

Differences in Graduation Rates at NM GRADS Sites and Factors Affecting Them

Destiny Graham

New Mexico Tech

Executive Summary

The NM GRADS program is a program implemented in multiple high schools across the state of New Mexico, targeting school-age parents and providing them the support and education needed to finish their high school degree. An important measure of success for the program is the graduation rates at each site. To better understand what may affect the graduation rates of the program, we investigated how different on-site programs affect the graduation rates, as well as some other factors that may have an effect.

The sites offer many different kinds of support, including programs such as childcare, GRADS Dads, which is a program specifically for young fathers, and case management. These programs are provided on an as-needed basis. Analysing whether or not sites had the above on-site programs, we found that none of the programs had a significant impact on the graduation rates of the program.

Looking at the graduation rates of sites that are currently open only, we found that there was a significant difference of graduation rates between sites. To further explore this, we looked at the type of school each site is located at and found no significant difference between school types. Furthermore, we explored the average household income within the county subdivision each site is located in, and found no significant correlation with graduation rates. Next, we looked at the ethnicity and race statistics for the city each site is located in, and did not find any significant impact on graduation rates. Finally, we found that the overall graduation rates at the schools the sites are located at could not be used to explain the graduation rates of the NM GRADS program. From these results, we concluded that the difference in graduation rates at the sites are caused by a factor that we did not look at and possibly hasn't been quantified yet, such as the level of dedication each GRADS teacher has to their students.

One significant limitation of this study is that the data collection is limited, and there is no comparison group available. Due to this, the only inferences that can be made are between sites. We recommend that the NM GRADS begin collecting more extensive data both within their program and similar groups of students outside of the program to fully

understand the impact the program has on the communities they are located in.

1 Introduction

The NM GRADS program is a specialized program implemented in select high schools across the state, providing support for young parents that are still in secondary school. This support includes equipping participants with the skills they need to be a successful parent, supporting them inside and outside of the classroom, and preparing them for college or careers. On top of supporting young parents still in school, they also try to recruit school-age parents who have dropped out [4].

The program offers a wide variety of on-site programs, including GRADS instructional, childcare, case management, and the GRADS Dads initiative. GRADS classes are offered to young parents to help promote healthy relationships with their children and partners [4]. Onsite childcare is offered at many sites, which allows the students to bring their children to daycare and attend class on the same campus. Case management is also offered at some sites. Case managers are one or two workers located at each site that provide emotional support to the students and direct them to the resources they may need (such as Medicaid, childcare funding, and Special Supplemental Nutrition Program for Women, Infants, and Children) [4]. Case managers also focus on improving participants' attendance and academic performance [4]. Occasionally, the GRADS instructor may take on the additional role of case manager if there is a need for it. Finally, some sites offer GRADS Dads, which provides support to young fathers specifically, allowing them to connect with a father figure [4].

One important goal of the program is to see the young parents through graduation. It is important to know which factors are affecting the graduation rates at the sites, and what kind of effect the factors are having. The expectation is that implementing childcare, case management and the GRADS dads program at the sites would correlate positively with the graduation rates. However, outside factors may also be affecting the graduation rates at the sites, such as economic status and race and ethnicity statistics in each area.

2 Data Overview

The raw data used in the analysis includes the school year, site location, names of students scheduled to graduate, and whether or not they graduated or got the GED. For this data, a 1 was used if the student graduated or completed the GED and a 0 was used if the student dropped out. Some students did not graduate the year they were scheduled and graduated later. For these students, they are listed as a 1 the year they graduated and are not included the year they were initially scheduled to graduate. The data covers 6 graduation years: 2010 through 2016. Using the student data of 0 or 1, we calculated the graduation rate per site per year to use in the analysis. Since the number of students

graduating per year varied significantly between and within sites, we used the number of students scheduled to graduate that year per site as a weight for the graduation rate.

