

# Future Problem Solving Students – A Five Year Study

## A Comparison of Reading and Mathematics Performance Between Students Participating in a Future Problem Solving Program and Nonparticipants

### THE STUDY

**Measurement Criteria:** The Minnesota Comprehensive Assessment (MCA), Reading and Mathematics Scaled Scores

**Data Collection:** Grandview Middle School (Mound, MN)

**Statistical Analysis:** Performed by Scholastic Testing Service, Inc.

Performance data on the MCA was collected from 2010-2014 for students in grade 6 at Grandview Middle School in Mound, MN (Westonka Public School District). Students were identified as either *FPS*: students participating in a Future Problem Solving program, or *Non-FPS*: students not participating in the program. Summary statistics were developed for each group of students by year and across years.

The MCA scaled scores range from 601-699 with the first digit identifying the grade level. For purposes of this study, the actual scaled score values are only used to compare FPS and Non-FPS student performance. To determine if the mean scores across the years were significantly different, *t*-tests were used. A Cohen's *d* test was then performed to measure the effect of the size of the found differences.

### MATHEMATICS PERFORMANCE

**Summary Statistics:** Table 1 below provides summary statistics for the students, both by year and across years, for performance on the Mathematics section of the MCA. Table 2 on the following page provides detailed descriptions of the headings used in the summary statistics table.

**Table 1**  
Summary Statistics for the MCA - Mathematics

BY YEAR																	
Year	ID	NCNT	MEAN	SIGMA	SEM	KR21	0.01	0.05	0.16	0.25	0.4	0.5	0.6	0.75	0.84	0.95	0.99
2010	Non	134	660	10.43	6.051	.663	639	642	650	654	658	659	663	667	669	674	698
2011	Non	129	652	9.23	6.632	.484	626	638	643	646	650	652	654	658	659	667	674
2012	Non	125	653	14.46	6.531	.796	624	630	639	644	649	652	656	661	666	681	688
2013	Non	132	654	11.91	6.454	.707	625	630	641	648	653	656	659	662	666	671	674
2014	Non	132	656	9.40	6.335	.546	633	637	646	652	655	658	659	662	666	670	673
2010	FPS	24	679	12.01	4.436	.864	652	665	666	670	676	679	683	689	698	698	698
2011	FPS	19	670	6.42	5.307	.316	659	660	663	664	667	669	673	675	677	680	680
2012	FPS	21	670	11.91	5.232	.807	652	654	658	663	665	667	669	680	688	688	689
2013	FPS	33	668	7.71	5.406	.509	650	658	660	663	666	669	671	673	676	682	686
2014	FPS	32	666	10.38	5.570	.712	642	651	657	659	661	668	671	675	677	682	688
ACROSS YEARS																	
10-14	Non	652	655	11.59	6.400	.695	626	636	644	648	653	656	658	662	666	672	688
10-14	FPS	129	670	10.75	5.238	.762	650	653	659	663	667	669	672	677	681	688	698

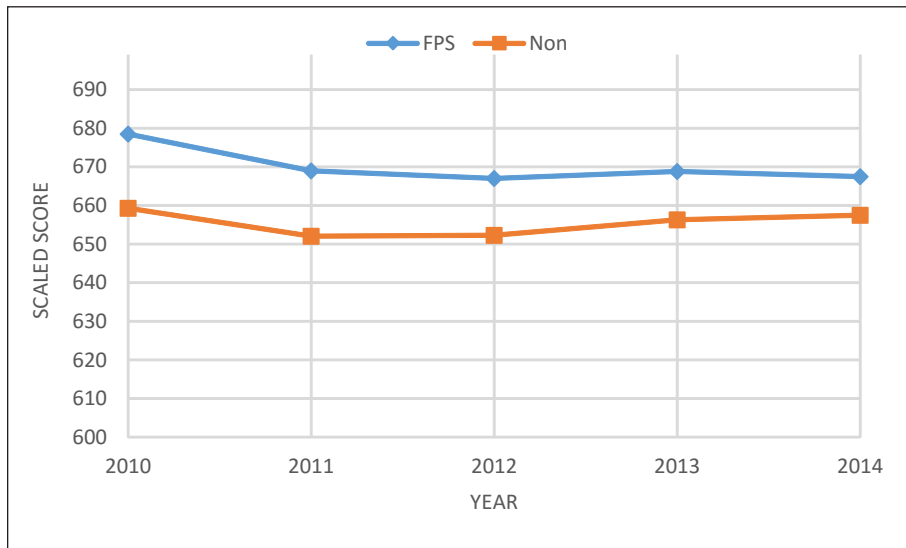
**Table 2**  
Descriptions of Summary Statistics Headings

