COLORADO SPRINGS SCHOOL DISTRICT 11

EXECUTIVE SUMMARY

EXPLORING THE EFFECTS OF MEASURES OF ACADEMIC PROGRESS (MAP) ON PARTNERSHIP FOR ASSESSMENT OF READINESS FOR COLLEGE AND CAREERS (PARCC) STUDENT OUTCOMES IN ELEMENTARY AND MIDDLE SCHOOL, SCHOOL YEAR 2014-2015

[*PREPARED BY PAUL M. MEDINA, JR., PH.D.*]

Introduction

Is it not the goal to advance the educational and personal growth of all students? I say it is. Referring to the future of education, President Bush, in his State of the Union on January 31, 2006, challenged citizens by saying "if we ensure that America's children succeed in life, they will ensure that America succeeds in the world." President Obama, in his address to the Joint Session of Congress on February 24, 2009, assessed that "In a global economy where the most valuable skill you can sell is your knowledge, a good education is no longer just a pathway to opportunity—it is a pre-requisite." Therefore, the basic approach to education is simply to provide the teaching, learning, and leadership necessary for a healthy and prosperous academic institution, and one that is accepted by the community. As such, elementary school lays the compulsory educational foundation for the basic knowledge that all children should acquire progressively enhancing this knowledge throughout the child's K-5 education levels in math, reading, writing, science, and social studies. Middle school years are vital in a child's education, a critical point at which education trajectory is sustained or changed. Subsequently, one can posit that demonstrating mastery in the basic core subjects at grade level or higher is a middle school goal. Although explicit instructional delivery in the classroom appears as the most common method of instruction, research suggests that auxiliary instructional time by supplemental educational programs enhances student learning and/or benefits struggling students, such as the Northwest Evaluation Association (NWEA) Measures of Academic Progress (MAP).

The Present Study

I explored specifically the effect of MAP on student academic achievement using PARCC ELA and math as the student outcomes across grades three through eight. Data were drawn for school year 2014-2015 from raw assessment datasets and the district's student information management system across 34 elementary (grades 3-5) and 13 middle schools (grades 6-8). Here, there was one elementary, one online, and one alternative school where students in grades 3-8 were part of the institution and overlap across school level designations. The statistical approach used in the study was simple linear regression analysis.

Results

Correlation and a series of simple linear regressions were conducted to examine the relationship and accuracy between PARCC and MAP. The findings showed that correlations were positive and strong at the school level and even stronger at the various grade levels.

Regression results indicate that, overall, when exposed to MAP at the school level and at the various grade levels, MAP statistically significantly predicted PARCC outcomes in math and ELA with a high degree of accuracy.

Discussion

Simple regression analyses were conducted to determine the accuracy of MAP predicting PARCC outcomes. First, I examined the association between MAP and PARCC and found strong positive correlations at the school level, where Pearson's *r* fell between 0.68 and 0.76, and at each of the grade levels, where Pearson's *r* fell between 0.75 and 0.89, across elementary and middle school grades. Second, I explored the effect of MAP on PARCC and found, from the regressions, that MAP statistically significantly predicted PARCC outcomes in math and ELA, where between 56% and 80% of the variance in PARCC was accounted for at the various levels. Here, the suggestion is that as students increase their MAP scores there is a predictive capability to realize increased scores in PARCC. In other words, the higher the MAP scores are, the higher the PARCC scores will be. These findings are promising particularly as a baseline. Yet, the follow-on question, therefore; has to be, are the school level MAP expectations set high enough to maximize the full predictability of MAP on future PARCC outcomes? The latter is deserving of further exploratory analyses.

Recent NWEA publications on norms and associations between MAP and PARCC serve as an additional validation of this study. Here, NWEA establishes norms using a national dataset that extends educators efficient and accurate estimates of student achievement status with a subject area. To this, NWEA linked PARCC scale scores in ELA and math, across grades three through eight, with those of MAP math and reading assessments for the State of Colorado, and predicting the probability of attaining level 4 (at benchmark) on the PARCC. These NWEA studies and that of the present study are statistically aligned.

The implication of the present study suggests that expectations at the student, grade, and school level should be reviewed specifically to determine if the existing MAP expectations are appropriate enough to maximize significant gains in PARCC outcomes. Once again, the suggestion is made that the higher the MAP scores are, the higher the PARCC scores will be.

A technical report of the study was generated and has been attached to this executive summary for those who want to read the more depth analysis.

COLORADO SPRINGS SCHOOL DISTRICT 11

TECHNICAL REPORT
EXPLORING THE EFFECTS OF MEASURES OF ACADEMIC PROGRESS (MAP) ON PARTNERSHIP FOR ASSESSMENT OF READINESS FOR COLLEGE AND CAREERS (PARCC) STUDENT OUTCOMES IN ELEMENTARY AND MIDDLE SCHOOL, SCHOOL YEAR 2014-2015

[*PREPARED BY PAUL M. MEDINA, JR., PH.D.*]

Abstract

The purpose of this study was to investigate the impact of elementary and middle school students' exposure to MAP on student outcomes as measured by PARCC in math and English language arts (ELA), and to gain some understanding about MAP's influence in predicting PARCC outcomes. Simple linear regression analysis was the statistical approach used in conducting the analysis. The findings showed that MAP and PARCC were highly correlated and that, at the school level and at the various grade levels, MAP statistically significantly predicted PARCC outcomes in math and ELA.

