CHILD CARE'S EFFECTS IN THE LAS VEGAS VALLEY

Abstract

This paper tests the theory that child care availability contributes to academic success in school age children in the Las Vegas Valley. School zone level data that includes standardized test scores, child care seats available by school zone, and school demographic variables are analyzed. Summary statistics show the highest correlations are between test scores and a proxy for poverty, and test scores and the school's transiency rate. The number of available seats does not end up highly correlated, economically significant, or statistically significant relating to test scores. However, transiency rate had a greater effect on test scores than expected. Future research is needed to determine the extent of this relationship, the causes of transiency, and how best to ameliorate it to offset its negative impact on academic achievement.

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I. Introduction

This analysis was inspired by a project being designed at the United Way of Southern Nevada. They are collaborating with the Las Vegas Urban League to provide a business-in-a-box microfranchise opportunity to unlicensed in-home child care providers. Urban League subsidizes child care for many of the most economically insecure families in the valley, so the plan is to offer these providers a path to licensure, early childhood education training, resources to provide the children in their care quality educational experiences, and entrepreneurship education to run their fledgling businesses.

This project inspires the question: Does access to child care really provide a means of overcoming poverty for children in the Las Vegas Valley?

In order to answer this question, test score data and demographic data was collected from Las Vegas, North Las Vegas, and Henderson schools, as well as data from the state regarding licensed child care providers in these cities. Test score data was used as a proxy to predict future lifetime earnings based on academic achievement. Free and reduced price lunch is a proxy for the average number of children living in poverty at an elementary school, and available child care seats is a proxy to measure families' access to child care within a school zone.

II. Literature Review

In 2014, a study was conducted by Bassok and Latham using longitudinal data from the National Center for Educational Statistics.[1] Two cohorts were compared: the first begins with kindergarteners in 1998 and the second with kindergarteners in 2010. The study focuses on teacher-reported measures as the most accurate over time and across the two cohorts.

The results indicate that children in 2010 scored significantly higher in math and literacy skills than children in 1998, although the explanations for the changes are not straightforward.

Preschool participation did not account for these changes, and rich controls for home environment and kindergarten teacher characteristics only account for one-fifth to one-third of the changes. One explanation offered by the study is that the quality of the child care experienced by these children could have improved over time. Although the study notes that the data did not provide information on child care quality, there is documentation of substantial increases in public investment in formal child care.

Public policy researchers Noa et al conducted a benefit-cost analysis on early childhood education programs using 49 scientifically rigorous studies.[7] Their findings show positive effects of state and district pre-k, Head Start, and model programs on low income children. These effects include higher test scores, high school graduation rates, self-regulation, and emotional development. They also include lower grade retention, special education, crime, and teen births. The benefit-cost analysis showed a $4.20 return on every dollar invested in state and district preschool programs, and a $2.63 return on every dollar invested in Head Start.

Their findings also show a small positive correlation between higher student test scores and teachers holding bachelor's degrees or higher, as well as a small positive correlation between higher student test scores and classroom quality as measured by the Early Childhood Environment Rating Scale (ECERS-R). Neither of these correlations were statistically significant, though. The study recommends further scientifically rigorous research is needed to identify specific early childhood education components that will improve student academic outcomes.

III. Model

The variables used are Math (3rd grade scores for the Math CRT, a national standardized test Clark County School District students are required to take); Read (3rd grade scores for the

Reading CRT); Seats (the State of Nevada's reported capacity for licensed child care seats, geocoded to their school zone); TotStu (the total number of elementary students attending public school in a school zone); Spend (the dollars spent in a school divided by the number of students); ST (the number of students for every teacher at a school); IEP (the percentage of students at a school that have individualized learning plans); ELL (the percentage of students at a school who are English language learners); FRPL (the percentage of students at a school who qualify for free and reduced priced lunch); and Tran (the percentage of the school population that has moved from school year to school year; the transiency rate).

The following table shows the variables used with brief descriptions and the signs they are expected to have in relation to the tests' scores.

