REA
Research · Evaluation · Assessment

Effect of Project GRAD on High School Graduation, Post-secondary Enrollment, and Post-Secondary Completion in Knox County Schools

Technical Report

Steven Rudder
Senior Data Analyst
Knox County Schools
Department of Research, Evaluation, and Assessment

August 2017

Overview

Project GRAD Knoxville (PGK) is a nonprofit organization that endeavors to increase educational attainment and provide support for disadvantaged students from kindergarten through post-secondary completion. Project GRAD Knoxville has partnered with Knox County Schools and Great Schools Partnership since 2001 to provide personnel, programs and services to students at fourteen school locations. These schools range from the elementary to high school level. Within these schools, PGK engages in a variety of activities and employs full time school-based staff to support three primary strategic goals: 1) to increase knowledge of post-secondary options, 2) to increase high school graduation rates, and 3) to increase post-secondary enrollment and completion.

The programs and activities provided to students via PGK are wide ranging and vary across school sites. At the elementary and middle school levels, emphasis is placed on student and family support to address problems that could impede students' future success. Some examples of the activities that PGK engages in are parent workshops, student enrichment activities, before and after school programming, coordination of access to community agencies, and academic tutoring and mentoring. At the high school level, some of PGK's initiatives provide student academic support, college application assistance, and organization of college visits for students. PGK also helps students with scholarship research and assistance, organizes ACT and FAFSA workshops, summer institutes, and awards scholarships up to $4000 to qualifying students.

During SY1617, Project GRAD schools impacted 6858 students which was about 11% of the enrollment of all Knox County Schools. Approximately 86% of students within project GRAD were classified as economically disadvantaged in SY1617, compared to 40% outside of the fourteen PGK sites. Project GRAD schools also had higher proportions of English Language Learners (PGK = 9%, non-PGK = 3.4%) and students with disabilities (PGK = 16.4%, non-PGK = 13%). PGK schools also serve a much more racially diverse population of students than that of non-GRAD schools. The program appeared to be reaching its target population by serving some of the most at-risk and traditionally underserved student populations within Knox County schools.

Knox County Schools has been a major funding partner to PGK since the partnership between KCS and PGK was formed but there have been few evaluation efforts to date. This study addresses the three main goals of Project GRAD through the following research questions:
1) What effect has PGK had on high school graduation rates at Fulton and Austin East High schools?
2) What effect has PGK had on post-secondary enrollment?
3) What effect has PGK programming had on post-secondary completion?

Data

The data used in this study was obtained from several sources. All student demographic, academic, and high school graduation data were extracted from the Knox County Schools student information system (Aspen) and the KCS data warehouse (EMIS). Post-secondary enrollment and completion was determined from a data file sent by the National Student Clearinghouse (NSC). Lastly, student participation as a Project GRAD scholar was determined from data sent ton Knox County Schools by PGK. It is important to note that many, but not all, post-secondary institutions participate in the National Student Clearinghouse. Over 97% of all Title IV institutions report to the NSC, but it is possible that some PGK students enrolled in institutions that do not report to NSC. All statistical analysis were conducted using Tableau 10.0 and RStudio 1.0.153.

Methods

Many of Project Grad Knoxville's efforts, though not all, are school-wide initiatives and available to all students at PGK schools. Participation is broad-based so any effects from these types of activities can be thought of as overall program effects. At the program level, logistic regression models were employed to determine the effect that being enrolled in a PGK high school had on the likelihood of a student receiving a regular education diploma or enrolling in a post-secondary program. After the model was constructed, the models' fit and accuracy were assessed and a power analysis was conducted to determine effect sizes.

Effects of Project GRAD programming were considered separately for students that were part of the PGK scholars program. The scholars program was evaluated separately since it is a more focused program that is designed to target post-secondary enrollment and completion. While students are in high school, the program provides students with annual post-secondary experiences, regular monitoring of academic progress, counseling, and mentoring. After high school, students that successfully met certain criteria during their high school years are eligible for academic scholarships.