Introduction

Is it not the goal to advance the educational and personal growth of all students? I say it is. Referring to the future of education, President Bush, in his State of the Union on January 31, 2006, challenged citizens by saying "if we ensure that America's children succeed in life, they will ensure that America succeeds in the world." President Obama, in his address to the Joint Session of Congress on February 24, 2009, assessed that "In a global economy where the most valuable skill you can sell is your knowledge, a good education is no longer just a pathway to opportunity—it is a pre-requisite." Therefore, the basic approach to education is simply to provide the teaching, learning, and leadership necessary for a healthy and prosperous academic institution, and one that is accepted by the community. Ultimately, an educator's conviction should be to pave the road for the student to ultimately exercise freedom of mind, independence of thought, and action. Furthermore, education should be rewarding, exciting, and fun. One way to measure the successes of progressive education is through differentiated and blended educational programs and large scale assessments such as the state assessment. Elementary and middle school are crucial stages in education that, if done well, prepare all students for the rigors of high school courses and postsecondary education.

As such, elementary school lays the compulsory educational foundation for the basic knowledge that all children should acquire progressively enhancing this knowledge throughout the child's K-5 education levels in math, reading, writing, science, and social studies. Middle school years are vital in a child's education, a critical point at which education trajectory is sustained or changed. Specifically, it is a point in time where students move from learning math, reading, and writing to applying math, reading and writing to learn, and the point at which education helps students circumnavigate the rigors of imminent high school courses and postsecondary education. Subsequently, one can posit that demonstrating mastery in the basic core subjects at grade level or higher is a middle school goal. Although explicit instructional delivery in the classroom appears as the most common method of instruction, research suggests that auxiliary instructional time by supplemental educational programs enhances student learning and/or benefits struggling students.

One such program is the Northwest Evaluation Association (NWEA) Measures of Academic Progress (MAP). It is a web-based computer adaptive interim assessment that provides stable scale and data that delivers real-time instructional insight to assist students accelerate learning and measuring and monitoring student growth term-to-term (fall, winter, and spring) and year-over-year (NWEA, 2016). NWEA, a nationally recognized organization and developer of MAP, has dedicated over 40 years of research to increasing the metrics to measure and encourage student learning and currently serve over 52,200 school districts across the nation. MAP is a valid test for measuring a student's achievement status to state standards (NWEA, 2013; NWEA, 2016a). In Colorado Springs School District 11 (D11), MAP complements the state assessment and serves as a metric for measuring student progress on Common Core Standards (CSSS) throughout the year. With exception of a few schools (20+), per district guidance, schools are not required to test in MAP and is therefore optional at the discretion of school leadership. However, most schools test in the fall and in the spring.

The Partnership for the Assessment of Readiness for College and Career (PARCC) is the state's new summative assessment and assesses students' grasp of grade level Common Core Standards (CSSS) in English language arts and math. It is considered a high quality assessment with respect to validity and reliability and it is aligned to the CCCS (Ansel, 2015) and state standards (NWEA, 2016). The first PARCC administration was conducted in the spring of 2015 and serves as a new baseline for measuring student progress. PARCC 2015 student level test results were released to the districts in November 2015. The State of Colorado requires that students in grades 3-9 be tested in PARCC.

This investigation explores the effect of MAP on PARCC outcomes at elementary and middle school during school year 2014-2015. Also, since PARCC's first test administration was during this same school year, the baseline correlation statistics between MAP and PARCC is a focus of this investigation.

Correlation and Simple Linear Regression Analysis

For purposes of refreshing the technical reader and enlightening the non-technical reader, a short summary on correlation and simple linear regression analysis is provided. Extant literature in scientific research suggests that correlation does not necessarily imply causation but causation does imply correlation (Stanovich, 2007). Correlation, however, can measure only the linear relationship between variables. Yet, once correlation is determined, it can be used to make predictions assuming subsequent test assumptions are met within the context and methodology of an analysis. When the relationship between the variables is strong, the more accurate the prediction will be.

The correlation, therefore, articulates the strength of association between the continuous variables expressed as a single value between -1 and +1, also known as the correlation coefficient and represented as r, or as Pearson's r. For the purposes of the present study, a positive coefficient of .1 to .3 has a strength of association of small, .3 to .5 a strength association of medium, and .5 to 1.0 a strength association of strong. A positive value indicates a positive linear relationship between the variables while a negative indicates the opposite and a correlation of zero indicates no relationship. While a positive correlation suggests as one variable increases the other variable will increase as well, a value of zero correlation does not inevitably mean there is no correlation. In this case, it would signify that there is no linear relationship within the data sample suggesting a non-linear relationship may exist and worthy of further exploration by using methods detecting non-linear relationships. The r-squared, r^2, is yet another statistic of importance when investigating the correlation. R-squared is the percent of variance explained by the model. However, sometimes it is better to look at the adjusted r-squared rather than the r-squared and the standard error of the regression rather than the standard deviation of the errors as they represent unbiased estimators that corrects for the sample size and numbers of coefficients estimated.

Linear regression analysis is the most widely used of all statistical approaches. It is the study of linear and additive relationships between dependent (DV) and independent (IV) variables whose dependent values one wants to predict from the independent variables which one wishes to use to predict. For example, one may want to predict the effect of a particular educational program (IV) on the state assessment in reading (DV) in a simple regression statistical approach using only one DV and IV. Or, one may want to predict the effect of a particular educational program (IV) and the contributions of different additive variable such as grade level, gender, and social economic status (additive IVs) on the state assessment in math (DV) in a multiple linear regression statistical approach using only one DV and multiple IVs. The end result, assuming all statistical assumption tests are met, are predications at the various IVs—suggesting increase, decrease, or no affect—on the DV over some specified time period (Mertler & Vannatta, 2016). In other words, simple regression exploits the correlation between the DV and the IV in order to make specific predictions about the DV (Sprinthall, 2000). Here, the idea behind simple regression is to secure the equation for the best-fitting line through a series of points, or scores as in the present study.

