores 422 and above

Participants

The lack of a consistent student identification number from year to year makes conducting longitudinal research with these datasets difficult. Since students are assigned new identification numbers when they switch districts it is impossible to track students across districts. Thus, in the absence of a common student identification number for past years, studies that include every student who took the WASL in 1998, in 2001, and again in 2004 was not possible. In addition, the former system of assigning student identification numbers (district numbers) led to some students being given the same identification number as other students, which made it impossible to match students to their particular test scores. Therefore, cases were eliminated in this study for the following reasons: duplicate cases; identification number reported as zero; student identification number blank or missing; and scores not available for all three WASL administrations.

The final database consisted of 8,463 students who were matched by district numbers over three time periods (4^{th}, 7^{th}, and 10^{th} grade) on either their WASL reading scale score or WASL math scale score (8,304 students on WASL reading scale score and 8,463 students on WASL math scale score)[2]. The students in this final database represented 33 districts and 318 schools around the state.

[1] Specifically, we utilized data from the WASL from three time periods (1998, 2001, and 2004) and data from the Iowa Test of Educational Development (ITED – 9^{th} grade 2003).
[2] Separate databases were used when analyzing WASL level data. The numbers of subjects in these databases were the same as for the WASL scale score databases listed above.

In order to determine if the students included in the final database were similar to other students from around the state, we compared the two on different characteristics including, WASL scale scores, WASL levels, ethnicity and gender. As shown in Table 1, the WASL reading and math scale scores for students in this database were similar to the scores for students from around the state.

Table 1
WASL Reading and Math Mean Scale Score Comparison between State Average and Study Database

	State Average 1998 4th grade	Sample Average 1998 4th grade	State Average 2001 7th grade	Sample Average 2001 7th grade	State Average 2004 10th grade	Sample Average 2004 10th grade
WASL Reading	398	405	395	399	411	417
Std. Deviation	26.6	21.3	20.6	19.8	33.2	30.7
Sample Size	76,071	8,304	73,049	8,304	71,055	8,304
WASL Math	377	390	369	382	393	403
Std. Deviation	45.9	36.6	51.6	51.2	44.6	43.8
Sample Size	76,071	8,463	73,219	8,463	71,385	8,463

Despite the similarities between WASL scale scores in the study database and the state average, the WASL level scores for reading and math were somewhat different between the database and the state average. Table 2 shows fewer students in Level 1 reading compared to the state average, while there were more students in Level 4 reading. Table 3 shows the same pattern within the math level scores, such that there were fewer students in Level 1 math, and more students in Levels 3 and 4 math.

Table 2
WASL Reading Level Comparison between State Average and Database

WASL Reading	State Average 1998 4th grade (*n*=76,071)	Sample Average 1998 4th grade (*n*=8,304)	State Average 2001 7th grade (*n*=77,557)	Sample Average 2001 7th grade (*n*=8,304)	State Average 2004 10th grade (*n*=79,635)	Sample Average 2004 10th grade (*n*=8,304)
Unclassified	0.0%	0.0%	5.8%	0.0%	10.8%	0.0%
Level 1	11.3%	6.3%	15.1%	11.6%	11.5%	8.1%
Level 2	34.2%	30.4%	40.4%	38.9%	16.3%	15.7%
Level 3	39.2%	43.2%	22.3%	26.7%	13.2%	13.3%
Level 4	15.3%	20.0%	16.3%	22.9%	48.2%	62.9%

Table 3
WASL Math Level Comparison between State Average and Database

WASL Math	State Average 1998 4th grade (*n*=76,071)	Sample Average 1998 4th grade (*n*=8,463)	State Average 2001 7th grade (*n*=77,557)	Sample Average 2001 7th grade (*n*=8,463)	State Average 2004 10th grade (*n*=79,635)	Sample Average 2004 10th grade (*n*=8,463)
Unclassified	0.0%	0.0%	5.6%	0.0%	10.4%	0.0%
Level 1	40.3%	30.2%	51.6%	44.6%	29.4%	25.2%
Level 2	29.1%	30.5%	16.2%	18.5%	18.3%	18.5%
Level 3	19.8%	24.2%	13.9%	17.5%	21.0%	24.9%
Level 4	10.8%	15.1%	12.7%	19.4%	20.9%	31.4%

Finally, student ethnicity and gender comparisons between state averages and the study database averages are displayed in Table 4. The data in Table 4 indicate that Asian/Pacific Islanders and Black/African American students were overrepresented in the study database as compared to the state average, while Hispanic students were under represented. In addition, males and females were represented fairly equally between the database and the state average. These results mirror the findings in the research report completed by Fouts (2002).

Table 4
Ethnicity and Gender Comparison between State Average and Database

	State Average 1998 4th grade (*n*=76,071)	Sample Average 1998 4th grade (*n*=8,463)	State Average 2001 7th grade (*n*=77,557)	Sample Average 2001 7th grade (*n*=8,463)	State Average 2004 10th grade (*n*=79,635)	Sample Average 2004 10th grade (*n*=8,463)
Ethnicity						
Unknown	1.3%	1.6%	1.2%	0.1%	1.3%	0.0%
Am Ind/Al Nat	2.7%	1.4%	2.6%	1.4%	2.6%	1.4%
Asian/Pac Isl	6.9%	12.9%	7.4%	13.0%	8.1%	13.0%
Black/Afr Am	4.9%	6.9%	5.1%	7.1%	5.1%	7.0%
Hispanic	8.8%	4.6%	9.1%	4.5%	9.5%	4.7%
White	74.3%	72.4%	73.3%	73.2%	73.0%	73.5%
Multi-racial	1.1%	0.3%	1.3%	0.7%	0.6%	0.5%
Gender						
Unknown	0.4%	0.0%	0.2%	0.0%	1.0%	0.0%
Female	48.3%	49.6%	48.4%	49.4%	47.8%	49.6%
Male	51.2%	50.4%	51.5%	50.5%	51.2%	50.4%