Table 1: Expected Signs

Variables	**Definition**	**Expected Signs**
Dependent Variables		
Math Reading	Average CRT test score in 3rd grade at individual elementary schools	
Independent Variables		
Seats	Number of child care seats available within a school zone	(+)
TotStu	Total number of elementary students	(-)
Spend	Dollars spent per pupil	(+)
ST	Number of students per teacher in 3rd grade	(-)
IEP	Number of students with an IEP	(-)
ELL	Number of English language learners	(-)
FRPL	Number of students that qualify for free or reduced price lunches	(-)
Tran	Transiency rate	(-)

School data from outlying communities within Clark County School District was omitted due to the difference in population density between these areas and the areas of interest: Las Vegas, North Las Vegas, and Henderson. Also omitted is data from school zones that did not report their 3rd grade CRT scores for both Math and Reading in the 2013-14 school year. Schools reporting one or the other are included in the regression for the test where scores are reported, but omitted from the regression for which no scores were reported. Charter schools and private schools are not included as they do not have zoning areas. This fact would limit the model's ability to explain test scores with child care information geocoded to a school zone.

IV. Descriptive Statistics

The following section will be summarizing the data for the Criterion-Referenced Tests (CRT) in Math and Reading and the childcare seats available in the corresponding school zones. Table 2, on the next page lists the number of observations in the data followed by the mean, the minimum and maximum values and the standard deviation for each variable. The data includes 169 individual observations in total, omitting the observations that lack Math test scores. The average Math score observed in 3rd grade at the elementary schools was 321.5, with a minimum of 259.6 and 391.2 observed as the maximum. Also observed is that the average number of child care seats available was 148, with some school zones having no child care seats and one having the maximum of 1103 child care seats.

Table 2: Math Summary Statistics

VARIABLES	N	mean	sd	min	max
Math	169	321.5	23.53	259.6	391.2
Seats	169	147.6	203.5	0	1,103
TotStu	169	713.0	152.7	326	1,211
Spend	169	8,359	1,231	6,303	14,881
ST	169	19.62	2.669	14	28
IEP	169	12.44	2.642	5.870	20.94
ELL	169	24.99	17.00	2.310	60.19
FRPL	169	63.40	24.59	8.450	100
Tran	169	28.85	9.609	5	51.50

Table 3 below, similar to table 2 above, lists the number of observations in the data followed by the mean, the minimum and maximum values, and the standard deviation for each variable. With all the information gathered, there are 170 individual observations after removing data from school zones missing Reading CRT scores. The average Read score observed in 3rd grade at the elementary schools was 310.1, with a minimum of 216.2, and 397.6 observed as the maximum. Also observed within the data is that the average number of child care seats available was 153, with some school zones having no child care seats and one school zone having a maximum of 1103 child care seats available.

Table 3: Reading Summary Statistics

VARIABLES	N	mean	sd	min	max
Read	170	310.1	29.84	216.2	397.6
Seats	170	152.8	208.9	0	1,103
TotStu	170	714.2	154.1	326	1,211
Spend	170	8,370	1,232	6,303	14,881
ST	170	19.62	2.670	14	28
IEP	170	12.58	2.671	5.770	20.94
ELL	170	24.91	17.41	2.310	67.39
FRPL	170	63.34	24.90	8.450	100
Tran	170	28.89	9.659	5	51.50

Table 4 below is a correlation matrix that shows the relationship each variable has to the Math scores. The table is used as a reference point to test the expected signs, and the predictions

made in the previous section were all correct with the exception of Spend. The expectation was that dollars spent per pupil would increase as the CRT scores increased due to the assumption that per pupil spending will raise the quality of education offered and thereby the test scores, but the correlation was not in agreement with expectation. This is likely due to the fact that schools in high poverty zones receive additional monies from the federal and state governments that drive up the per pupil spending. Students in these areas still struggle to overcome the academic disadvantages resulting from poverty, though, so their scores remain comparatively lower than those at more affluent schools.

The strongest correlation was negative and between the test scores and free and reduced price lunch. This fits with the expectation that poverty level remains the strongest indicator of academic success among school age children. Transiency rate is the next strongest negative correlation, demonstrating the power of educational consistency's connection to academic achievement.

Table 4: Math Correlation Matrix

Variable	Math
Seats	0.1982
TotStu	0.2095
Spend	-0.4242
ST	-0.0243
IEP	-0.2855
ELL	-0.6253
FRPL	-0.7809
Tran	-0.6656

The next two figures (Figure 1 and Figure 2) are scatter plots depicting the relationship between Math Test Scores and Number of Child Care Seats, and Transiency Rate. The Math Test Score v. Number of Child Care Seats is consistent with the results thus far. There is a slight upward trend in the plot which represents rising Number of Child Care Seats with rising Math

Test Scores, which shows the positive correlation. The flatness of this line is indicative of the weakness of the relationship, though.