The Present Study

In this study, I explore specifically the effect of MAP on student academic achievement using PARCC ELA and math as the student outcomes across grades three through eight. Data were drawn for school year 2014-2015 from raw assessment datasets and the district's student information management system across 34 elementary (grades 3-5) and 13 middle schools (grades 6-8). Here, there was one elementary, one online, and one alternative school where students in grades 3-8 were part of the institution and overlap across school level designations.

The purpose of this study is to investigate the impact of elementary and middle school students' exposure to MAP on student outcomes as measured by PARCC in English language arts (ELA) and math. First, the present study examines the role that correlation plays between MAP and PARCC. This is important because PARCC is the new state assessment and its first test administration will serve as a baseline. Second, a series of simple linear regression analyses examine for predictive statistically significant effect of MAP on PARCC from the school level followed by more in depth regression analyses from each of the grade levels (models), inclusive of best-fitting line scatterplot graphic representations between MAP and PARCC results. Also, comparative analyses are drawn between the school level and grade levels relative to when MAP testing occurred, in the spring (end of the school year) or in the winter (prior to testing in

PARCC). No investigation was conducted to draw interaction results from other related variables. The latter will be explored in future MAP to PARCC investigations.

The statistical approach used in the study is simple linear regression analysis. As such, the state assessment, PARCC, is the dependent variable (DV) and the independent variable (IV) is MAP. The simple linear regression equation takes the form,

$$(1)\ \hat{Y} = \beta_0 + \beta_1 X + \epsilon_i$$

where, $\hat{Y}$ is the predicted value for the student outcome in PARCC (DV); β_0 is the least-squares estimate of β_0, also known as the *Y* intercept; β_1 is the slope of the regression line, *X* is the raw score value on MAP (IV); and, ϵ_{it} represents the error term.

Results

Descriptive Statistics

The descriptive statistics for the PARCC 2015 math and ELA test takers are presented in Tables 1 and 2, respectively. Since middle school students had the option to test in math, algebra I, or geometry, the number of students shown in the table reflect only those students who tested in math, a number smaller than the sum total of students who tested in math, algebra I, or geometry. Otherwise, the statistics show a fairly balanced number of minority (Minority), students on free and reduced lunch (Perc FRL), gifted students (GT), and students requiring special services (SPED) as test takers at the elementary and middle school grades, and slightly higher percentages of English language learners (ELL) at the elementary school grades. The descriptive statistics for PARCC 2015 math and ELA results, disaggregated by performance level and those students who achieved or exceeded the achievement benchmark, are shown at Tables 3 and 4, respectively. Here, it should be noted that the results of this new and first test administration serve primarily as a baseline, a starting point from which a comparison, or a measure of student change toward achieving important academic indicators, can be made. Nevertheless, third graders fared better (36%) than fourth or fifth graders and sixth graders fared better (20%) than seventh or eighth graders in PARCC math. The statistics on PARCC ELA showed that third graders once again fared better (33%) than fourth or fifth graders and seventh and eighth graders fared better (31%) than sixth graders.

Linear Regressions

Correlation and a series of simple linear regressions were conducted to examine the relationship and accuracy between PARCC and MAP when using MAP spring and winter (prior to testing in PARCC) test scores as potential predictors. Tables 5 and 6 show the associations and strengths of the correlations when using MAP spring and winter scores, for those students who tested in MAP, respectively. The findings showed that correlations are positive and strong at the school level (r>.73 - .78, p<.001) and even stronger at the various grade levels (r>.75 - .89, p<.001) when using scores from the MAP spring testing session as predictors of PARCC. Likewise, but not as strong, correlations are positive and strong at the school level (r>.68 - .76, p<.001) and even stronger at the various grade levels (r>.71 - .86, p<.001) when using scores from the MAP winter testing session as predictors of PARCC. However, it should be noted that the number of MAP test takers during the winter session was considerably lower than the spring session, a direct result of optional MAP testing. Nevertheless, correlations between PARCC and MAP were found to be strong. Tables 7 through 10 show the scatterplots of the predicted variable (MAP) and outcome variable (PARCC) with the regression line plotted. Here, the scatterplots illustrate higher predictive gains in PARCC for fifth graders at the elementary grades and eighth graders at the middle school level. For illustration purposes, NWEA probability lines (NWEA, 2016a) for passing PARCC at level 4 (benchmark) at grades 3, 4, and 5, when MAP is taken in the spring, have been superimposed. It illustrates what it would take, on average, should a school want to achieve level 4 at certain probabilities of success (i.e., 57%, 85%, 92%, etc.).

Table 1

Descriptive Statistics of Students Testing in PARCC Math 2015

Grade	*N*	Perc FRL	Perc Minority	Perc ELL	Perc GT	Perc SPED
Elementary School, Grades 3-5	4731	63%	49%	8%	10%	9%
3rd Grade	1651	63%	48%	10%	9%	10%
4th Grade	1537	64%	49%	7%	9%	9%
5th Grade	1543	62%	51%	6%	13%	10%
Middle School, Grades 6-8	2964	65%	52%	7%	7%	11%
6th Grade*	1135	64%	49%	6%	9%	11%
7th Grade*	1045	64%	52%	6%	8%	10%
8th Grade*	784	67%	55%	9%	3%	12%

*Only students that tested in math are included in the sample. Students had an option to test in math, Algebra I, or Geometry.