RESULTS

Consistent with findings presented by Fouts (2002), the results of the current study indicated a significant correlation between WASL reading scale scores in 4th and 7th grade (r = .68). Similarly, the WASL math scale scores in 4th and 7th grade were correlated (r = .67). As expected, student performance on the 7th grade WASL was strongly related to their performance three years later on the 10th grade WASL. Both the reading and math scale scores in 7th and 10th grade correlated strongly (r = .70 and r = .83, respectively). These findings indicate that future academic success is related to past academic achievement. Therefore, student scores on the WASL can help predict how students will perform on future tests of academic achievement.

How did students who took the 2001 7th grade reading and math WASL perform three years later on the 2004 10th grade WASL?

Figures 1 and 2 display the results of crosstabulations for each category (Levels 1-4) of students on the 2001 7th grade WASL reading and math, with their level of performance on the 2004 10th grade WASL reading and math. This follows Fouts' (2002) procedure with the exception that the current study focused on 7th to 10th grade, while Fouts' study examined 4th to 7th grade. Reading level and math level are depicted in the first column of the figures. These levels are based on students' 2001 WASL results. The second column shows student level on the 2004 WASL. The final column shows the percentage of students from 2001 that met the reading or math standard (Level 3 or Level 4) in 2004. The results presented in Figures 1 and 2 were very similar to results presented by Fouts (2002).

The first section of Figure 1 follows the progression of Level 1 reading students from 2001 to 2004. Examination of the percentages in the second column indicate that 45.0% of students who fell within Level 1 reading in 2001 (7th grade) remained at Level 1 in 2004 (10th grade); 36.7% of students who fell within Level 1 reading in 2001 moved up to Level 2 reading in 2004; 11.0% moved up to Level 3 reading in 2004; and 7.3% moved up to Level 4 reading by 2004. In total, of the Level 1 reading students in 2001, only 18.3% were able to meet the standard three years later in 2004.

By comparison, students who fell within Levels 3 and 4 reading in 2001 were much more likely to meet the standard reading level by 2004. Almost all of the 7th grade Level 3 and 4 students (93.6% and 98.6%, respectively) met the standard in 10th grade, however a small percentage dropped below 'met standard' levels.

The results for mathematics shown in Figure 2 mirror the reading results. Of the students who were in Level 1 math in 7th grade, only 18.5% were able to make the standard by 10th grade. The percentage of students who met the standard by 10th grade increased throughout the rest of the levels, 69.4%, 91.7%, and 98.5% (Level 2, 3, and 4, respectively).