Site factors included in the analysis were whether or not the site had GRADS instructional, daycare on site, GRADS Dads program, or case management available. A 1 was used if the site provided the program that year, and a 0 was used if the site did not. However, every site that provided graduation data had GRADS instructional onsite, so it was not included in the analysis.

Additional data for sites that are currently open are the type of school the site is located in (public, charter, or alternative) [6], the mean household income from 2010-2015 for the county subdivision each site is located in [7], and the ethnicity and race statistics for the city each site is located in from 2013-2018 [8]. To analyze the economic status, we assume that the average household income of the county subdivision the school is located in is a good representation of average household income at the site. Furthermore, we assume that the ethnicity and race statistics of the city the school is located in are a good representation of the ethnicity and race statistics of each site. Furthermore, we use the graduation rates of each school the sites are located at for the school years 2009-2010 through 2015-2016, compiled from the New Mexico Public Education Department database [3].

3 Results

3.1 Analysis on All Sites

First, linear regression was performed with all site factors. We found that none of the predictors were statistically significant. The only term that was significant was the intercept, 0.86. Performing linear regression with each site factor individually, we received the following results:

Predictor	Intercept	Slope	Slope 95% CI	Significance
Childcare	0.82	0.01	[-0.05, 0.08]	$p = 0.73$
GRADS Dads	0.85	-0.07	[-0.12,-0.01]	$p = 0.018^*$
Case Management	0.85	-0.06	[-0.10, -0.01]	$p = 0.027^*$

By themselves, case management and GRADS dads lowered the graduation rate. Looking at the effect size of each predictor using Cohen's f^2 statistic, we found that the effect size of both case management and GRADS dads were small ($f^2 = 0.03$ in both cases) [1]. After the initial analysis on site factors, linear regression was performed with interaction terms. Multiplying the terms, 0 is defined as one or none of the factors on site, and 1 is defined as both predictors are on site:

Predictor	Intercept	Slope	Slope 95% CI	Significance
CM x Dads	0.85	-0.07	[-0.12,-0.01]	$p = 0.013^*$
CM x Childcare	0.84	-0.03	[-0.08,0.02]	$p = 0.24$
Dads x Childcare	0.84	-0.04	[-0.10,0.02]	$p = 0.23$

From the results, it looks like there is a significant negative correlation between Graduation Rates and whether or not the site has Grads Dads and Case management. The effect size of the interaction term was small, however ($f^2 = 0.04$) [1].

3.2 Analysis on Current Sites

3.2.1 Linear Regression Analysis on Site Factors

The initial data included all sites that were open in the given school year, including sites that are no longer open. Only looking at the sites that are currently open, we get similar results as before. No predictors were statistically significant and the intercept was very significant with a value of 0.856. Performing the linear regression with predictors individually, we receive the following results:

Predictor	Intercept	Slope	Slope 95% CI	Significance
Childcare	0.82	0.004	[-0.07,0.08]	$p = 0.91$
GRADS Dads	0.84	-0.06	[-0.12,-0.005]	$p = 0.034^*$
Case Management	0.84	-0.05	[-0.11,0.001]	$p = 0.057^*$

GRADS Dads and case management correlates with lower graduation rates. Looking at the effect size of Grads Dads using Cohen's f^2 , we get that there is a small effect size ($f^2 = 0.03$) [1]. Looking at the effect size of Case Management, we see a similar effect size ($f^2 = 0.03$). Performing a linear regression on the interaction terms of the programs offered at current GRADS sites:

Predictor	Intercept	Slope	Slope 95% CI	Significance
CM x Dads	0.84	-0.08	[-0.14,-0.02]	$p = 0.013^*$
CM x Childcare	0.83	-0.02	[-0.08,0.04]	$p = 0.45$
Dads x Childcare	0.83	-0.03	[-0.10,0.03]	$p = 0.32$

The only statistically significant interaction term is Case Management x GRADS Dads. It correlates negatively with the Graduation Rates and has a small-medium effect size ($f^2 = 0.05$) [1]. Since these programs are offered on an as-needed basis at the sites, more analysis needs to be done to see if the programs improved graduation rates at sites they were implemented at for certain amount of time.