Figure 1: Math CRT Score and Number of Child Care Seats

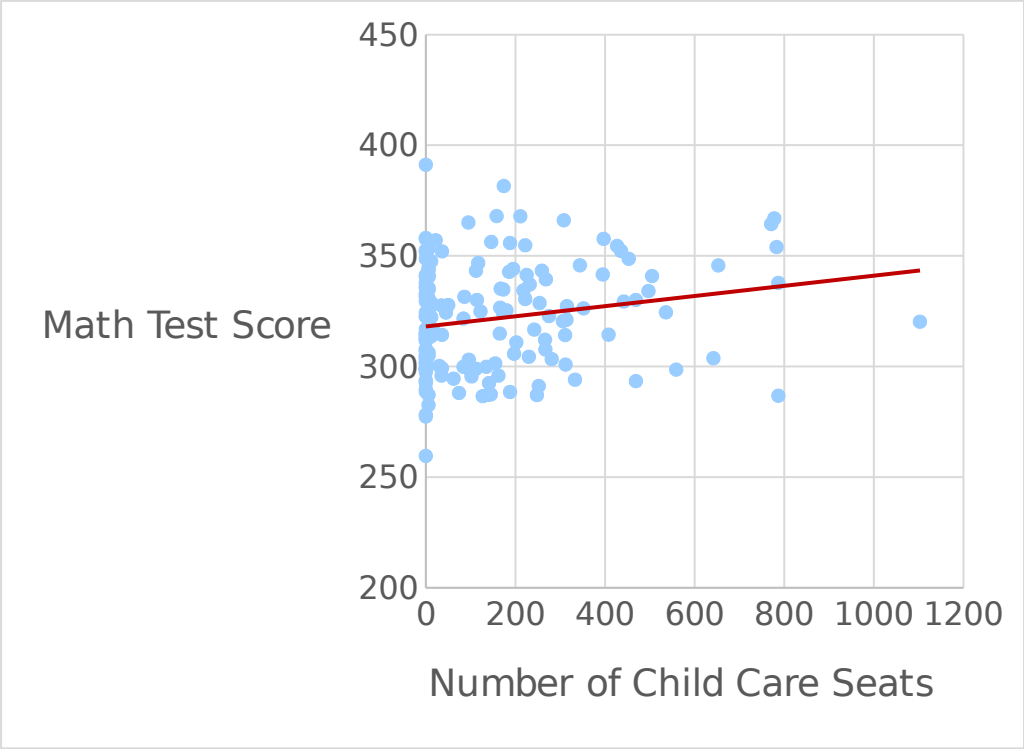


Figure 2, which represents the relationship between Math Test Scores and Transiency Rates also provides consistent results with what was found earlier. There appears to be a strong downward sloping trend as Transiency increases, although a few outliers are slightly skewing the data.