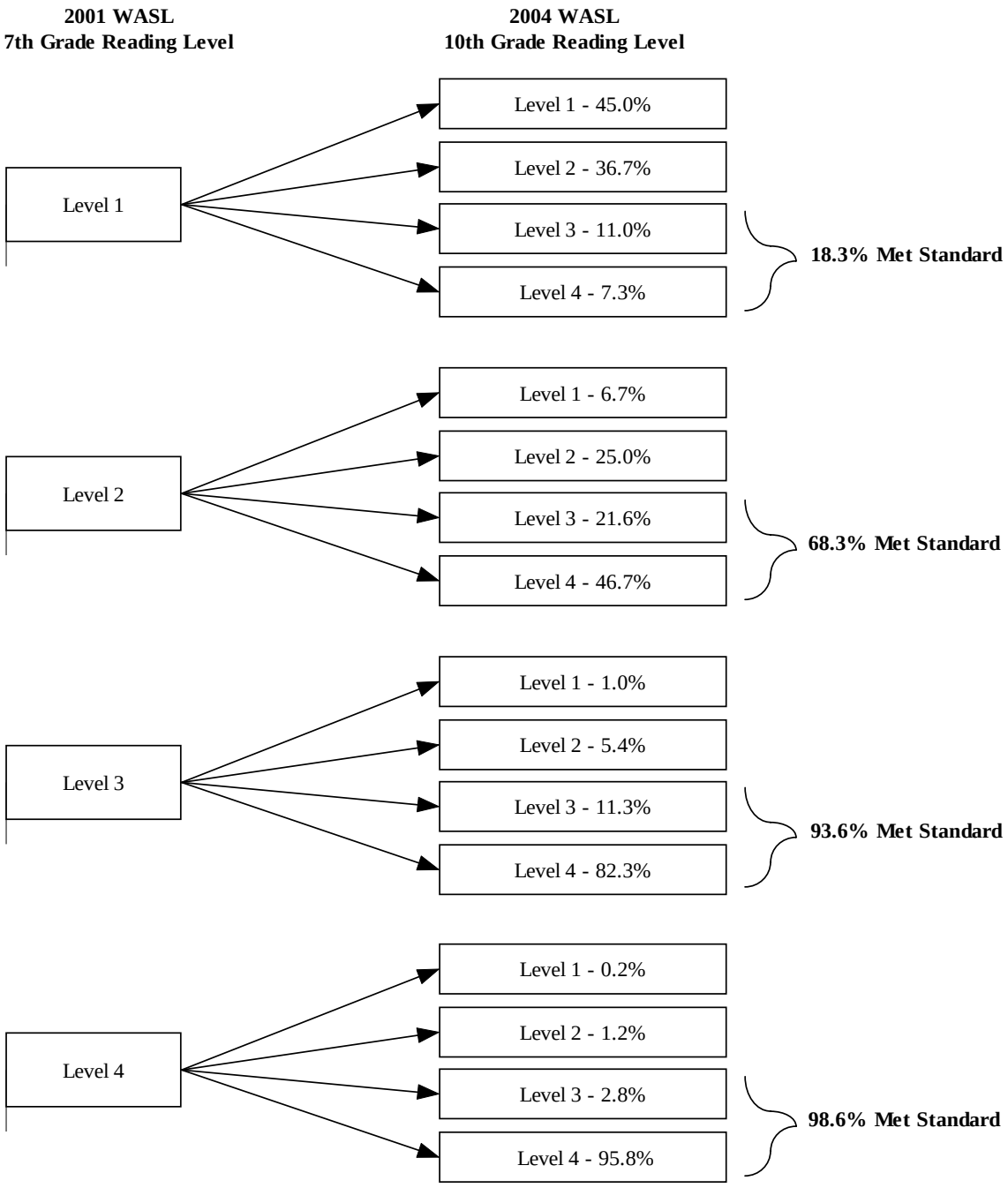

***Figure 1*. Distribution of 7th Grade Students on the 10th Grade WASL Reading**

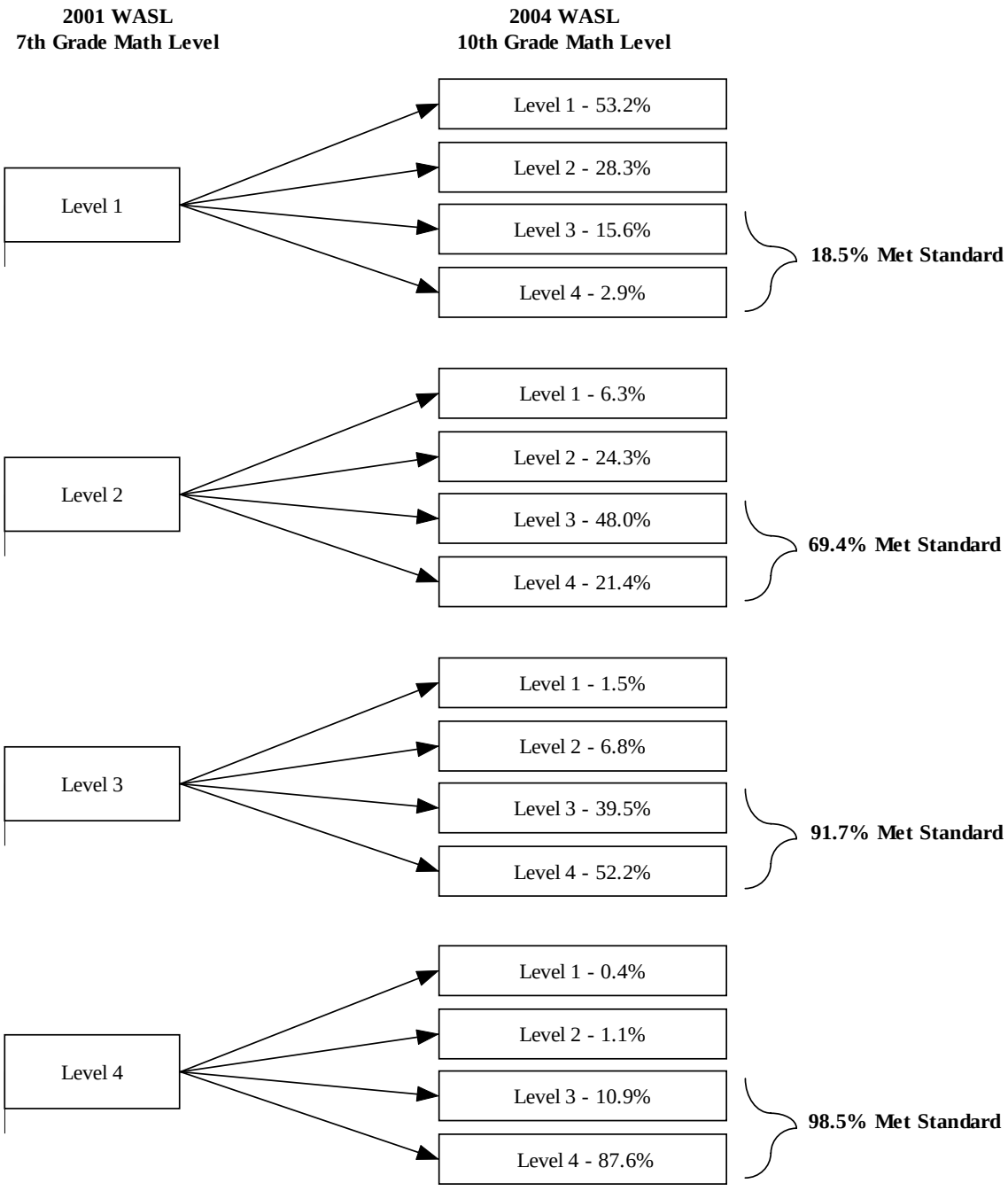

***Figure 2*. Distribution of 7th Grade Students on the 10th Grade WASL Math**

How did students in different levels on the WASL in 1998 4th grade perform in 2001 7th and 2004 10th grades?

Having student level data matched over 3 time periods (4th, 7th, and 10th grade) allowed us to investigate what percentage of students were able to improve their performance on the WASL. Trends and patterns of performance could also be examined

by tracking each student's progress from 4th to 10th grade, irrespective of their performance in 7th grade.