Table 2

Descriptive Statistics of Students Testing in PARCC ELA 2015

Grade	*N*	Perc FRL	Perc Minority	Perc ELL	Perc GT	Perc SPED
Elementary School, Grades 3-5	4790	63%	49%	8%	10%	9%
3rd Grade	1665	64%	48%	11%	9%	10%
4th Grade	1565	64%	49%	7%	9%	9%
5th Grade	1560	62%	51%	6%	13%	10%
Middle School, Grades 6-8	3254	62%	50%	6%	11%	9%
6th Grade	1117	62%	48%	6%	10%	11%
7th Grade	1111	64%	51%	6%	12%	10%
8th Grade	1026	60%	51%	7%	13%	8%

Table 3

Descriptive Statistics of the Percent of Students' Academic Achievement Across the Various Performance Levels in the PARCC Math Assessement of 2015

	PARCC Math School Year 2015					
Testing Grades	Perc Stu Scoring at Level 1	Perc Stu Scoring at Level 2	Perc Stu Scoring at Level 3	Perc Stu Scoring at Level 4	Perc Stu Scoring at Level 5	Perc Stu Scoring at Benchmark (4 and 5)
Elementary and Middle School Grades 3-8	16.01%	29.67%	30.66%	21.73%	1.94%	23.66%
Elementary School, Grades 3-5	12.75%	27.48%	30.82%	26.23%	2.73%	28.96%
3rd Grade	13.45%	22.96%	27.56%	31.25%	4.78%	36.04%
4th Grade	11.52%	29.28%	34.22%	24.01%	0.98%	24.98%
5th Grade	13.22%	30.52%	30.91%	23.07%	2.27%	25.34%
Middle School, Grades 6-8	21.22%	33.16%	30.40%	14.54%	0.67%	15.22%
6th Grade*	19.47%	31.10%	29.43%	18.68%	1.32%	20.00%
7th Grade*	12.34%	35.50%	37.13%	14.83%	0.19%	15.02%
8th Grade*	35.59%	33.04%	22.83%	8.16%	0.38%	8.55%

*Only students that tested in math are included in the sample. Students had an option to test in math, Algebra I, or Geometry.

Table 4

Descriptive Statistics of the Percent of Students' Academic Achievement Across the Various Performance Levels in the PARCC ELA Assessement of 2015

	PARCC ELA School Year 2015					
Testing Grades	Perc Stu Scoring at Level 1	Perc Stu Scoring at Level 2	Perc Stu Scoring at Level 3	Perc Stu Scoring at Level 4	Perc Stu Scoring at Level 5	Perc Stu Scoring at Benchmark (4 and 5)
Elementary and Middle School Grades 3-8	16.35%	22.79%	29.66%	28.07%	3.13%	31.20%
Elementary School, Grades 3-5	16.26%	21.69%	30.25%	29.19%	2.61%	31.80%
3rd Grade	22.28%	20.54%	23.78%	30.75%	2.64%	33.39%
4th Grade	12.27%	21.02%	36.17%	26.71%	3.83%	30.54%
5th Grade	13.85%	23.59%	31.22%	30.00%	1.35%	31.35%
Middle School, Grades 6-8	16.47%	24.40%	28.80%	26.43%	3.90%	30.33%
6th Grade	15.94%	24.08%	32.05%	26.23%	1.70%	27.93%
7th Grade	15.12%	24.48%	29.16%	24.57%	6.66%	31.23%
8th Grade	18.52%	24.66%	24.85%	28.65%	3.31%	31.97%

Table 5

Correlation Results: PARCC Math Association to MAP Math

Models	When Using Spring MAP as a Predictor		When Using Winter MAP as a Predictor	
	N	*r*	*N*	*r*
Elementary School, Grades 3-5	4731	.73***	3106	.68***
3rd Grade	1651	.88***	1084	.85***
4th Grade	1537	.89***	972	.84***
5th Grade	1543	.89***	1050	.86***
Middle School, Grades 6-8	2964	.78***	1416	.74***
6th Grade*	1135	.87***	511	.83***
7th Grade*	1045	.84***	495	.83***
8th Grade*	784	.75***	410	.71***

*Only students that tested in math are included. Students had an option to test in math, Algebra I, or Geometry.

***p <.01

Table 6

Correlation Results: PARCC ELA Association to MAP Reading

Models	When Using Spring MAP as a Predictor		When Using Winter MAP as a Predictor	
	N	*r*	*N*	*r*
Elementary School, Grades 3-5	4790	.77***	3245	.75***
3rd Grade	1665	.83***	1193	.80***
4th Grade	1565	.83***	985	.80***
5th Grade	1560	.88***	1067	.80***
Middle School, Grades 6-8	3254	.78***	1436	.76***
6th Grade	1117	.82***	503	.78***
7th Grade	1111	.83***	474	.80***
8th Grade	1026	.79***	459	.77***

***p <.01

Table 7

Scatterplot: PARCC Math Association to MAP Math When Taken in the Spring and Winter (prior to testing in PARCC) for Elementary School Level and Specific Grade Levels