Estimation of the effects that PGK scholars programming was difficult due to concerns with selection bias. Since student participation in these programs is not randomly assigned, the factors that are used to recruit students into the program are likely related to the outcome measures. A propensity score matched-pairs design was used in an attempt to limit the bias that may have resulted from the selection process. A logistic regression was employed at the participant level to calculate an estimate of the probability that a student was a PGK scholar participant (propensity score). One-to-one nearest neighbor matching was then used to find the closest match between participants and non-participants which resulted in equal size control and treatment groups with similar characteristics. Chi-squared tests were then carried to determine if there was a difference in the post-secondary enrollment and completion between PGK Scholars and the control group.

Results: Overall Program Effects

In the state of Tennessee, graduation rates are calculated based on a cohort of students starting ninth grade in the same academic year. Students are given four years and one summer term to complete graduation requirements in order to be counted as a graduate. Students who earn special education diplomas, GEDs, and certificates of attendance do not count as graduates in these calculations. In 2003, the second year after the start of Project GRAD, the graduation rates at Austin East and Fulton High Schools were 51.6% and 60.2%, respectively. At Austin East, graduation rates gradually increased over the next six years to 74.9%, but the graduation rate at Fulton remained at approximately 60% in 2009 (See Appendix A). In SY0910, the business rules surrounding the calculation of graduation rates were retooled by the Tennessee Department of Education (TDOE) which may have led to an increase in graduation rates across the county. Over the next seven years, the Knox County Schools graduation rate has trended upward, from a low of 86.6% in 2010 to a high of 90.3% in 2016. During that same timeframe, graduation rate trends at Fulton High School have been relatively flat and graduation rates at Austin East have been trending downward (Figure1).

Austin East high school experienced a sharp decline in graduation rate from 85.6% in 2013 to 72.9% the following year and graduation rate has remained in the mid-70% range over that last few years. The graduation rate at Fulton High was trending upward until 2017 when the graduation rate fell by approximately 10%.
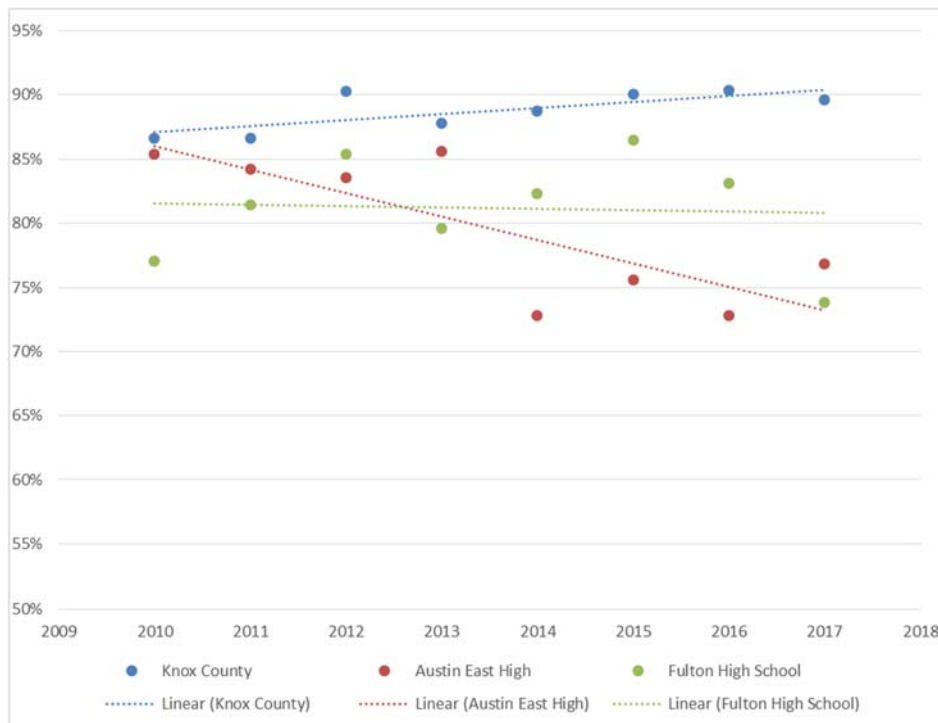

Figure 1: Longitudinal Graduation Rates from SY0910 through SY1617

There are many factors that impact high school graduation rates and the observed declines over the last few years at each Project GRAD school are likely due to a combination of effects. A logistic regression was conducted in order to estimate the effect that being in a PGK school had on the probability of a student earning a regular high school diploma. Seven different cohorts of Knox County School students were obtained from EMIS along with their cohort school, cohort year, race, gender, graduation information, eight grade math and reading standardized test scores (TCAP), and economic status. Gender, race, and economic status were chosen as control variables in the model due to historical differences in graduation rates among those subgroups. TCAP scores were also included as a control variable and served as a measures of prior academic achievement. Exploratory analysis confirmed that, on average, graduates had higher incoming achievement than non-graduates (See Table 1).