In order to investigate student progress over time, we computed crosstabulations for each category (Levels 1-4) of students on the 1998 4th grade WASL reading and math with their levels of performance on the 2001 7th grade WASL reading and math. These crosstabulations were repeated for each category of students on the 2001 7th grade WASL with their performance on the 2004 10th grade WASL. The results from those analyses are displayed in Tables 5 and 6. Each table displays the 2001 7th and 2004 10th grade results for each of the 1998 4th grade reading or math levels. The first column of Table 5 displays each student's 1998 4th grade reading level. The second column shows the distribution of students in each level in 2001 7th grade. The third column shows the percentage of students on the 10th grade WASL for each level of the 2001 7th grade WASL.

The first panel of Table 5 shows that 62.4% of students who fell in reading Level 1 in 4th grade continued to be in reading Level 1 in 7th grade. As can be seen in the 10th grade reading level column, 67.8% of the Level 1 students in 2001 (7th grade) remained at Level 1 in 2004 (10th grade); 25.2% of the Level 1 students in 2001 moved up to Level 2 in 2004; 4.3% of the Level 1 students had moved up to Level 3 in 2004; and 2.7% of the Level 1 students had moved up to Level 4 in 2001. The last panel of Table 5 shows that the majority of students who initially achieved Level 4 reading in 4th grade tended to stay at that Level in both 7th and 10th grades.

The results for mathematics shown in Table 6 are very similar to the reading results. Of the Level 1 math students in 4th grade, 86.3% continued to be Level 1 in 7th grade and 65.1% of those students continued to be Level 1 in 10th grade.

A couple of trends were noticeable in Tables 5 and 6. First, a vast majority of students passed the 10th grade WASL reading test that initially did not pass in 4th or 7th grades (77.2%). However, almost one third (30.7%) of 7th grade students did not pass the WASL reading test that initially passed in the 4th grade. As stated earlier, many of these students went on to pass in the 10th grade, but this does represent a 7th grade "dip" for some students in achievement results over six years. Fouts offered some potential explanations for these dynamics.

Table 5

Students Progress from 4th to 7th to 10th Grade – WASL Reading Levels

4th Grade Reading Level	7th Grade Reading Level	10th Grade Reading Level
Level 1 (*n* = 527)	Level 1 – 62.4% (329)	Level 1 – 67.8% (223)
		Level 2 – 25.2% (83)
		Level 3 – 4.3% (14)
		Level 4 – 2.7% (9)
	Level 2 – 28.5% (150)	Level 1 – 22.7% (34)
		Level 2 – 38.0% (57)
		Level 3 – 21.3% (32)
		Level 4 – 18.0% (27)
	Level 3 – 4.6% (24)	Level 1 – 4.2% (1)
		Level 2 – 8.3% (2)
		Level 3 – 8.3% (2)
		Level 4 – 79.2% (19)
	Level 4 – 4.6% (24)	Level 1 – 0.0% (0)
		Level 2 – 8.3% (2)
		Level 3 – 0.0% (0)
		Level 4 – 91.7% (22)
Level 2 (*n* = 2,527)	Level 1 – 21.8% (552)	Level 1 – 35.3% (195)
		Level 2 – 43.5% (240)
		Level 3 – 13.0% (72)
		Level 4 – 8.2% (45)
	Level 2 – 61.2% (1,547)	Level 1 – 8.0% (123)
		Level 2 – 31.4% (485)
		Level 3 – 22.4% (347)
		Level 4 – 38.3% (592)
	Level 3 – 14.0% (354)	Level 1 – 1.7% (6)
		Level 2 – 9.3% (33)
		Level 3 – 21.2% (75)
		Level 4 – 67.8% (240)
	Level 4 – 2.9% (74)	Level 1 – 0.0% (0)
		Level 2 – 4.1% (3)
		Level 3 – 13.5% (10)
		Level 4 – 82.4% (61)
Level 3 (*n* = 3,589)	Level 1 – 2.1% (74)	Level 1 – 16.2% (12)
		Level 2 – 37.8% (28)
		Level 3 – 25.7% (19)
		Level 4 – 20.3% (15)
	Level 2 – 38.1% (1,366)	Level 1 – 4.2% (57)
		Level 2 – 18.4% (251)
		Level 3 – 21.3% (291)
		Level 4 – 56.1% (767)
	Level 3 – 37.5% (1,347)	Level 1 – 1.1% (15)
		Level 2 – 5.4% (73)
		Level 3 – 10.5% (142)
		Level 4 – 82.9% (1,117)
	Level 4 – 22.3% (802)	Level 1 – 0.1% (1)
		Level 2 – 1.0% (8)
		Level 3 – 3.9% (31)
		Level 4 – 95.0% (762)

Table 5, continued

Level 4 (n = 1,661)	Level 1 – 0.3% (5)	Level 1 – 40.0% (2)
		Level 2 – 20.0% (1)
		Level 3 – 20.0% (1)
		Level 4 – 20.0% (1)
	Level 2 – 10.0% (166)	Level 1 – 1.2% (2)
		Level 2 – 8.4% (14)
		Level 3 – 16.3% (27)
		Level 4 – 74.1% (123)
	Level 3 – 29.6% (492)	Level 1 – 0.2% (1)
		Level 2 – 2.2% (11)
		Level 3 – 6.5% (32)
		Level 4 – 91.1% (448)
	Level 4 – 60.1% (998)	Level 1 – 0.3% (3)
		Level 2 – 0.9% (9)
		Level 3 – 1.3% (13)
		Level 4 – 97.5% (973)