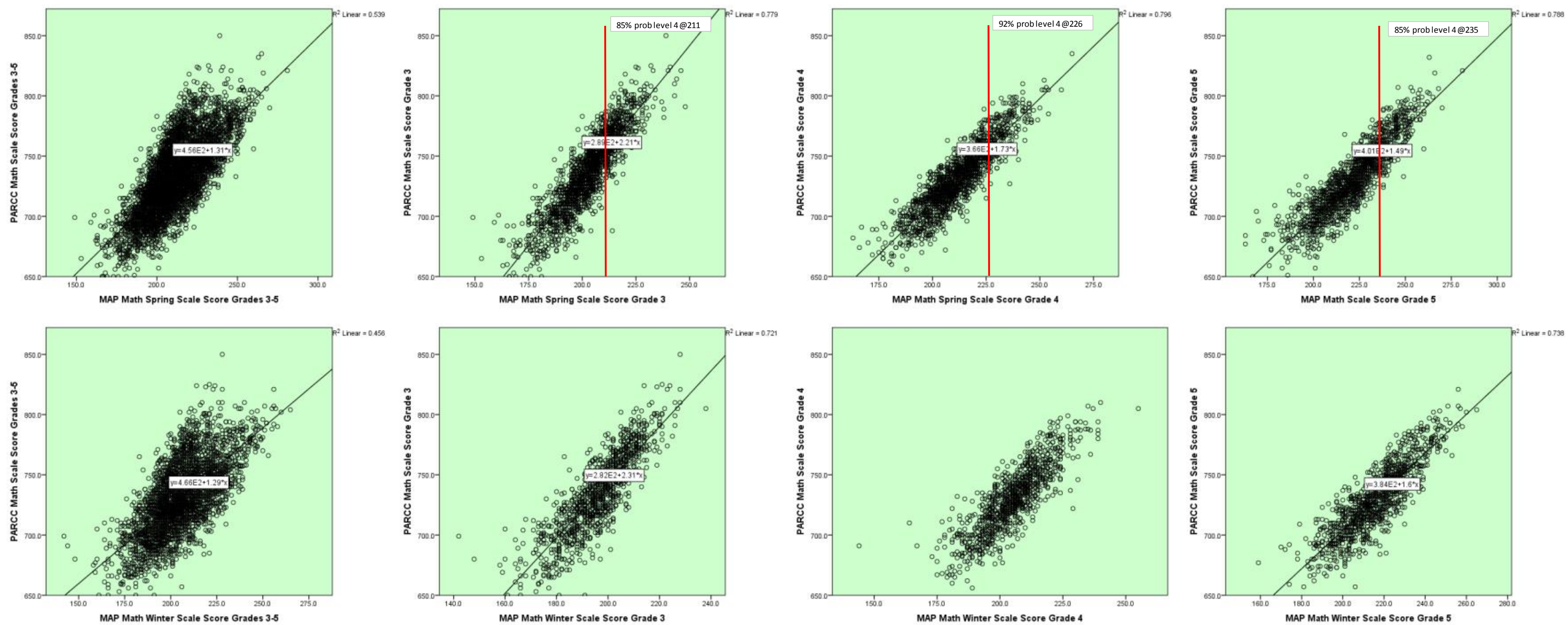

Table 8

Scatterplot: PARCC ELA Association to MAP Reading When Taken in the Spring and Winter (prior to testing in PARCC) for Elementary School Level and Specific Grade Levels