Table 1: Mean TCAP NCE by Subject and Year

	8th Grade TCAP Math		8th Grade TCAP RLA	
	Non-Graduates	Graduates	Non-Graduates	Graduates
2010	40.79 (23.97)	60.93 (22.02)	44.63 (22.69)	61.94 (19.85)
2011	42.33 (24.25)	62.51 (22.09)	46.61 (21.83)	63.85 (19.47)
2012	44.25 (24.28)	64.23 (20.75)	50.56 (22.21)	67.26 (19.00)
2013	40.23 (21.13)	56.40 (20.11)	41.08 (22.40)	56.88 (20.71)
2014	33.88 (21.10)	52.68 (21.33)	34.72 (22.75)	54.12 (23.33)
2015	39.63 (23.90)	56.61 (22.74)	38.26 (25.10)	55.95 (23.89)
2016	36.35 (25.14)	42.10 (29.62)	37.85 (25.34)	56.73 (24.78)

Note: Measurements are mean NCE(SE)

While every effort was taken to control for variables that bias graduation rates, it is important to note that it is not possible to know if bias due to other factors still exists and the readers should keep that in mind when interpreting results.

Since many of Project GRAD's efforts related to graduation rate were available school-wide, any student that finished their final year at either Austin East or Fulton were flagged as having attended Project GRAD schools. The students' cohort year was included as a predictor variable in order to account for any cohort related effect which could have resulted from state or district policy changes from one year to the next. Students were assigned to a cohort school based on the last school that they attended in their terminal year. Students that left the district to enter another school setting were removed from the cohort, and students that dropped out were left in the cohort and counted as non-graduates.

The results of the logistic regression model are shown in Table 2 and estimates are given in logits. Since there were over 25,000 data points used in the model, a power analysis was conducted which indicated that a significance level of $\alpha \leq 1E\text{-}10$ was needed to detect small effects.

Table 2: Coefficients from Logistic Regression Model estimating the likelihood of high school graduation

		Estimate	Std. Error	z value	p-value
	(Intercept)	-0.815	0.072	-11.247	<2.00E-16*
	PGK Participant	0.074	0.062	1.182	2.37E-01
	TCAP8_MATH	0.015	0.001	13.196	<2.00E-16*
	TCAP8_RLA	0.019	0.001	15.566	<2.00E-16*
	Non-ED	0.890	0.045	19.573	<2.00E-16*
	Male	-0.197	0.039	-5.108	3.26E-07
Race	American Indian	-0.328	0.286	-1.146	2.52E-01
	Asian	0.608	0.215	2.831	4.64E-03
	Black	0.483	0.054	8.879	<2.00E-16*
	Hispanic	0.066	0.098	0.671	5.03E-01
	Pacific Islander	0.175	0.495	0.354	.72368
Cohort Year	2011	0.382	0.066	5.784	7.28E-09
	2012	0.632	0.071	8.885	<2.00E-16*
	2013	0.651	0.067	9.742	<2.00E-16*
	2014	0.788	0.067	11.716	<2.00E-16*
	2015	0.860	0.069	12.507	<2.00E-16*
	2016	1.030	0.069	14.912	<2.00E-16*

*p ≤ 1.00E-10

Null deviance: 21252 on 25683 degrees of freedom

Residual deviance: 18549 on 25667 degrees of freedom

AIC: 18583 $NagelKerke\ r^2 = 0.177$

The model was built sequentially and ANOVA testing indicated significant model improvement after the addition of each covariate. There was no evidence of collinearity between the model predictors. The coefficient values in Table 2 suggest that TCAP scores, ED status, Race, and cohort are all significant predictors of the probability of earning a high school diploma in Knox County. Since coefficient estimates are given in logits, positive values indicate an increased likelihood of high school graduation and negative values indicate a decreased likelihood of high school graduation. These results are consistent with past findings in other studies involving graduation rate conducted by the KCS Research and Evaluation.