Table 6
Students Progress from 4th to 7th to 10th Grade – WASL Math Levels

4th Grade Math Level	7th Grade Math Level	10th Grade Math Level
Level 1 (n = 2,257)	Level 1 – 86.3% (2,207)	Level 1 – 65.1% (1,437)
		Level 2 – 23.7% (524)
		Level 3 – 9.6% (212)
		Level 4 – 1.5% (34)
	Level 2 – 9.3% (239)	Level 1 – 13.8% (33)
		Level 2 – 31.0% (74)
		Level 3 – 43.9% (105)
		Level 4 – 11.3% (27)
	Level 3 – 3.2% (82)	Level 1 – 3.7% (3)
		Level 2 – 11.0% (9)
		Level 3 – 52.4% (43)
		Level 4 – 32.9% (27)
	Level 4 – 1.1% (29)	Level 1 – 3.4% (1)
		Level 2 – 3.4% (1)
		Level 3 – 10.3% (3)
		Level 4 – 82.8% (24)
Level 2 (n = 2,578)	Level 1 – 46.2% (1,190)	Level 1 – 39.9% (475)
		Level 2 – 35.4% (421)
		Level 3 – 21.3% (253)
		Level 4 – 3.4% (41)
	Level 2 – 28.9% (744)	Level 1 – 5.5% (41)
		Level 2 – 28.1% (209)
		Level 3 – 47.4% (353)
		Level 4 – 19.0% (141)
	Level 3 – 18.7% (482)	Level 1 – 1.7% (8)
		Level 2 – 12.7% (61)
		Level 3 – 41.7% (201)
		Level 4 – 44.0% (212)
	Level 4 – 6.3% (162)	Level 1 – 1.2% (2)
		Level 2 – 3.7% (6)
		Level 3 – 19.8% (32)
		Level 4 – 75.3% (122)

Table 6, continued

Level 3 (n = 2,050)	Level 1 – 16.1% (330)	Level 1 – 26.1% (86)
		Level 2 – 33.9% (112)
		Level 3 – 32.1% (106)
		Level 4 – 7.9% (26)
	Level 2 – 23.8% (487)	Level 1 – 4.7% (23)
		Level 2 – 17.2% (84)
		Level 3 – 48.7% (237)
		Level 4 – 29.4% (143)
	Level 3 – 32.4% (665)	Level 1 – 1.2% (8)
		Level 2 – 3.9% (26)
		Level 3 – 40.3% (268)
		Level 4 – 54.6% (363)
	Level 4 – 27.7% (568)	Level 1 – 0.0% (0)
		Level 2 – 1.4% (8)
		Level 3 – 15.5% (88)
		Level 4 – 83.1% (472)
Level 4 (n = 1,278)	Level 1 – 3.6% (46)	Level 1 – 21.7% (10)
		Level 2 – 21.7% (10)
		Level 3 – 39.1% (18)
		Level 4 – 17.4% (8)
	Level 2 – 7.2% (92)	Level 1 – 2.2% (2)
		Level 2 – 14.1% (13)
		Level 3 – 58.7% (54)
		Level 4 – 25.0% (23)
	Level 3 – 19.9% (254)	Level 1 – 1.2% (3)
		Level 2 – 2.0% (5)
		Level 3 – 29.1% (74)
		Level 4 – 67.7% (172)
	Level 4 – 69.3% (886)	Level 1 – 0.3% (3)
		Level 2 – 0.3% (3)
		Level 3 – 6.4% (57)
		Level 4 – 92.9% (823)

What percentage of students scoring at various levels on the 4th grade WASL in 1998 met the WASL standard in the 10th grade in 2004?

We created Tables 7 and 8 in order to determine whether there were patterns within these data. These tables display the percentage of 4th grade students passing reading and math in the 7th and 10th grades. The first column in Table 7 shows the 4th grade reading level and the second column indicates the percentage of 4th grade students passing in 7th grade within each 4th grade level. The third column represents the percentage of 4th grade students passing in 10th grade, irrespective of their performance in 7th grade. As shown in Table 7, the percentage of students passing in the 10th grade was higher than the percentage of students passing in the 7th grade for each 4th grade level, indicating improvement in achievement over time. Unfortunately, the majority of 4th grade Level 1 students were still not passing in the 10th grade for reading or math, while the majority of students in Levels 2, 3 and 4 in 4th grade were able to reach or maintain passing status by 10th grade.

The data in Tables 7 and 8 confirm predictions made by Fouts (2002) of percentages of students passing standards in the 10th grade based on their level of achievement in 4th grade. Table 7 indicates that a student in 4th grade reading Level 2 has a 2.41 times greater chance of passing by 10th grade than a student in 4th grade reading Level 1. Similarly, a student in 4th grade reading Level 3 or 4 has a greater chance of passing in the 10th grade than a student in 4th grade reading Level 1 (3.70 times greater chance and 4.11 times greater chance, respectively). Results for 4th grade math level predicting 10th grade passing paralleled the reading level results.

Table 7
Percentage of 4th Grade Students Passing in the 7th and 10th Grades - Reading

4th Grade Reading Level	Percentage of 4th Graders Passing in 7th Grade	Percentage of 4th Graders Passing in 10th Grade
Level 1 (527)	9.2% (48)	23.7% (125)
Level 2 (2,527)	16.9% (428)	57.0% (1,442)
Level 3 (3,589)	59.8% (2,149)	87.6% (3,144)
Level 4 (1,661)	89.7% (1,490)	97.4% (1,618)

Table 8
Percentage of 4th Grade Students Passing in the 7th and 10th Grades - Math

4th Grade Math Level	Percentage of 4th Graders Passing in 7th Grade	Percentage of 4th Graders Passing in 10th Grade
Level 1 (2,257)	4.3% (111)	18.6% (475)
Level 2 (2,578)	25.0% (644)	52.5% (1,355)
Level 3 (2,050)	60.1% (1,233)	83.1% (1,703)
Level 4 (1,278)	89.2% (1,140)	96.2% (1,229)

Are there student factors that are related to student performance over time?