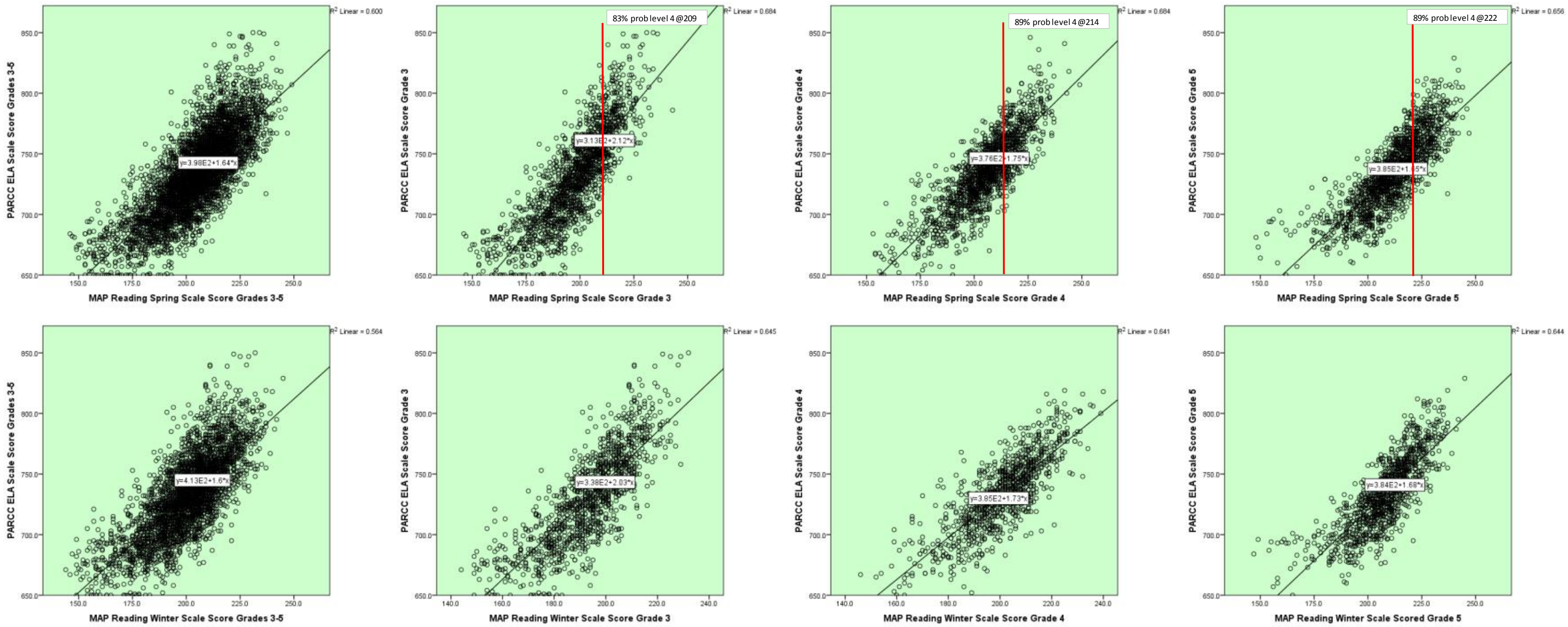

Table 9

Scatterplot: PARCC Math Association to MAP Math When Taken in the Spring and Winter (prior to testing in PARCC) for Middle School Level and Specific Grade Levels

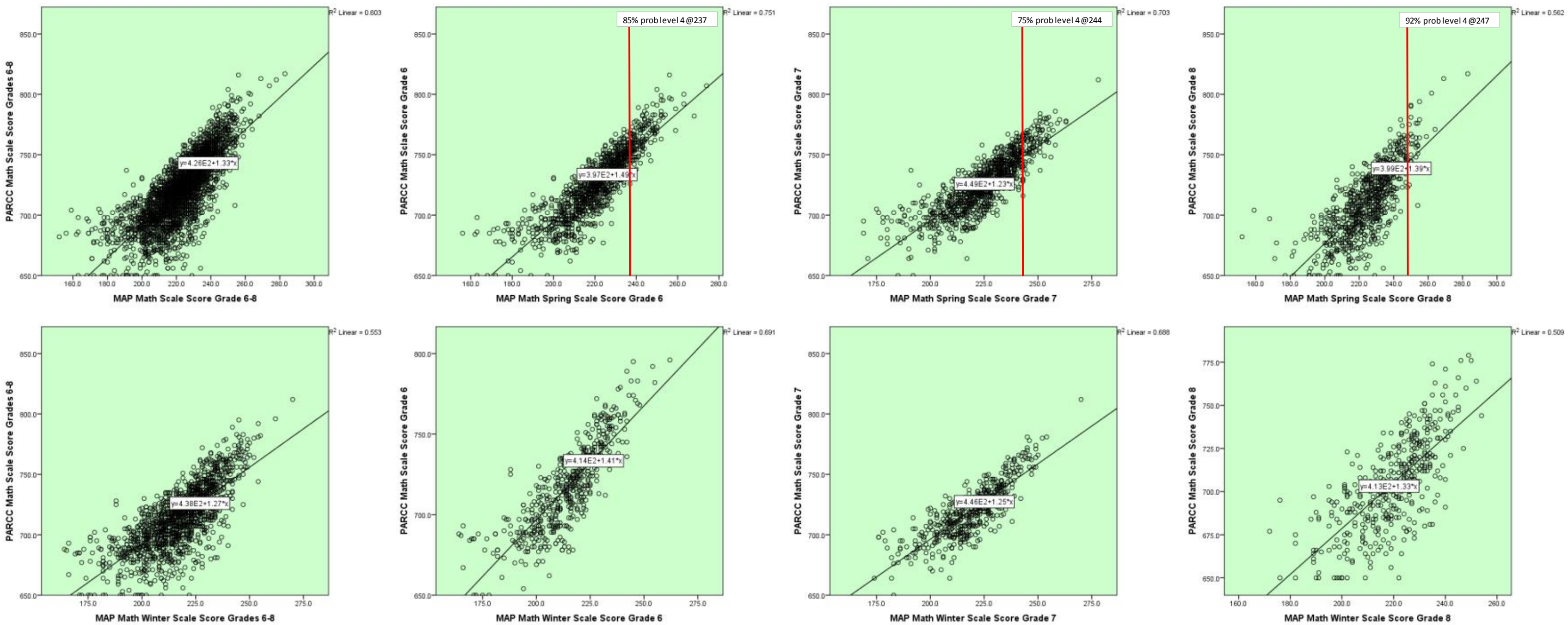

Table 10

Scatterplot: PARCC ELA Association to MAP Reading When Taken in the Spring and Winter (prior to testing in PARCC) for MIddle School Level and Specific Grade Levels

