2014

The Relationship between Teacher Training Institutions and Student Performance

Shelby King
University of Kentucky

Click here to let us know how access to this document benefits you.

The Relationship Between Teacher Training Institutions and Student Performance

Shelby King
Capstone Project
Spring 2014

Advisor: Dr. Eugenia Toma

Table of Contents

Executive Summary

This study intends to contribute to the literature by seeking evidence of a relationship between teacher characteristics and their high school students' academic success in college. In this study, average college success is defined by six outcomes. The outcomes consist of the average first-year college GPA, average hours completed, percentage of students returning for a second year, percent of students receiving a GPA above a 3.0, percent of students completing 30 plus hours in their first year, and the average college math GPA. The analysis uses aggregated data at the school level from both the 2013 Kentucky High School Feedback Reports and the National Center for Education Statistics' Common Core Data set.

There are two research questions that this study attempts to address. First, the research attempts to assess whether a high school's concentration of teachers from particular Kentucky training programs has a significant effect on the average college success of the high school's graduates. The second research question seeks to evaluate whether or not variability among teacher training institutions in a high school will have an impact on the average high school students' college success.

The study found that few teacher training institutions mattered in the regression equations, but Alice Lloyd was notably significant in many cases. Additionally, college readiness, financial variables, and high schools located in Appalachia were control variables that were consistently significant in the models. Lastly, the study found that if there is a decrease in teacher training share (meaning an increase in the diversity of teacher training programs represented in the school) then there will be an increase in the dependent variables indicating successful college performance.

Introduction

Senate Bill 1, enacted by the 2009 General Assembly, was a major education reform that redefined Kentucky's academic standards and assessment. Kentucky education policy makers opined that, "as the nature of work and the type of careers change, all students will need higher-level skills to meet their career goals." (Kentucky Department of Education, 2010). As a result, the Education Department implemented a college readiness and degree completion curriculum in an effort to reduce college remediation and provide students with the academic knowledge needed to have a successful college career (Kentucky Department of Education, 2010).

The Kentucky Department of Education and the Kentucky Council on Postsecondary Education then developed four unified strategies to better improve college readiness. Their strategies included:

- Increase accelerated learning opportunities for all Kentucky students,
- Provide targeted interventions for students who are not college and career ready,
- Increase access to and quality of college and career readiness advising,
- Increase the college completion rates of students entering with one or more developmental or supplemental course needs. (Kentucky Department of Education, 2010).

Each of these strategies includes several action items regarding the professional development and improvement of teachers. This development is critical, as "nearly all observers of the education process, including scholars, school administrators, policymakers, and parents, point to teacher quality as the most significant institutional determinant of academic success." (Clotfelter, Ladd & Vigdor, 2006)

Although teacher quality is a factor for the academic success of many students, characteristics of teacher quality are hard to pinpoint. Teacher quality may be associated

with several different teacher characteristics including advanced degree attainment, type of certification, and years of experience to name a few. This study seeks to add to the literature information regarding teacher quality by identifying one possible attribute of teacher quality, their training institution, as it relates to the academic achievement of their students, as defined by college success. Although there are several factors of college success, this study looks at six outcomes. The college success outcomes are percent of students returning for a second year of college, average first-year college GPA, average hours completed, whether the college GPA was above a 3.0 (percentage of students), completing 30 plus hours, and average college math GPA. These are outcomes averaged for the 2009-2010 high school graduates from particular high schools for their freshman year of college in 2010-2011. Following is a review of the literature with regard to indicators of teacher quality with emphasis on a teacher's training institution.

Literature Review

To begin, most of the studies mentioned below regarding teacher characteristics typically define student academic success as achievement on standardized tests in the grade level at the school they are currently attending. This study intends to contribute to the literature by seeking evidence of a relationship between teacher characteristics and their high school students' academic success in college.