Student Ethnicity

In order to determine if there were other factors besides previous level of achievement that may have contributed to a student's performance over time, the study database was disaggregated by ethnicity. Table 9 displays the percentage of students in each ethnic category who were in Level 1 reading or math in 1998 4th grade that continued to be at Level 1 reading or math in 2004 10th grade, irrespective of their level of achievement in 2001 7th grade. As shown in the first panel of Table 9, the likelihood of a student moving out of Level 1 reading in 2004 10th grade was the greatest for Asian/Pacific Islander students and the least for Black/African American students. In contrast, the second panel of Table 9 shows that the likelihood of a student moving out of Level 1 math in 2004 10th grade was the greatest for Asian/Pacific Islander and White students, and the least for Hispanic and Black/African American students. These dynamics were similar in the other 4th grade levels for both reading and math, with ethnicity becoming much less prominent in Level 4.

These results correspond to those reported by Fouts (2002). For the most part, starting in Level 1 in the 4th grade is a powerful factor in determining where a student ends up in the 10th grade, especially for students in some ethnic categories. However, the influence of ethnicity appears to diminish across the levels of achievement by the time the students reach 10th grade. Therefore, the best predictor of a student's achievement in the 10th grade is their past level of achievement. The results of this disaggregation must be interpreted cautiously due to the small sample size within each group. For this reason, we did not show results for American Indian/Alaskan Native students.

Table 9
Level 1 Students in 4th Grade Compared to Level 1 Students in 10th Grade

4th Grade Reading to 10th Grade Reading Percentage of students at Level 1 Reading in the 4th Grade who are at Level 1 Reading in the 10th Grade based on student ethnicity.		**4th Grade Math to 10th Grade Math** Percentage of students at Level 1 Math in the 4th Grade who are at Level 1 Math in the 10th Grade based on student ethnicity.	
Asian/Pac. Islander	38.0% (30)	Asian/Pac. Islander	55.9% (209)
White	49.0% (151)	White	53.4% (875)
Hispanic	44.9% (22)	Hispanic	66.5% (109)
Black/African American	63.5% (47)	Black/African American	75.6% (232)

ITED Variables

ITED assessments completed by students in the 9th grade provided information on additional factors that may have an impact on achievement. In order to investigate these other factors, the 8,463 students in the WASL study database were matched with their 9th grade ITED information. This database included achievement data from all three administrations of the WASL (4th, 7th, and 10th grades) and answers to the following questions from the ITED:

- Do you have a computer in your home?
- Do you feel safe at school?
- On average, how much time do you spend on homework each week?
- During the school week, how many hours a day do you usually watch TV?
- How far in school did your mother (or female guardian) go?
- How far in school did your father (or male guardian) go?
- During the past 12 months, in how many activities run by your school or community have you participated?
- As things stand now, how far in school do you plan to go?

We calculated crosstabulations for student responses to the 9th grade ITED questions based on their reading achievement level in the 10th grade. As shown in Table 10, student success on the 10th grade WASL was related to some of the variables reported on the ITED in 9th grade. Although the majority of students reported having a computer at home, the percentage of students with computers in the home increased from Level 1 to Level 4. More students in Level 4 also reported feeling safe at school most of the time or always compared to students in Level 1 (85% vs. 57%). While almost a quarter (24%) of all students in Level 4 reported doing seven or more hours of homework per week,

only 5% of students in Level 1 reported doing seven or more hours of homework per week. Twice as many students in Level 1 reported watching four or more hours of television a day compared to students in Level 4 (26% vs. 11%). In comparison to the parents of Level 1 students, parents of Level 4 students were almost four times as likely to have graduated from college. (This result has to be interpreted somewhat cautiously due to the majority of students across Levels that either did not respond to the question or were unsure of their parents' education level).

The majority (51%) of students in Level 1 reported engaging in one or less extra curricular activity in the past year, compared to 33% of students in Level 4. In fact, 26% of students in Level 4 were participating in four or more activities compared to 12% of students in Level 1. Finally, three times as many students in Level 4 reported wanting to either graduate college or attend graduate school compared to students in Level 1 (76% vs. 25%). This result has to be qualified by the high percentage of students in Level 1 who did not respond to the question or were missing data (61%). In fact, student response to this question increased from Level 1 to Level 4.