3.2.2 Linear Regression for the GRADS Dads Program

Looking at sites that did not have the Dads program and then had it for at least two consecutive years, we performed linear regression with the graduation rates and the GRADS Dads predictor. We found that there was an intercept of 0.84 ($p < 10^{-16}$), and a slope of -0.029. However, the predictor was not significant. We can conclude there is no statistically significant correlation between graduation rates and implementing GRADS dads.

3.2.3 Linear Regression for Case Management

Looking at sites that did not offer case management and then offered it for at least two consecutive years, we performed a linear regression with the Graduation rates and the CM predictor. We found that there was an intercept of 0.82 ($p < 10^{-16}$ *), and a slope of -0.0079. The predictor was not significant. We can conclude there is no statistically significant correlation between graduation rates and implementing case management.

3.2.4 Analysis of Variance at Current Sites

Performing an analysis of variance with current sites and their graduation rates without any of the predictors, we get that there is a significant difference in means between the sites ($p = 0.0072$ *). The effect size calculated by η^2 is 0.30, which is a large effect size (95% CI [0.05,0.31]) [2]. At least 30% of the change in graduation rates is explained by the different sites. Due to the large effect size, it looks like the difference in graduation rates may be from fundamental differences in the sites and not due to the supplemental programs offered at select sites. Looking at the box plot, we can see a few sites had significantly lower averages.

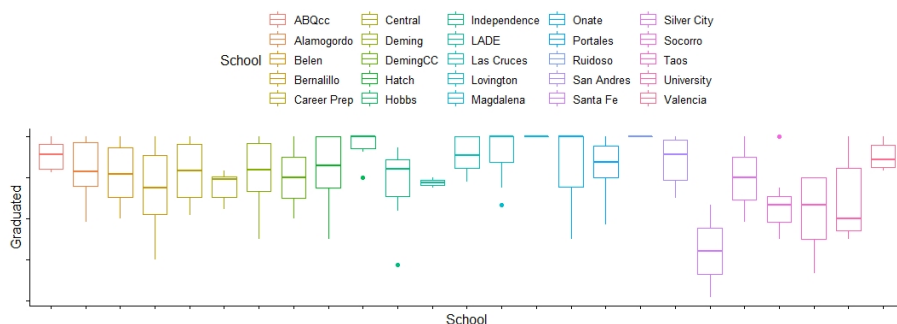


Figure 1: Box Plot of Graduation Rates at Current Sites

3.2.5 Analysis of Variance for School Type

Looking at the type of school the site is located at, we found that there was not a significant difference in means ($p = 0.101$). We can conclude that the type of school the site is located at does not significantly correlate with a difference in graduation rates.

3.2.6 Analysis of Variance for School Year

Looking at the school year as a factor for an ANOVA, we found that there was a slight significant difference in means ($p = 0.075$ *). However, the effect size is small ($\eta^2 = 0.02$, 95% CI [0.0,0.08]).

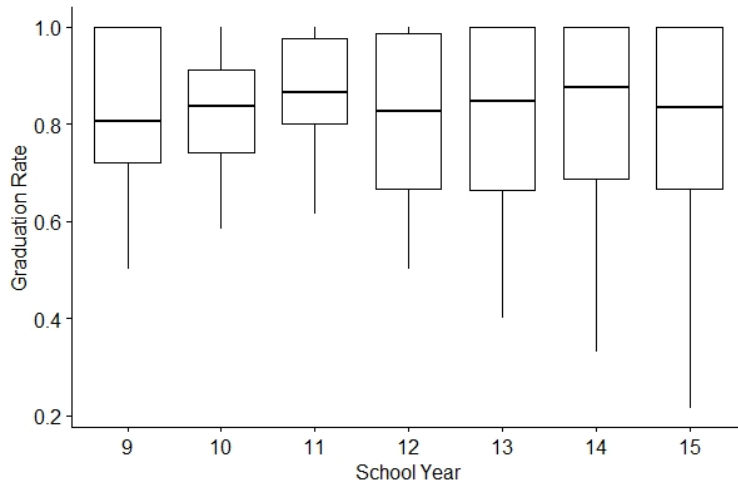


Figure 2: Box Plot of Graduation Rates for Each School Year

Looking at the box plot, we believe that the difference in each school year may be due to the extreme outliers, especially in the later years. Due to the small effect size, we looked at a two-way ANOVA between school year and site location. We found the following results:

- Site location was statistically significant ($p = 0.003^*$, partial $\eta^2 = 0.38$)
- School year was statistically significant, but the effect size small ($p = 0.038^*$, partial $\eta^2 = 0.05$)
- The interaction term between site location and school year was statistically significant and had a large effect size ($p = 0.011^*$, partial $\eta^2 = 0.33$)

The statistical significance of the interaction between school year and site location indicates the significance of the relationship between school year and graduation rates depends on the site.

Due to the relationship between school year and site location, we take look at some of the sites' graduation rates over the years. Looking at the plot, it seems as if some sites had a fairly steady graduation rate then had a sudden drop before increasing again.

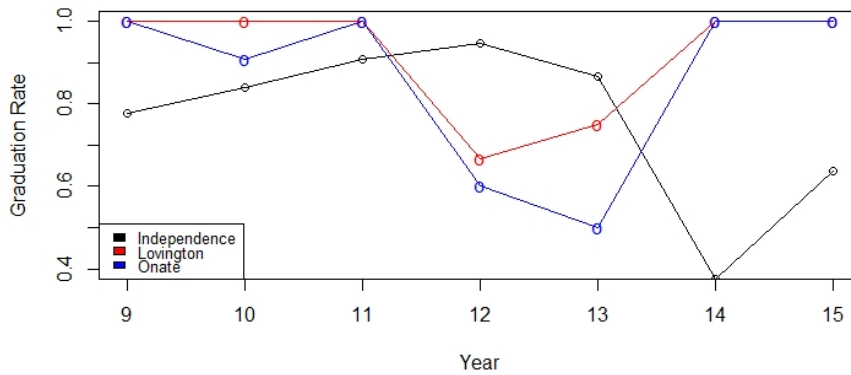


Figure 3: Graduation Rates at Certain Sites Throughout the School Years

3.2.7 Linear Regression of Average Household Income Per County Subdivision

Looking at the 2010-2015 5-year average household income Census Data for the county subdivision that each site resides in, we found that there's an intercept of 0.76 ($p < 10^{-16*}$), and there was no significant effect of income on graduation rates.

3.2.8 Linear Regression on Ethnicity and Race Data

Performing linear regression on the ethnicity and race statistics of each site, we get the following results:

Predictor	Intercept	Slope	Slope 95% CI	Significance
Hispanic %	0.78	0.08	[-0.05,0.21]	$p = 0.21$
White %	0.80	0.07	[-0.12,0.25]	$p = 0.48$
Native American %	0.83	-0.07	[-0.16,0.03]	$p = 0.17$

In this case, no ethnicity factors are statistically significant on their own. However, performing linear regression on the interaction terms, we get the following results:

Predictor	Intercept	Slope	Slope 95% CI	Significance
White x Hispanic	0.79	0.22	[-0.19,0.62]	$p = 0.29$
White x N.A.	0.84	-1.5	[-3.0,0.04]	$p = 0.056^*$
N.A. x Hispanic	0.84	-1.0	[-1.95,-0.04]	$p = 0.040^*$

The effect size of White Percentage x Native Percentage is small ($f^2 = 0.03$) and the effect size of Native Percentage x Hispanic Percentage is small as well

($f^2 = 0.03$) [1]. Despite being statistically significant, the effect of each predictor is very small.