Year	Year the MCA was administered
ID	FPS = Students participating in a Future Problem Solving program; Non = Students not participating in a program
NCNT	Number of students that took the MCA
MEAN	Average scaled score
SIGMA	Standard deviation of the scaled score
SEM	Standard Error of the Measurement
KR21	Kuder-Richardson reliability
0.01	Performance at the 1st percentile
0.05	Performance at the 5th percentile

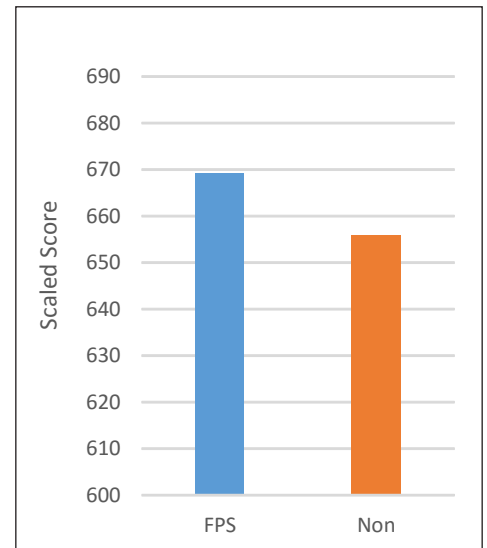
0.16	Performance at the 16th percentile
0.25	Performance at the 25th percentile
0.4	Performance at the 40th percentile
0.5	Performance at the 50th percentile
0.6	Performance at the 60th percentile
0.75	Performance at the 75th percentile
0.84	Performance at the 84th percentile
0.95	Performance at the 95th percentile
0.99	Performance at the 99th percentile

**Median Performance:** Figure 1 below shows the median performance by year between the two groups of students while Figure 2 compares the median performance across years between the two groups of students.

**Figure 1**  
Median Performance  
By Year - Mathematics



**Figure 2**  
Median Performance  
Across Years - Mathematics



**Significance of the Difference:** We used *t*-tests to determine the significance of the differences found between the mean scores by year and across the years. Table 3 below shows in all cases that the difference between the means was found to be significant and the Cohen's *d* test of the effect of size indicates a large effect.

**Table 3**  
Significance of the Difference Between the Mean Scores - Mathematics

Year	t	Significant	d	Effect
2010	7.259	Yes	1.691	Large
2011	10.700	Yes	2.300	Large
2012	5.856	Yes	1.289	Large
2013	8.255	Yes	1.427	Large
2014	4.977	Yes	1.011	Large
2010-2014	14.290	Yes	1.343	Large

## READING PERFORMANCE

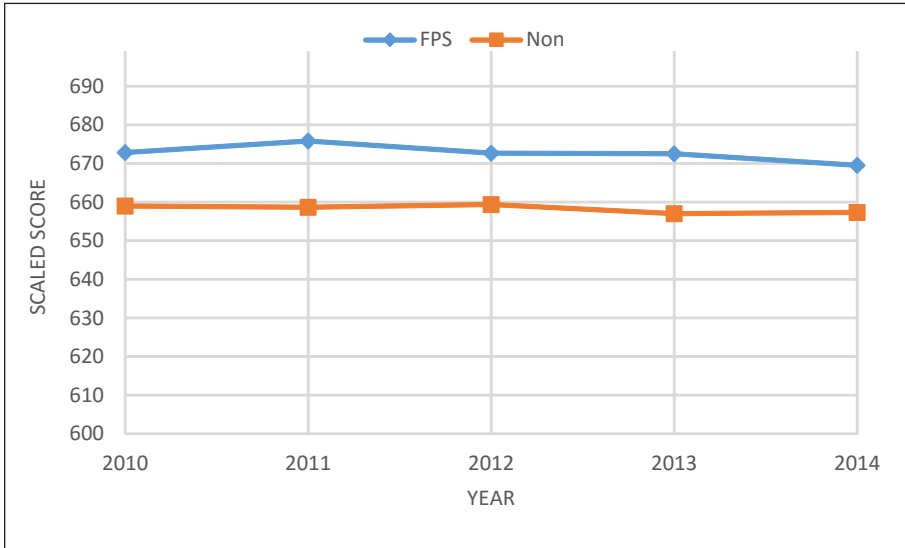
**Summary Statistics:** Table 4 below provides summary statistics for the students, both by year and across years, for performance on the Reading section of the MCA. The headings used in the summary statistics table are the same as the Mathematics section (see Table 2 for descriptions).