Table 10
9th Grade ITED Variables by 10th Grade WASL Reading Level

Computer at Home

	Yes	No	Missing or No Response
Level 1	74.5%	13.5%	12.0%
Level 2	87.2%	6.8%	6.1%
Level 3	90.6%	5.4%	4.0%
Level 4	94.8%	1.8%	3.3%

Feel Safe at School

	Always	Most of the Time	Some of the Time	Never	Missing or No Response
Level 1	22.8%	33.9%	20.8%	9.8%	12.7%
Level 2	25.4%	43.5%	17.5%	6.8%	6.8%
Level 3	26.0%	52.3%	13.0%	4.1%	4.5%
Level 4	34.7%	50.2%	8.9%	2.7%	3.5%

Hours Per Week Doing Homework

	1 hr. or less	2-3 hrs.	4-6 hrs.	7 or more hrs.	Missing or No Response
Level 1	42.2%	23.7%	10.5%	4.7%	18.8%
Level 2	32.4%	32.2%	17.0%	7.5%	11.0%
Level 3	24.5%	33.2%	21.4%	12.4%	8.5%
Level 4	15.1%	27.6%	27.2%	23.9%	6.2%

Hours of TV Watched Per Day

	1 hr. or less	2 hrs.	3 hrs.	4 or more hrs.	Missing or No Response
Level 1	21.2%	19.1%	15.3%	25.6%	18.8%
Level 2	24.9%	23.6%	19.5%	21.4%	10.6%
Level 3	30.0%	24.2%	18.0%	19.4%	8.4%
Level 4	43.0%	24.0%	15.7%	11.0%	6.2%

Table 10, continued

Mother's Educational Level*

	No H.S.	College Grad	Adv. College	Not Sure	Missing or No Response
Level 1	10.5%	6.5%	3.5%	21.2%	58.4%
Level 2	9.9%	8.1%	4.3%	19.5%	58.1%
Level 3	7.7%	9.7%	7.1%	18.0%	57.5%
Level 4	4.3%	20.4%	12.6%	13.2%	49.5%

Father's Educational Level*

	No H.S.	College Grad	Adv. College	Not Sure	Missing or No Response
Level 1	13.2%	5.0%	4.0%	25.5%	52.2%
Level 2	9.8%	7.1%	5.6%	25.5%	52.0%
Level 3	8.1%	10.0%	8.7%	22.2%	51.0%
Level 4	3.8%	20.1%	17.6%	16.1%	42.4%

Number of School Extra Curricular Activities

	0 Activities	1 Activity	2 Activities	3 Activities	4 or More Activities	Missing or No Response
Level 1	33.5%	17.1%	14.8%	10.7%	11.6%	12.3%
Level 2	28.7%	22.4%	20.2%	7.9%	14.4%	6.5%
Level 3	24.9%	22.1%	20.8%	12.3%	15.5%	4.4%
Level 4	15.6%	17.2%	21.3%	16.4%	26.0%	3.5%

Future Plans for School*

	Not Finish High School	Graduate High School	Graduate College	Attend Graduate School	Missing or No Response
Level 1	3.5%	10.6%	19.0%	6.2%	60.7%
Level 2	1.1%	6.5%	30.1%	11.0%	51.3%
Level 3	0.7%	3.8%	38.6%	17.4%	39.6%
Level 4	0.4%	1.1%	43.8%	31.8%	22.8%

*Note: Total percents by reading level are less than 100% because of other possible responses. These responses were used in order to replicate the study by Fouts in 2003.

We performed hierarchical regressions on 10th grade reading and math scores using several of the variables included in the 9th grade ITED dataset[3]. The variables used in the regressions included mothers' education, number of school activities the student participates in, amount of time per week doing homework, amount of time per day watching TV, and all possible 2nd, 3rd, and 4th order interactions between variables. Tables 11 and 12 show the results of the regression analyses for reading and math achievement, respectively. All non-significant variables were eliminated from the final regression equations. We used squared semi-partial correlations to describe the unique contribution of each variable to the prediction of achievement.

Taken together, mothers' education, amount of time per week doing homework, and the three interaction terms displayed in Table 11 predicted about 16% of the variance in 10th grade reading achievement. Although, the overall R^2 for this regression was

[3] Some cases were dropped from the analysis in order to meet the distribution requirements of multiple linear regression.

statistically significant, the amount of variance explained by these variables was not large. Interestingly, the amount of time per week doing homework in the 9th grade was the single largest unique predictor of reading achievement in 10th grade, predicting 3% of variance. In fact, amount of time per week doing homework was three times more influential in the prediction of reading achievement than mothers' education (squared semi-partial correlations = 0.03 vs. 0.01).

The findings for math achievement were similar to those for reading achievement. Table 12 indicates that taken together, mothers' education, amount of time per week doing homework, and the two interaction terms displayed in Table 12 predicted about 23% of the variance in 10th grade math achievement. Again, the amount of time per week doing homework made the largest unique contribution to the prediction of math achievement, predicting 7% of the variance. Amount of time per week doing homework was seven times more influential in the prediction of math achievement than mothers' education (squared semi-partial correlations = 0.07 vs. 0.01). Additionally, these results indicate that wealthier students (as evidenced by mothers' education) who were engaged in more activities in their school and the community, and who watched less television had better achievement scores for math. However, this interaction term predicted a small percentage of the overall variance in math achievement.

These regression results generally confirmed the earlier analyses using achievement levels. However, more detailed analyses revealed some insights that may be helpful for understanding the relationship among achievement, background, and student behaviors. Perhaps the most practically significant finding from the regressions was that the amount of homework a student does per week has a more significant impact on a student's level of achievement than their socioeconomic background.

Fouts (2002) noted that ethnicity influenced student responses to questions on the ITED. In the current study, responses to ITED questions differed depending on a student's ethnicity. For example, Black/African American and Hispanic students were less likely to report having a computer in the home compared to White students (80%, 81%, and 93%, respectively). Black/African American and Hispanic students were also less likely to have had a parent graduate from college than White students (17%, 15%, and 28% of mothers graduate from college, and 17%, 17%, and 32% of fathers graduate from college, respectively). These findings replicate the previous study completed by Fouts. As Fouts pointed out, while ethnicity is important to consider when evaluating factors related to student achievement, it cannot solely explain group differences. In fact, family income may have a stronger impact than ethnicity on student achievement. Joireman and Abbott (2004) findings revealed some support for low income mediating the relationship between ethnicity and math achievement (the results of the overall model were less clear for reading achievement). However, this study also found that ethnicity continued to make a significant and unique impact on reading achievement over and above the effects of low income.