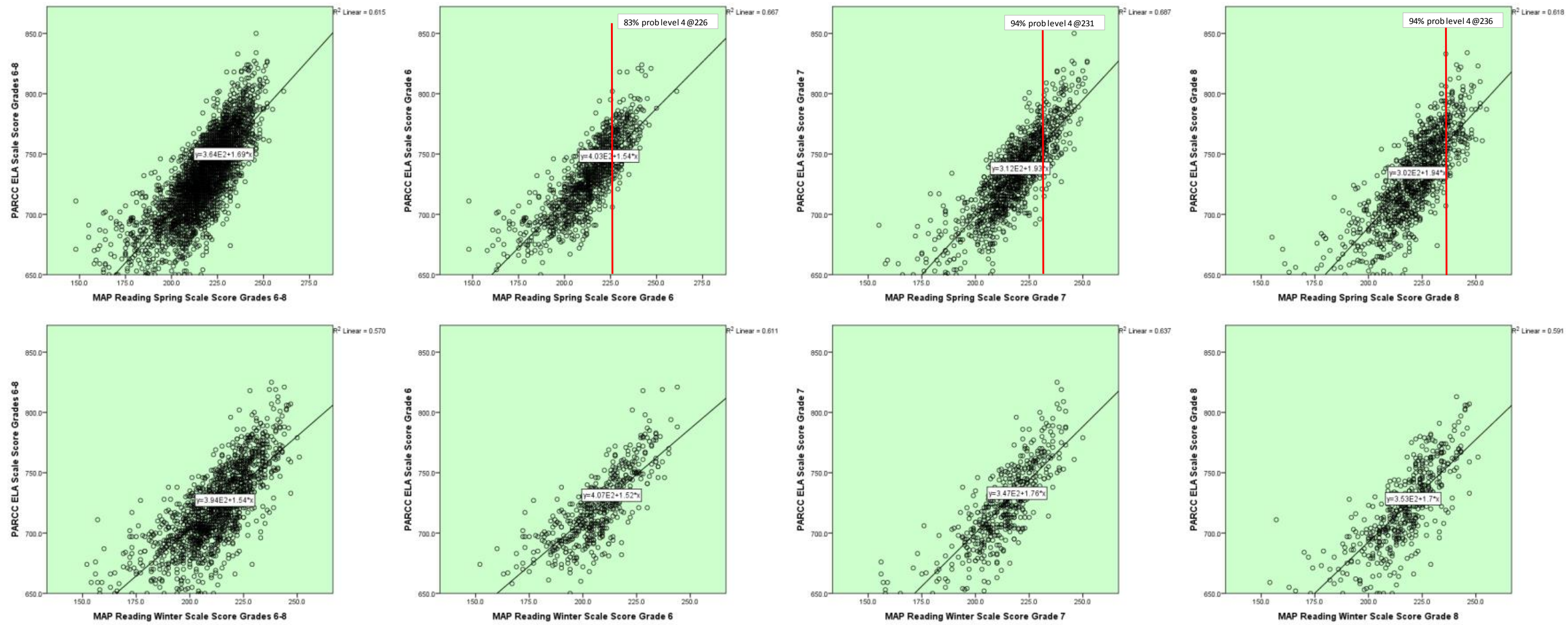

Table 11

Series of Simple Linear Regression Results and Drawing Comparison between the Predictor Variables Spring MAP Math and Winter MAP Math

	When Using Spring MAP as a Predictor								When Using Winter MAP as a Predictor							
	PARCC Math			MAP Spring Math					PARCC Math			MAP Winter Math				
Models	*N*	Mean	Std Dev	Mean	Std Dev	r^2	r^2_{adj}	*Std Error of the Estimate*	*N*	Mean	Std Dev	Mean	Std Dev	r^2	r^2_{adj}	*Std Error of the Estimate*
Elementary School, Grades 3-5	4731	733***	29.7	211.6	16.7	0.539	0.539	20.2	3106	732***	30.0	205.6	15.7	0.456	0.455	22.2
3rd Grade	1651	736***	32.5	202.4	13.0	0.779	0.778	15.3	1084	735***	33.2	196.1	12.2	0.721	0.720	17.5
4th Grade	1537	732***	27.3	211.8	14.1	0.796	0.796	12.3	972	730***	27.4	205.0	12.1	0.707	0.707	14.8
5th Grade	1543	731***	28.5	221.3	17.0	0.788	0.788	13.1	1050	730***	28.7	216.0	15.4	0.738	0.738	14.7
Middle School, Grades 6-8	2964	721***	27.0	222.8	15.8	0.603	0.603	17.0	1416	714***	26.0	217.1	15.2	0.553	0.553	17.4
6th Grade*	1135	725***	27.8	220.1	16.2	0.751	0.751	13.9	511	716***	26.8	213.8	15.8	0.691	0.690	14.9
7th Grade*	1045	726***	22.6	224.6	15.4	0.703	0.703	12.3	495	720***	22.4	218.6	14.8	0.688	0.687	12.5
8th Grade*	784	711***	28.4	224.4	15.3	0.562	0.562	18.8	410	704***	26.5	219.4	14.2	0.509	0.507	18.6

*Only students that tested in math are included. Students had an option to test in math, Algebra I, or Geometry.

***p <.01

Table 12

Series of Simple Linear Regression Results and Drawing Comparison between the Predictor Variables Spring MAP Reading and Winter MAP Reading

	When Using Spring MAP as a Predictor								When Using Winter MAP as a Predictor							
	PARCC ELA			MAP Spring Reading					PARCC ELA			MAP Winter Reading				
Models	*N*	Mean	Std Dev	Mean	Std Dev	r^2	r^2_{adj}	*Std Error of the Estimate*	*N*	Mean	Std Dev	Mean	Std Dev	r^2	r^2_{adj}	*Std Error of the Estimate*
Elementary School, Grades 3-5	4790	734***	33.4	204.6	15.7	0.60	0.600	21.1	3245	733***	33.4	200.5	15.7	0.56	0.564	22.1
3rd Grade	1665	732***	39.0	197.7	15.2	0.68	0.684	21.9	1193	731***	38.4	193.4	15.2	0.64	0.644	22.9
4th Grade	1565	735***	30.4	205.0	14.3	0.68	0.684	17.1	985	734***	30.3	201.0	14.0	0.64	0.640	18.2
5th Grade	1560	735***	29.6	211.4	14.5	0.66	0.656	17.4	1067	734***	29.9	207.9	14.2	0.64	0.643	17.9
Middle School, Grades 6-8	3254	732***	32.3	217.5	15.0	0.61	0.615	20.1	1436	722***	32.0	212.2	15.6	0.57	0.570	21.0
6th Grade	1117	731***	29.1	213.3	15.4	0.67	0.666	16.8	503	721***	29.4	206.9	15.1	0.61	0.610	18.3
7th Grade	1111	733***	33.2	218.0	14.2	0.69	0.687	18.6	474	723***	33.0	213.2	14.9	0.64	0.636	19.9
8th Grade	1026	731***	34.6	221.6	14.0	0.62	0.617	21.4	459	721***	33.7	216.8	15.2	0.59	0.590	21.6