3.2.9 Comparing School and Site Graduation Rates

To better understand the graduation rates at the GRADS sites, we compare them to the graduation rates at the schools they are located at. The average graduation rate of the schools was 63.4%. This is quite a bit lower than the average graduation rate of the program, 81.6%. To see if this difference is significant, we perform a paired t-test, as the data is not independent [5].

First, we check if the difference in graduation rates follow a normal distribution [5]. To check the normality, a Shapiro-Wilk test is performed. Performing the test with $\alpha = 0.05$, we find that the differences follow a normal distribution ($p = 0.074$). Now, we perform the following hypothesis test:

$$H_o : \mu_{GRADS} - \mu_{Schools} \leq 0$$

$$H_a : \mu_{GRADS} - \mu_{Schools} > 0$$

Performing a paired t-test, we reject the null hypothesis ($p < 10^{-12^*}$). The mean graduation rate of the GRADS program is higher than the mean graduation rate of the schools (95% CI [0.137, 0.225]).

Next, we perform a linear regression to see if we can predict the graduation rates of the GRADS program using the graduation rates of the schools. Performing a linear regression with the schools' graduation rates as a predictor, we find that the intercept of 0.80 is significant ($p < 10^{-15^*}$), while the slope of 0.025 is not ($p = 0.70$).

4 Discussion

In all sites and just current sites, we found that individually, case management and GRADS Dads correlated with lower graduation rates. However, the size of effect both predictors had on graduation rates were small, and could possibly be explained by a different factor. Furthermore, we found that if a site had both case management and GRADS Dads, the graduation rate went down. The size of the effect of this interaction, however, was also small.

To look further in depth at the GRADS Dads program, we analyzed sites that did not have the program initially, and then had it for at least two consecutive years. We found that implementing the GRADS Dads program did not significantly affect the graduation rate at these sites. Similarly, we analyzed programs that did not have case management and then implemented it for at least two consecutive years. We found that case management did not significantly affect the graduation rate at these sites.

Performing an ANOVA on the current sites to see if there was a significant difference in graduation rates for each site, we found that the difference in graduation rates was very significant. Furthermore, the size of the effect was

very large. We found that an estimated 30% of the difference in graduation rates can be explained by the different sites.

Delving deeper to see if this difference could be explained by some outlying factor, we looked at school types to see if there was a significant difference in graduation rates for each school type. We found that there was no significant difference in graduation rates between the three types. Furthermore, we analyzed the average household income in the county subdivision each site was located in, and found that average household income did not have a significant effect on graduation rates.

Looking at the ethnicity and race data for the city each current site resides in, we found that the interaction terms between White percentages and Native American percentages as well as between Native American percentages and Hispanic percentages were statistically significant, however the size of the effect either interaction term had on graduation rates were small.

To better understand the GRADS program's graduation rates, we compared school graduation rates with the program graduation rates. Using a paired t-test, we found that the mean graduation rates of the GRADS program was higher than the mean graduation rates of the schools themselves. However, the schools' graduation rates is not a significant predictor when trying to predict the GRADS program's graduation rates.

These results were fairly unexpected. We were expecting site factors such as childcare, case management, and the GRADS Dads programs to increase graduation rates. However, we found that these factors had no significant impact on graduation rates. Furthermore, we expected lower average household income to correlate with lower graduation rates at the sites. We found that there was no significant impact on graduation rates. It was found that significant differences in graduation rates could be explained by the different sites. Exploring this further, we found that this was not due to school types. Looking at race and ethnicity statistics, we found that none of these had a significant impact on the graduation rates at the sites. Furthermore, we found that the sites' graduation rates could not be explained by the school's graduation rates. Based on this, we recommend that the GRADS program explore the site differences more closely to see if there is an underlying factor that causes the differences in graduation rates between the sites. The differences between sites may be from a difference that hasn't been quantified yet, such as the dedication the GRADS teachers commit to the program or the level they are able to connect with their students.

There are several limitations to this analysis. We were unable to analyze specific household income data and ethnicity and race statistics at these sites due to the lack of information available. To analyze the economic status and ethnicity and race statistics at these sites, we assumed data that came from a more general source represented the statistics at the individual sites well. Finally, due to the lack of data, individual student differences could not be compared.