Table 11
Regression Predicting 10th Grade Reading Achievement from 9th Grade ITED Variables

Predictors for Reading	*B*	Std. Error	Beta	Correlations: Zero-Order	Correlations: SemiPartial^2
Mother's Education	4.00	0.50	0.15**	0.26	0.008
Amount HW/Week	4.69	0.33	0.27**	0.33	0.027
Mom Ed * # of Act	0.95	0.18	0.18**	0.28	0.004
# of Act * HW/Week	0.46	0.15	0.12*	0.32	0.001
Mom Ed * # of Act * HW/Week	-0.16	0.05	-0.16**	0.34	0.002

Note: R^2=.164 (N = 6,339, p < .001)
* p < .01, **p < .001

Table 12
Regression Predicting 10th Grade Math Achievement from 9th Grade ITED Variables

Predictors for Math	*B*	Std. Error	Beta	Correlations: Zero-Order	Correlations: SemiPartial^2
Mother's Education	3.96	0.51	0.11**	0.30	0.007
Amount HW/Week	6.49	0.28	0.27**	0.36	0.065
Mom Ed * # of Act	2.67	0.13	0.35**	0.35	0.050
Mom Ed * # of Act * TV	-0.59	0.05	-0.19**	0.10	0.020

Note: R^2=.229 (N = 6,390, p < .001)
** p < .001

DISCUSSION

The current study tracked individual student achievement from 4th (1998) to 10th (2004) grade. The study database included WASL scale and level scores for reading and math from 4th, 7th, and 10th grades. We matched student scores on these time points based on their district student identification numbers. We also included demographic variables in the database such as ethnicity and gender. Finally, we examined questions from the ITED (9th grade) in order to determine the influence of other factors on student achievement over time, such as time spent doing homework and parents' level of education.

A total of 8,463 students were included in the final database. The students in this study represented 33 districts and 318 schools around the state. Students in this study were similar to students around the state on WASL scale scores for reading and math and on gender. However, students in this study differed from students around the state on their WASL level scores and on ethnicity. Compared to the state average, a higher percentage of students in the study database fell in Level 4 reading and math and a lower percentage fell in Level 1 reading and math. Additionally, Asian/Pacific Islanders and Black/African American students were overrepresented in the study database, while Hispanic students were underrepresented.

The findings presented in this report extend Fouts (2002) study and are consistent with his report. The examination into student achievement over time revealed that past achievement was the best predictor of future achievement. Fouts points out that this finding indicates a need to intervene with children at an early age in order to create a trajectory of academic success. Our findings suggest that students who fall within the middle two WASL levels of achievement may be more likely to move to another level (typically up) than students who fall at the extreme levels. Unfortunately, in our study, the majority of students in 4th grade reading Level 1 were still not passing in the 10th grade. Students in reading Level 2 in 4th grade had a 2.41 times greater chance of passing in the 10th grade than did Level 1 students. Similarly, Level 3 and 4 students had a 3.70 and 4.11 times greater chance of passing in the 10th grade than students in Level 1. These results were similar for math achievement. In general, results showed that student scores on the WASL improved from 4th to 10th grade. An exception to this occurred in the 7th grade, where there was a dip in achievement. Possible reasons for this dip include developmental issues that may be occurring in the 7th grade or possibly that the academic program is not consistent across all grade levels.

One variable that is often cited as being influential in student achievement is ethnicity. The current study found that the likelihood of moving out of Level 1 reading was the greatest for Asian/Pacific Islander students and the least for Black/African American students. For math, Asian/Pacific Islander and White students were more likely to move out of Level 1 than Hispanic and Black/African American students. These findings were replicated to a lesser degree for Levels 2 and 3 and become much less

pronounced in Level 4. Thus, the influence of ethnicity appears to diminish across the levels of achievement by the time students reach the 10th grade. While it appears to be important to consider the impact of ethnicity on achievement, it is clear that ethnicity alone cannot explain the differences in student achievement over time. Abbott and Joireman (2001) suggested that other variables such as family income may have more power in predicting academic success.

We also investigated other factors thought to be involved in achievement including the amount of time per week doing homework, parents' education, and the number of school activities in which a student participates. Hierarchical regressions revealed that mothers' education, amount of time per week doing homework, and three interaction terms predicted 16% of the variance in 10th grade reading achievement. In this regression the amount of time a student spent doing homework per week was the single largest predictor of reading achievement. Although the amount of variance explained by amount of time per week doing homework was not large (3%), it was three times more powerful in predicting achievement than was mothers' level of education. Findings for math achievement were similar to reading.

Taken together, mothers' education, amount of time per week doing homework, and two interaction terms accounted for 23% of the variance in math achievement. Once again, the amount of time spent doing homework per week was the strongest predictor of math achievement. Amount of time spent doing homework per week was seven times more powerful in predicting math achievement than was mothers' education. These findings suggest that academic achievement is predicted by influences other than a student's background and that other variables can be more powerful in predicting achievement.

Our study affirmed Fouts' (2002) conclusion that early success on the WASL was a strong predictor of later success. Although there were some differences between his predicted 10th grade scores and our actual scores, the dynamics of achievement progression over the grades was the same. Our last finding implies that there are some student practices that may be potentially helpful in partially mitigating the lack of early success. This is an area that deserves further investigation. This may assist leaders and practitioners in their quest for improving school success.

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