Figure 2: Math CRT Scores and Transiency Rate

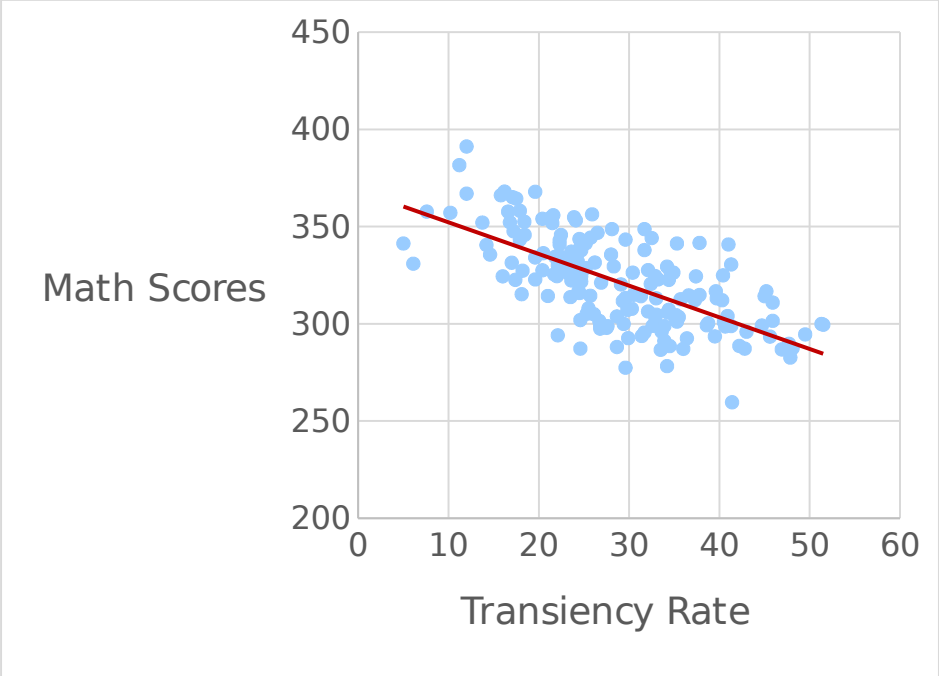


Table 5 below shows the relationship that each variable has to one another when observing the Reading scores. The table is used as a reference point to the expected signs, to determine if the predictions made were true. The predictions made in the previous section were all correct with the exception of Spend, as also noted above in the Math Correlation Matrix.

Table 5: Reading Correlation Matrix

Variable	Read
Seats	0.2008
TotStu	0.1871
Spend	-0.4464
ST	-0.0045
IEP	-0.2206
ELL	-0.7002
FRPL	-0.8211
Tran	-0.7104

The next two figures (Figure 3 and Figure 4) are scatter plots illustrating the relationship between Reading Test Scores and Number of Child Care Seats, and Transiency Rate. The

Reading Test Score v. Number of Child Care Seats is consistent with the results thus far. There is a slight upward trend in the plot which represents rising Number of Child Care Seats with rising Reading Test Scores, which is a weak positive correlation.