***p <.01

Math

Regression results indicate that, overall, when exposed to MAP at the school level and at the various grade levels, MAP statistically significantly predicted PARCC outcomes in math. At the elementary school level, when using the MAP math spring test as the predictor, the regression results found that MAP performance statistically significantly predicted PARCC math outcomes, r^2=.539, r^2_{adj}=.539, F(1,4729)=5522, p<001. This model accounted for 54% of the variance in PARCC. At the middle school level, when using the MAP math spring test as the predictor, the regression results found that MAP performance statistically significantly predicted PARCC math outcomes, r^2=.603, r^2_{adj}=.603, F(1,2963)=4506, p<001. This model accounted for 60% of the variance in PARCC. Similar but stronger results were found at the specific grade levels. For example, at the third grade level, when using the MAP math spring test as the predictor, the regression results found that MAP performance statistically significantly predicted PARCC math outcomes, r^2=.779, r^2_{adj}=.778, F(1,1649)=5796, p<001. This model accounted for 80% of the variance in PARCC. Still, when looking at the sixth grade level, when using the MAP math spring test as the predictor, the regression results found that MAP performance statistically significantly predicted PARCC math outcomes, r^2=.751, r^2_{adj}=.751, F(1,1133)=3423, p<001. This model accounted for 75% of the variance in PARCC. Likewise, when using the MAP math winter test (prior to testing in PARCC) as the predictor, similar but not as strong results were found across the school levels and at each of the grade levels. A summary of math regression coefficients is presented in Table 11.

English language arts (reading)

Regression results indicate that, overall, when exposed to MAP at the school level and at the various grade levels, MAP statistically significantly predicted PARCC outcomes in ELA. At the elementary school level, when using the MAP reading spring test as the predictor, the regression results found that MAP performance statistically significantly predicted PARCC ELA outcomes, r^2=.600, r^2_{adj}=.600, F(1,4788)=7170, p<001. This model accounted for 60% of the variance in PARCC. At the middle school level, when using the MAP reading spring test as the predictor, the regression results found that MAP performance statistically significantly predicted PARCC ELA outcomes, r^2=.615, r^2_{adj}=.615, F(1,3252)=5190, p<001. This model accounted for 62% of the variance in PARCC. Similar but stronger results were found at the specific grade levels. For example, at the fifth grade level, when using the MAP reading spring test as the predictor, the regression results found that MAP performance statistically significantly predicted PARCC ELA outcomes, r^2=.656, r^2_{adj}=.656, F(1,1558)=2977, p<001. This model accounted for 66% of the variance in PARCC. Still, when looking at the seventh grade level, when using the MAP reading spring test as the predictor, the regression results found that MAP performance statistically significantly predicted PARCC ELA outcomes, r^2=.687, r^2_{adj}=.687, F(1,1109)=2436, p<001. This model accounted for 69% of the variance in PARCC. Likewise, when using the MAP ELA winter test (prior to testing in PARCC) as the predictor, similar but not as strong results were found across the school levels and at each of the grade levels. A summary of ELA regression coefficients is presented in Table 12.

Discussion

Simple regression analyses were conducted to determine the accuracy of MAP predicting PARCC outcomes. First, I examined the association between MAP and PARCC and found strong positive correlations at the school level, where Pearson's *r* fell between 0.68 and 0.76, and at each of the grade levels, where Pearson's *r* fell between 0.75 and 0.89, across elementary and middle school grades. Second, I explored the effect of MAP on PARCC and found, from the regressions, that MAP statistically significantly predicted PARCC outcomes in math and ELA, where between 56% and 80% of the variance in PARCC was accounted for at the various levels. Here, the suggestion is that as students increase their MAP scores there is a predictive capability to realize increased scores in PARCC. In other words, the higher the MAP scores are, the higher the PARCC scores will be. These findings are promising particularly as a baseline. Yet, the follow-on question, therefore; has to be, are the school level MAP expectations set high enough to maximize the full predictability of MAP on future PARCC outcomes? The latter is deserving of further exploratory analyses.

Recent NWEA publications on norms and associations between MAP and PARCC serve as an additional validation of this study. Here, NWEA establishes norms using a national dataset that extends educators efficient and accurate estimates of student achievement status with a subject area (NWEA, 2015a). To this, NWEA linked PARCC scale scores in ELA and math, across grades three through eight, with those of MAP math and reading assessments for the State of Colorado, and predicting the probability of attaining level 4 (at benchmark) on the PARCC (NWEA, 2016a). These NWEA studies and that of the present study are statistically aligned.

The implication of the present study suggests that expectations at the student, grade, and school level should be reviewed specifically to determine if the existing MAP expectations are appropriate enough to maximize significant gains in PARCC outcomes. Once again, the suggestion is made that the higher the MAP scores are, the higher the PARCC scores will be.

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