The estimate for project GRAD participation ($\beta = 0.074$) was positive. However, the estimate was not statistically significant so we failed to reject the null hypothesis that attending a Project Grade school has no effect on the probability of a student earning a high school diploma. It is important to note that this result may not imply that the program had no effect on graduation rate. Many schools in Knox County engage in activities to increase graduation rate and post-secondary enrollment similar to Project Grad programming. The results from the modeling simply provide evidence that a school's involvement with PGK did not increase the probability of a student graduating in comparison to non-PGK schools.

Post-secondary enrollment was defined as enrolling in a post-secondary institution for at least one term (semester or quarter) after graduating from high school with a regular education diploma. Since SY1011, approximately 66% of graduates from Project GRAD schools enrolled in a post-secondary program compared to approximately 78% of graduates from other schools. However, other factors almost certainly influence a student's decision whether or not to attend a post-secondary program. For that reason, a logistic regression analysis was conducted on post-secondary enrollment after controlling for achievement, race, economic status, gender, prior academic achievement and cohort. In this case, prior academic achievement was approximated using the students' best ACT composite score. Initially, the model contained GPA as a predictor, but it did not make a significant improvement to the model so it was omitted for parsimony.

The final model suggested that ACT composite scores, ED status, gender, race, and cohort year were all significant predictors of post-secondary enrollment for graduates of Knox County schools (See Table 3). The coefficient estimate for attending a Project Grad school was again positive ($\beta = 0.17$) but it was not significant at the $\alpha \leq$ 1E-10 level. Since the coefficient did not pass the significance test, we failed to reject the null hypothesis that attending a PGK school had no effect on post-secondary enrollment.

Table 3: Coefficients from Logistic Regression Model estimating the likelihood of post-secondary enrollment

		Estimate	Std. Error	Z value	Pr(>|z|)
	(Intercept)	-3.79605	0.112108	-33.861	<2e-16*
	PGK_SCHOOL1	0.171114	0.06636	2.579	0.00992
	ACT_COMP	0.257493	0.005289	48.682	<2e-16*
	Non-ED	0.838991	0.042614	19.688	<2e-16*
	Male	-0.51595	0.038525	-13.393	<2e-16*
Race	American Indian	0.4363	0.345061	1.264	0.20608
	Asian	0.140625	0.174994	0.804	0.42163
	Black	0.870009	0.057796	15.053	<2e-16*
	Hispanic	-0.02964	0.105041	-0.282	0.77783
	Pacific Islander	-0.09619	0.409968	-0.235	0.81449
Cohort Year	YE92007	0.036607	0.076114	0.481	0.63055
	YE92008	-0.20869	0.074005	-2.82	0.00480
	YE92009	-0.18401	0.074203	-2.48	0.01314
	YE92010	-0.21543	0.074609	-2.887	0.00388
	YE92011	-0.17559	0.07446	-2.358	0.01837
	YE92012	-0.45339	0.072497	-6.254	4e-10*

*p ≤ 1.00E-10
Null deviance: 22115 on 20354 degrees of freedom
Residual deviance: 16942 on 20339 degrees of freedom
AIC: 16974 $NagelKerke\ r^2$ = 0.339

Results: Project GRAD Scholars Program Effects

The Project GRAD scholar program is open to all students at Austin East and Fulton high schools. It is a four year program that provides students with academic support, FAFSA and post-secondary application assistance, and summer institutes during their high school years. The summer institutes are one to two week long programs that take place on post-secondary campuses and are designed to give students exposure to life as a student in those environments. If Project GRAD scholars maintain a minimum GPA and attend at least two summer institutes, then they are eligible for an academic scholarship after graduation. On average, the Project GRAD scholar program has served about 135 students each year since the first cohort in 2005. This study is limited to the last seven cohorts due to the availability of post-secondary enrollment data. Also, it is important to note that a small percentage (less than 3.5%) of students identified as scholars were excluded from this study due to missing data or inability to identify them based on the name received from