**Table 4**  
Summary Statistics for the MCA - Reading

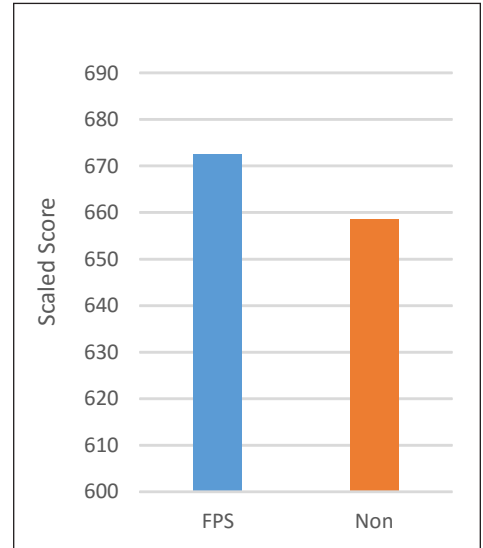
BY YEAR																	
Year	ID	NCNT	MEAN	SIGMA	SEM	KR21	0.01	0.05	0.16	0.25	0.4	0.5	0.6	0.75	0.84	0.95	0.99
2010	Non	133	660	10.51	6.073	.666	640	643	649	653	658	659	662	666	669	678	687
2011	Non	125	658	9.88	6.205	.606	638	642	649	652	656	659	661	664	666	676	681
2012	Non	121	662	13.16	5.913	.798	634	643	652	655	658	659	663	667	673	699	699
2013	Non	131	659	14.27	6.140	.815	626	636	645	649	654	657	662	668	672	684	698
2014	Non	132	658	12.78	6.209	.764	627	636	645	650	655	657	661	666	671	680	684
2010	FPS	24	674	11.45	4.850	.820	658	661	664	666	669	673	673	687	687	699	699
2011	FPS	20	676	7.53	4.746	.602	666	666	666	672	676	676	676	681	681	690	690
2012	FPS	21	673	10.36	5.014	.766	650	659	669	669	669	673	673	673	674	699	699
2013	FPS	32	672	13.10	5.097	.849	650	652	660	661	667	673	675	683	685	699	699
2014	FPS	32	673	14.75	4.935	.888	653	653	660	663	665	670	675	689	690	699	699
ACROSS YEARS																	
10-14	Non	642	659	12.32	6.111	.754	631	641	648	651	656	659	662	666	670	680	699
10-14	FPS	129	673	12.20	4.944	.836	650	654	661	665	669	673	673	681	687	699	699

**Median Performance:** Figure 3 below shows the median performance by year between the two groups of students while Figure 4 compares the median performance across years between the two groups of students.

**Figure 3**  
Median Performance  
By Year - Reading



**Figure 4**  
Median Performance  
Across Years - Reading



**Significance of the Difference:** We used *t*-tests to determine the significance of the differences found between the mean scores by year and across the years. Table 5 below shows in all cases that the difference between the means was found to be significant and the Cohen's *d* test of the effect of size indicates a large effect.

**Table 5**  
Significance of the Difference Between the Mean Scores - Reading

Year	t	Significant	d	Effect
2010	5.581	Yes	1.275	Large
2011	9.466	Yes	2.068	Large
2012	4.301	Yes	0.935	Large
2013	4.943	Yes	0.950	Large
2014	5.291	Yes	1.090	Large
2010-2014	11.874	Yes	1.142	Large

## **CONCLUSION**

In all cases, students participating in the Future Problem Solving Program performed significantly higher on the MCA in both areas of Mathematics and Reading.