Teacher quality as defined by years of teacher experience has yielded contradictory conclusions. Some authors have concluded that increased teacher experience results in student achievement gains throughout the teacher's entire career(Clotfelter). This is further supported by findings of higher average reading scores among students of teachers with 10+ years of teaching experience compared to students

of teachers with less tenure (Rockoff, 2004). However, other studies have found that the positive relationship between student achievement and teacher experience has been overstated. They explain that, after the first few years of teaching, added years of teacher experience is not a significant predictor of an overall increase in student achievement (Rivkin, 2005).

To explain the differences among the various studies one group of researchers' concluded that teachers with greater tenure, degrees from competitive colleges, and having advanced degrees were often teaching more affluent, higher achieving schools with a lower percentage of minorities as students. Even within schools they found evidence that teachers with stronger credentials and more tenure were teaching more affluent students (Clotfelter, 2006). Also, Boyd concluded that the quality of teacher preparedness for beginning teachers could consistently improve several student outcomes. The evidence suggests that those applicants coming from an institution that requires observing their future daily duties, will be better teachers than first year teachers entering schools without this experience (Boyd, 2009).

In the past, teacher certification has served as an indicator of higher teacher quality. However, this notion has been challenged. In 2000, Goldhaber found that there is actually no evidence that teachers with standard certification have a greater effect on student outcomes than those with emergency credentials (Goldhaber, 2000). This is consistent with the stance of the National Education Association, which supports alternative routes to teacher certification. The organization boasts the profound impact alternative certification has had on K-12 education and cites numerous benefits to this option. For example, "most teachers entering the profession through alternative routes are

recruited for areas where the demand for teachers is greatest—in large cities and rural areas—and in subject areas in greatest demand—special education, mathematics, and science." (NEA, 2013). In a later study, however, Goldhaber finds that teachers with subject matter certifications licensure do yield higher student achievement outcomes than teachers who possess standard certification or an alternative certificate (Goldhaber, 2007).

Teachers who possess advanced degrees are often viewed as a more valuable asset than teachers without advanced degrees (Harris, 2008). Many states, like Kentucky, now require their teachers to pursue advanced degrees. However, Rivkin (2005) found no statistically significant evidence of an increase in teacher effectiveness, measured by student achievement gains, among teachers with a master's degree compared to similar teachers without the advanced degree (Berger, Toma 1994). Further, Harris found no evidence that the scholastic aptitude of teachers, measured by the college entrance exam scores, influenced their students' achievement (Harris, 2008). Kane concluded that selectivity of the teacher training institution as well as the student teacher's GPA could not predict the academic success of a teacher's students. Yet these characteristics are highly predictive of whether or not a teacher job applicant is selected (Kane). Some have found that teacher requirements are too demanding and rigorous, limiting the number of prospective job applicants (Goldhaber, 2000). The requirements are intended to improve teacher quality, yet the reduction in teaching applicants because of these requirements could actually decrease teacher quality.

There are 29 accredited teacher-training programs in Kentucky, and each school varies in cost, curriculum, and teaching pedagogy. It is because of these variations that

the possibility of including training program as a relevant teacher characteristic arises. As stated above some studies have found that differences in teacher training programs have very little impact on teacher quality. Additionally, a study was conducted to observe the effects of various types of education and training on the productivity of teachers in promoting student achievement. The results provided no evidence that teachers' pre-service training, undergraduate education, or college entrance exam scores were related to an increase in student achievement outcomes (Harris, Sass 2011).

However, there is research that presents evidence of a link between teacher training and student achievement. Hammond found that teachers who participate in more course work on teaching and learning versus additional training in a specific subject matter have more of an effect on student outcomes and are more likely to stay in the field of teaching (Hammond, 2000). A study based in North Carolina found that teachers trained through the teacher training programs in North Carolina public institutions, versus those trained out-of-state or within-state in private or independent programs, taught elementary and high school students who had slightly better learning outcomes (Henry, 2011).

This study does not observe the differences in teacher training institutions, but merely acknowledges these differences across the institutions. The research hopes to analyze if teacher training institutions have an effect on the outcomes and whether or not this can be detected.

Data Description

For this analysis, two different data sets were used, the 2013 Kentucky High School Feedback Reports and the National Center for Education Statistics' Common

Core Data set. Certain variables in the National Center for Education Statistics' Common Core Data set were supplemented through information obtained by the Kentucky Department of Education. Both sets of data are aggregated at the school level.