A total of 29 statistical tests were performed. Many of those tests were statistically significant. However, due to the amount of statistical tests that

were conducted, it is important to note that some of the results may have been significant by chance [9]. Additional methods may need to be implemented to deal with this problem, such as a Bonferroni correction [9]. With the exception of the difference between sites, most tests that were statistically significant had small effect sizes, thus appearing to have little practical significance. Using a multiple testing correction, we would likely see that many, if not all, of these tests are not statistically significant at all. Due to the very small p-value and large effect size, we believe that the difference between sites did not happen by chance. However, with the data available, we could not find an explanation for the difference between sites, and thus we recommend that further analysis be done in an attempt to identify a possible cause of the differences.

The data collected by the NM GRADS program is helpful to see how the program is doing and what needs to be improved, however there are several limitations to the data. As discussed by Harper et al., if a participant drops out or transfers out of the district, the participant is no longer tracked by the program. Furthermore, there is not a comparison group to use when looking at the success of the program as a whole. More rigorous data collection would be helpful to see how the program has impacted its participants in comparison to a similar group of participants who did not have access to the program [4]. With this in mind, we recommend that the NM GRADS program begin collecting more rigorous data within the program and outside of the program to evaluate the program outcomes and the effectiveness of the program.

5 Conclusion

NM GRADS is a young parenting program located at multiple high schools across the state. The program aims to support young parents in and outside of the academic setting to help them become successful parents. They implement multiple programs at these sites, including GRADS instructional, case management, onsite childcare, and GRADS Dads. The expectation was that implementing these programs at the sites would correlate with higher graduation rates. We found that these programs do not have a significant impact on graduation rates within the program, but still provide additional support to the young parents. However, there is a significant difference in graduation rates between sites. We found that this could not be explained by school type, average household income, race and ethnicity statistics, or the overall graduation rates at the schools the sites are located in. Furthermore, we found that the mean graduation rate of the NM GRADS program was higher than the mean graduation rate of the schools the sites are located at. However, we could not predict the program's graduation rates using the schools' graduation rates. More in-depth data collection may be needed to be able to explain the difference in graduation rates between sites. There may be an underlying factor that affects the graduation rates at the sites that has yet to be quantified, such as differing effectiveness of the GRADS teachers at the individual sites.

References

- [1] Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. Hillsdale, NJ: L. Erlbaum Associates.
- [2] Fritz, C. O., Morris, P. E., Richler, J. J. (2012). Effect size estimates: current use, calculations, and interpretation. *Journal of experimental psychology: General*, 141(1), 2.
- [3] Graduation Data. (2020, September 11). Retrieved December 12, 2020, from <https://webnew.ped.state.nm.us/bureaus/accountability/graduation/>
- [4] Harper, J., Hopper, D., Keating, B., Harding, J. (2020). NM GRADS: Lessons learned from implementing a school-based program for young parents across New Mexico. *Maternal and Child Health Journal*, 24(2), 163-170.
- [5] Rietveld, T., van Hout, R. (2017). The paired t test and beyond: Recommendations for testing the central tendencies of two paired samples in research on speech, language and hearing pathology. *Journal of Communication Disorders*, 69, 44-57.
- [6] NM PED (2020). Graduation Data. Retrieved from <https://webnew.ped.state.nm.us/bureaus/accountability/graduation/>
- [7] U.S. Census Bureau (2015). Mean Household Income (Dollars), 2010-2015 American Community Survey 5-year estimates. Retrieved from <https://data.census.gov/cedsci>
- [8] U.S. Census Bureau (2018). American Community Survey 5-year estimates. Retrieved from Census Reporter Profiles. Retrieved from <http://censusreporter.org/>
- [9] Wasserman, L. (2004). Hypothesis Testing and p-values. In *All of statistics a concise course in statistical inference* (pp. 165-168). New York, New York: Springer.