PGK. Figure 2 shows the number of scholars each year since 2010. Participation in the program has declined slightly over the last three years but the decline was small and could be due to variation between cohorts.
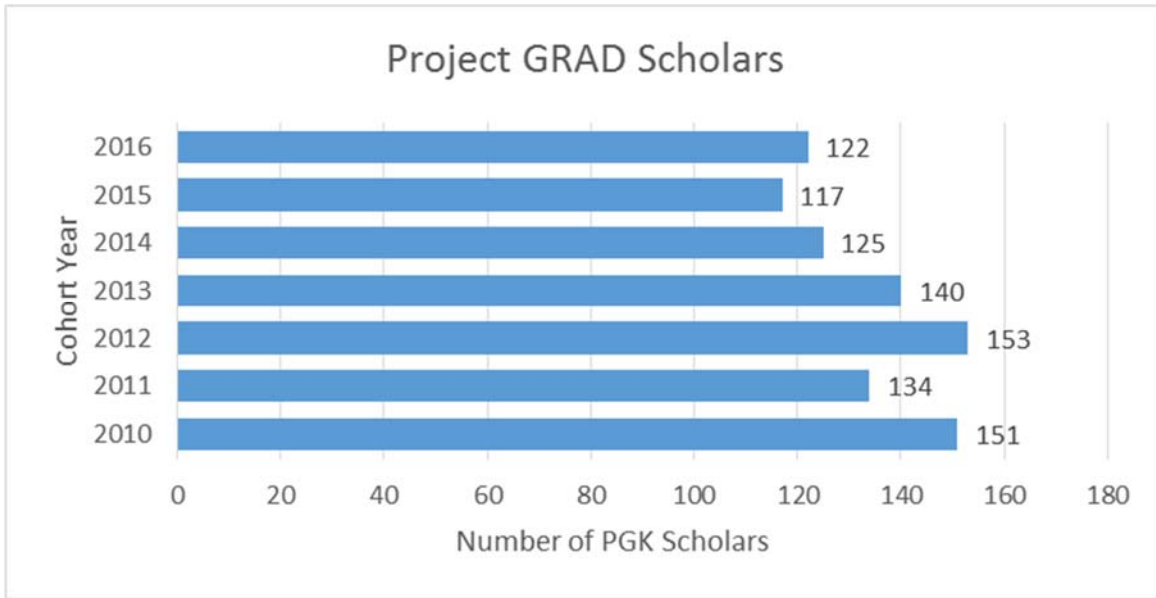

Figure 2: Project GRAD Participation by Year

Since students were self-selected to participate in the Project GRAD scholar program, a propensity score matched-pairs design was used in an attempt to limit bias that may have resulted from voluntary selection. A logistic regression was employed to calculate an estimate of the probability that a student was a Project GRAD scholar participant (propensity score). One-to-one nearest neighbor matching was then used to find the closest match between participants and non-participants at each school which resulted in equal size control and treatment groups with similar characteristics. Once control and treatment groups had been established, chi squared testing was employed to discern differences between the participant group and the control group for post-secondary enrollment and completion.

The covariates selected for the propensity score model were the following: high school grade point average, ACT composite, race/ethnicity, economic disadvantaged status, and cohort year. Predictor variables were selected for the regression based on their theoretical impact on either the selection process or the outcome measure. After the model was employed, a match was found for each Project Grad scholar which resulted in control and treatment groups with 910 students each. The balance between the newly formed control and treatment groups was analyzed and the overall balance was improved from pre-match data. The post-match means for the control and treatment groups are listed in Table 4.

Table 4: Post-match Differences in Means

		Means Treated	Means Control	Mean Diff
	distance	0.2214	0.2188	0.0026
	GPA_WEIGHTED	3.0807	3.0604	0.0203
	ACT_COMP	18.0692	18.0429	0.0264
	Non-ED	0.1769	0.1824	-0.0055
Race	White	0.289	0.2824	0.0066
	American Indian	0.0022	0.0033	-0.0011
	Asian	0.0044	0.0044	0
	Black	0.667	0.6747	-0.0077
	Hispanic	0.0308	0.0319	-0.0011
	Pacific Islander	0.0066	0.0033	0.0033
Cohort Year	2011	0.1451	0.1374	0.0077
	2012	0.1637	0.1659	-0.0022
	2013	0.1495	0.1363	0.0132
	2014	0.1308	0.1341	-0.0033
	2015	0.122	0.1176	0.0044
	2016	0.1319	0.1154	0.0165