Figure 3: Reading CRT Score and Number of Child Care Seats

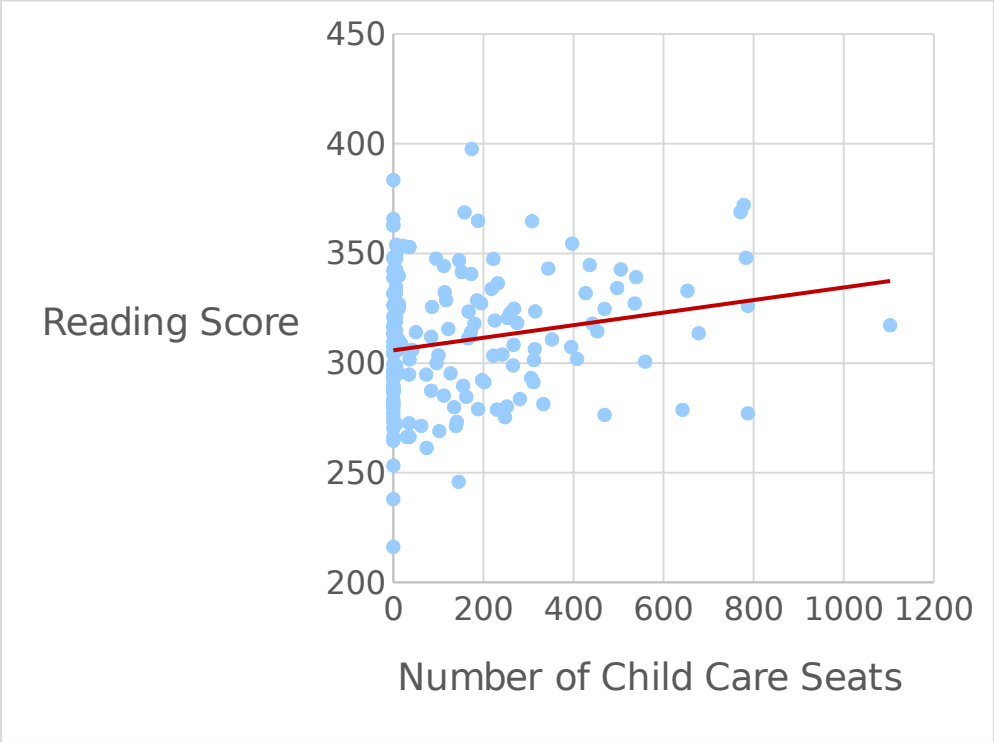
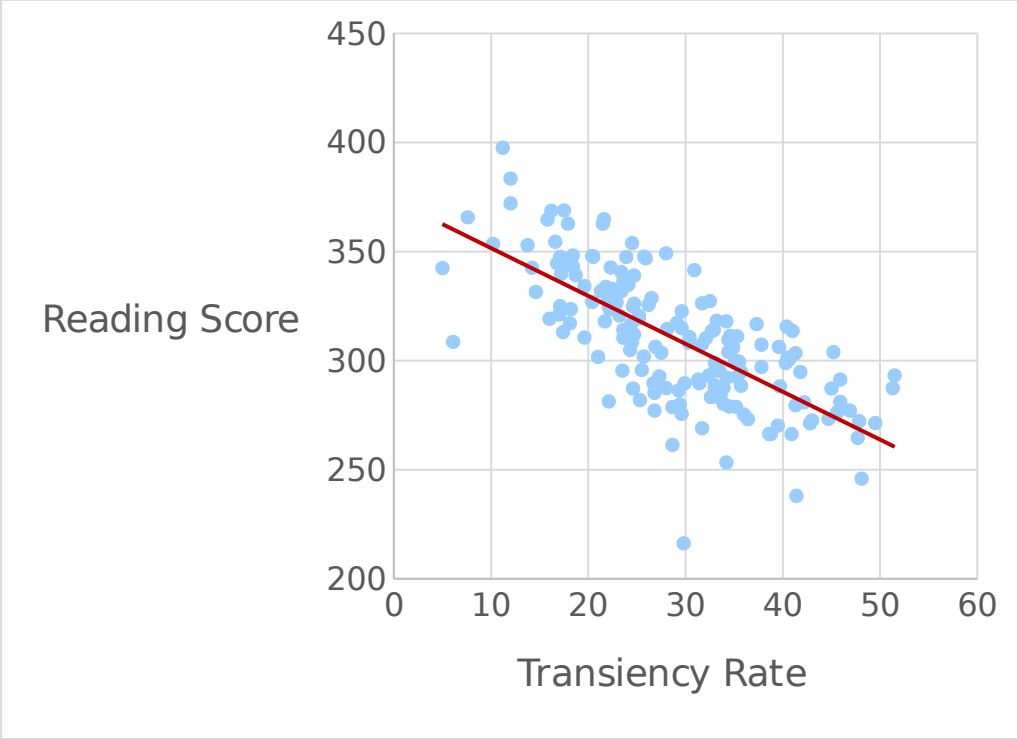


Figure 4, which represents Reading Test Scores v. Transiency Rates relationship, also provides consistent results with what was found earlier. There appears to be a steep downward sloping trend as Transiency increases. The relationships between these metrics and Reading test scores is nearly identical to those between these metrics and Math test scores, This suggests that the universal application of these variables on academic achievement is a reasonable assumption overall.

Figure 4: Reading CRT Scores and Transiency Rate



V. Empirical Results

Two OLS regressions were run: one with Math CRT scores regressed on the variables, and one with Reading CRT scores regressed on the variables. This was done to balance the data but discard the fewest observations and maximize accuracy of the predictions. The variable of interest is Seats, so CRT scores were regressed on it first to see its contribution to predicting academic achievement.

The other variables control for the total number of students in an elementary school, per student spending within a school, the number of students per teacher as a proxy for class size, school-level populations of students with special needs, English learners, students that qualify for free and reduced price lunches as a proxy for poverty at the school zone level, and elementary schools' transiency rates.

The data collected were measured using different scales, so the variables would not have an accurate interpretation in the analysis if a simple regression were run on them as given. For example, in the summary statistics, one can see that the range for Seats is 0 to 1,103, while ST ranges from 14 to 28. This means that the effects of Seats would outweigh those of ST in the analysis. In order to prevent this problem, the variables were standardized into equal units of measurement. The following formula was used to normalize the variables where $\acute{x}$ is the mean of x and sd is the standard deviation of x:

$$z1\,x = \frac{x - \acute{x}}{sd}$$

By standardizing the variables, the results can be measured as the number of standard deviations away from the mean. The new normalized variables' names are preceded by "z1." Table 4 shows the regression results for the standardized variables controlling for z1Math and z1Reading. Standard deviations are included so that the coefficients can be interpreted conveniently.

Table 4: Empirical Results

VARIABLES	z1Math	Math s.d.	z1Read	Read s.d.
z1Seats	0.027	203.5	0.021	208.9
	-0.047		-0.044	
z1TotStu	-0.002	152.7	0.031	154.1
	-0.065		-0.060	
z1Spend	0.046	1231	0.026	1,232
	-0.070		-0.066	
z1ST	-0.0980**	2.669	-0.062	2.670
	-0.048		-0.044	
z1IEP	-0.170***	2.642	-0.0913*	2.671
	-0.057		-0.052	
z1ELL	0.074	17	-0.080	17.41
	-0.109		-0.101	
z1FRPL	-0.708***	24.59	-0.561***	24.90
	-0.125		-0.115	
z1Tran	-0.194***	9.609	-0.262***	9.659
	-0.066		-0.061	
Constant	-0.001		0.002	
	-0.045		-0.042	
S.D. on Regressor		23.53		29.84
Observations	169		170	
R-squared	0.672		0.722	

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The expectation was that the regression would show the Seats variable driving up Math and Reading CRT scores. The results indicate a one standard deviation increase in Seats only increases Math CRT scores by 0.027 standard deviations and Reading CRT scores by 0.021 standard deviations. This is not economically significant as it is a less than 1 point increase in both math and reading scores (0.63 points) for an increase in child care capacity of over 200 seats. The table also shows the Seats variable does not have statistical significance, which means these results may not be accurate at predicting test scores based on availability of child care.

One variable that does carry high statistical significance for predicting both Math and Reading CRT scores is FRPL. This variable was correctly expected to be negative as it is a proxy for poverty. However, it is surprising how dramatically it is related to test scores. An increase of about 25 students qualifying for free and reduced price lunch at a school predicts a decline in the Math CRT score of 0.708 standard deviations, or -16.65 points on the test. For the Reading score, an increase of 25 students qualifying for free and reduced price lunches leads to a decrease of 0.561 standard deviations, or -16.74 points on the test.

Another variable carrying statistical significance is Tran. The regression output shows that the rate at which students move to and from a school does indeed predict a decline in CRT scores. For Math scores, a transiency rate hike of one standard deviation (9.6%) reduces scores by about 4.5 points. Reading scores drop by 7.8 points when transiency rates increase by one standard deviation (9.7%).

VI. Conclusion

The R-squared shows that about 70% of the variation in test scores is explained by these two models. However, there are limitations to the models. The most obvious is that four of the nine variables in the models lack statistical significance at the 90% confidence level. This could be due to the mean transiency rate for the schools in the data set being nearly 29%. This high percentage of students moving to and from schools could reduce the accuracy of the variables tracked at the school level, like child care seats, total students at a school, and ELL.

The transiency rate does seem to be a logical explanation for the lack of statistical significance in the variable of interest, Seats, as well. If the population of students is moving between schools at a high rate, the relationship between the number of available child care seats in a school zone and standardized test scores becomes weaker. However, it is recognized that the

model imperfectly relates 3rd grade test data from the 2013-2014 school year to child care seats available in 2016. The State of Nevada does not report data on child care availability from previous years, though, so this limitation could not be overcome in this project.

These problems could be ameliorated if random preschool children across the valley could be tracked as they age. To date, there is no system in place to randomly track Clark County children before they enter public school, though. Another necessary component of this analysis would be to collect panel data on available child care seats by licensed providers. This should be collected over the years the cohort was aged to be in preschool care, so from birth to about 5 years old. Acquiring these data sets should yield results with variables that have higher statistical significance.

Despite these limitations, the regression analysis has yielded some very telling results. Nearly of equal importance as poverty rate for predicting variation in test scores is transiency rate. Common theory is that this is an important factor in determining test scores for schools; however, the magnitude of the coefficient was higher than anticipated. Further study should be conducted to determine the reasons for the high rates of transiency in the Las Vegas Valley. These results could drive the development of future programs that aim to reduce this rate, establish academic stability in key areas of the valley, and test the effects of the programs on the increase of Reading and Math standardized test scores going forward.

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Data

Nevada Report Card
http://nevadareportcard.com/di/

Nevada Division of Public and Related Health
http://dpbh.nv.gov/uploadedFiles/dpbh.nv.gov/content/Reg/childCare/Folders/Providers/Facility_List_March_2016.pdf