With control and treatment groups established, the post-secondary enrollment for each group was compared (Table 5). A total of 767 or 84.3% of students that participated in the Project GRAD scholar program enrolled in a post-secondary school compared to 680 of 74.7% from the control group, a 9.6% difference. A chi squared test of independence was conducted which indicated that the differences between the two groups was statistically significant (χ^2 = 16.18, p = 5.75e-5, w = 0.11). The effect size was small but this is an encouraging finding for the program and provides some evidence that Project GRAD scholars were more likely to enroll in post-secondary schools that similar students outside the program.

Table 5: Post-secondary Enrollment for Project GRAD Scholars and the Control Group

	Post-secondary Enrollment	
	No	Yes
Control Group	230	680
Project GRAD Scholars	143	767

Given this evidence, the post-secondary enrollment patterns of the scholars was compared to their matched control group to determine if the two groups were enrolling in different types of schools. Again a chi squared test of independence was conducted. The results

from that test (χ^2 = 44.31, p = 1.29E-9, w = 0.17) suggest that participants in the Project GRAD scholar program enrolled in four year post-secondary schools more often than similar students (Table 6).

Table 6: Percentage of Student Post-secondary Enrollment by School Type

	2-Year Program	4-Year Program	Less than 2 Year Program	No Enrollment
Project GRAD Scholars	29.89%	54.18%	0.22%	15.71%
Control Group	37.47%	38.90%	0.44%	23.19%

The final part of the analysis focused on post-secondary completion. Table 7 shows the number of graduates and non-graduates that enrolled in a post-secondary program for both the scholar and control groups. It is important to note that the following table is not a complete accounting of post-secondary completion since many students in the later cohorts are still enrolled and working toward their post-secondary goals. Table 7 and the following analysis is a comparison between the control and treatment groups when students in each cohort are given the same amount of time to complete their post-secondary studies. For example, the only cohort that has had the entire standard six year window to finish was the 2010 cohort and their completion rate was about 40%.

For all cohorts, 181 students in the control group (25.9%) graduated from a post-secondary program, compared to 121 (15.8%) students in the scholar group. A chi square test was again used and found a statistically significant difference between the control group and the scholar group (χ^2 = 22.41, p = 2.20E-6, w = 0.13). This result provides evidence that Project GRAD scholars finish their post-secondary program less often than the control group. There are a myriad of possible reasons for this finding and additional study is needed to determine why PGK scholars tended to finish their post-secondary program less often than students with similar demographic and academic characteristics.

Table 7: Post-secondary Graduation for Project GRAD Scholars and the Control Group

	Post-secondary Graduate	
	No	Yes
Control Group	517	181
Project GRAD Scholars	646	121

Conclusions & Considerations

This analysis of Project GRAD Knoxville provides evidence of the program's strengths and weaknesses with respect to its primary goals of increasing high school graduation rates, increasing post-secondary enrollment, and increasing post-secondary completion. An

exploratory analysis of the students that attended Project GRAD schools provided evidence that the program is reaching the most disadvantaged populations within Knox County Schools. The proportion of Project GRAD students that qualified as economically disadvantaged was over twice that found in the rest of the district, and the ethnic makeup of PGK schools was far more diverse.

We found no evidence that attending a Project GRAD high school increased the likelihood that students earned a high school diploma or enrolled in a post-secondary program. Since the inception of the program in 2001, graduation rates at both Project GRAD high schools have generally trended upward. However, graduation rates also trended upward at every Knox County school during that same time period. Additionally, there were several instances of policy changes since 2001 which impacted the way in which graduation rates were calculated. The graduation rate calculations have been relatively stable since 2010 and the graduation rate for Knox County Schools has been trending slightly upward since. During the same time period, graduation rate trends at Fulton were relatively flat but they were trending downward at Austin East. Even after controlling for other factors that have historically been related to graduation rate (race, gender, ED status, prior achievement, and cohort effects), there was no evidence that PGK students were more or less likely to earn a regular high school diploma than their peers in Knox County from SY0910 through SY1516. We also found no evidence that school-wide Project GRAD programming increased the likelihood that graduates from PGK schools enrolled in post-secondary programs.

Analysis of data relating to the Project GRAD scholar program did provide some evidence that students who participated in the Project GRAD scholars program enrolled in post-secondary programs more often than other students with similar characteristics; however, they were no more likely to complete their post-secondary program given the same amount of time as similar students. This is an overall positive finding for the program from a district perspective since post-secondary enrollment is one of Knox County School's district priorities. There was also evidence that Project GRAD scholars enrolled in 4-year programs more often that students with similar characteristics outside the program. Reallocation of resources to expand the program could provide even more benefit.

These results should be interpreted with some limitations in mind. Many factors may influence whether students graduate from high school, enter post-secondary programs, or finish those programs. We have accounted for some of those factors which have historically been related to academic outcomes, but it is possible that there are other unmeasured and important factors that could influence the results presented in this study. Policy makers should carefully consider other possibly influential factors when making decisions regarding PGK programming.

Appendix A – Longitudinal Graduation Rates

	Class of 2004	Class of 2005	Class of 2006	Class of 2007	Class of 2008	Class of 2009	Class of 2010	Class of 2011	Class of 2012	Class of 2013	Class of 2014	Class of 2015	Class of 2016	Class of 2017
Austin East High	69.3%	62.6%	68.7%	67.8%	75.2%	74.9%	85.4%	84.2%	83.5%	85.6%	72.9%	75.6%	72.9%	76.8%
Bearden High School	88.3%	88.4%	89.8%	88.4%	91.1%	92.5%	94.2%	91.0%	94.4%	92.4%	93.7%	96.3%	94.3%	93.6%
Carter High School	77.8%	77.7%	74.9%	76.1%	74.0%	74.4%	82.9%	91.7%	93.0%	88.6%	90.3%	93.3%	96.7%	91.8%
Central High School	72.9%	70.1%	66.9%	70.8%	76.4%	70.8%	80.2%	81.9%	87.5%	87.1%	84.2%	88.2%	87.7%	80.1%
Farragut High School	90.1%	93.8%	91.9%	93.3%	91.6%	93.2%	93.6%	93.0%	95.0%	95.8%	95.7%	98.1%	97.9%	98.0%
Fulton High School	61.2%	56.0%	53.9%	60.7%	43.6%	60.0%	77.1%	81.4%	85.4%	79.6%	82.3%	86.5%	83.1%	73.9%
Gibbs High School	78.6%	87.3%	74.5%	75.1%	73.6%	76.8%	83.2%	89.5%	94.0%	87.2%	89.1%	91.7%	93.9%	92.2%
Halls High School	87.2%	83.8%	90.7%	85.7%	85.9%	88.9%	88.0%	89.1%	95.2%	94.5%	93.6%	94.0%	94.6%	95.8%
Hardin Valley Academy							87.0%	87.4%	91.6%	90.2%	90.7%	91.4%	91.8%	93.5%
Karns High School	79.8%	77.9%	79.0%	80.3%	86.9%	87.2%	85.5%	88.4%	90.0%	86.9%	91.8%	92.5%	96.2%	92.2%
KVA								46.8%	65.9%	69.4%	75.4%	55.3%	63.8%	76.8%
L & N STEM Academy											97.7%	99.0%	97.6%	97.8%
Powell High School	88.4%	91.0%	90.6%	88.5%	89.3%	85.1%	89.8%	88.7%	92.1%	87.9%	91.8%	93.5%	93.2%	94.0%
South Doyle High School	75.7%	68.9%	74.5%	66.6%	70.6%	71.3%	80.5%	85.7%	88.7%	81.3%	88.2%	93.5%	94.3%	86.1%
West High School	77.2%	77.6%	76.7%	76.9%	83.1%	83.8%	86.9%	87.9%	91.9%	88.9%	81.8%	90.8%	86.8%	87.5%
Knox County	78.7%	76.0%	77.0%	79.3%	79.3%	81.4%	86.6%	86.6%	90.3%	87.8%	88.7%	90.0%	90.3%	89.6%