The 2013 Kentucky High School Feedback Report specifically looks at the decision of Kentucky residents to attend college and tracks their academic performance once they are there. The report is generated by the Kentucky Center for Education and Workforce Statistics, and gathers data from the Kentucky Longitudinal Data System, which draws on data from the Council on Postsecondary Education, the Kentucky Department of Education, the National Student Clearinghouse and the Kentucky Higher Education Assistance Authority. "These data are provided by matching actual student-level electronic records from the Kentucky Department of Education with official enrollment records from the Council on Postsecondary Education for students attending in-state public and independent colleges and universities and from the National Student Clearinghouse with the assistance of Kentucky Higher Education Assistance Authority for out-of-state institutions and other in-state colleges and universities." (McGrew, 2013)

This data set contains information about the high school graduating class of 2009-2010. For each school, the data set contains information about the percent of the school's graduates who entered a postsecondary institution at any point during the 2010-2011 academic years. The data includes information for each school in Kentucky regarding the students' average high school GPA, average college GPA, average credit hours completed, average percent of students returning for their second year, as well as information regarding control variables such as average percent meeting Kentucky's

college readiness benchmarks, average percent of high school students starting college full time, and average on several financial aid variables.

"The Common Core of Data is a program of the U.S. Department of Education's National Center for Education Statistics that annually collects fiscal and non-fiscal data about public schools." (Common Core of Data) This information is provided for years 1998-2008 and includes important control variables for each high school in Kentucky, such as percent of teachers trained at specific teacher training institutions, total free and reduced lunch students, and demographic profiles of the student body of each school.

The dependent variables for each school are explained in the 2013 Kentucky High School Feedback Reports:

- Average first year cumulative GPA: calculated as the mean GPA for all 2010 public high school graduates who attended an in-state public college or university during academic year 2010-11. Developmental courses are not included in the calculation of GPAs.
- Average college-level credit hours earned: Calculated as the mean number of college-level credit hours earned by 2010 public high school graduates who attended an in-state public college or university during academic year 2010-2011. College-level credit hours count toward curricular fulfillment and do not include developmental coursework.
- Percent who returned for a second year of college: The percentage of 2010 public high school graduates who attended an in-state public college or university during academic year 2010-11 and also attended at some point during academic year 2011-2012. (McGrew, 2013)

The explanatory variables consist of the average percentage of teachers in each school who were trained in 12 Kentucky public teacher training institution for years 2006-2008. The question of interest is whether having a higher percentage of a school's teachers trained at a specific institution has a statistically significant positive or negative effect on the performance of that school's high school graduates in college.

Because other factors are also expected to influence college success, several control variables are used to help isolate a teacher training institutions' effect on high school students' college performance. The first control variable is the average high school GPA. If a school's students do well in high school, we would expect this to have a positive significant effect on the average college GPA of that group of students. Percent of students starting college full time is included because students going to school part time will have a different effect on the total credit hours completed and could potentially have an effect on the group's average college GPA. College students starting part-time could have a higher GPA with a smaller school workload or may be going to school part time because of a need to work, which might lower their average GPAs. College readiness is a status graduates receive based on meeting all three Kentucky benchmarks (English 18, math 19, and reading 20) on the 2008-09 statewide ACT administration. This control variable is essential because it is reasonable to assume that the percentage of a school's graduates who meet college readiness benchmarks would have a significant effect on the dependent variables, as students deemed college ready are likely to experience more college success.

It was also imperative to control for educational financial support variables, because financial support gives students additional resources to be successful in college. There are four variables considered—a high school's average per-student amount of federal loans received, average per-student state grants received, average percent receiving Pell grants, and average per-student amount of institutional grants received. It is expected that these variables would be correlated but after running a pairwise correlation,

they were found not to be. According to this test, each of the financial support programs serve different students, this is seen by further research about each financial variable.

The federal loans are an average of both the need-based loan and average non-need loan students receive. Examples of this type of aid include subsidized and unsubsidized Stafford loans. The state grants include average need-based and non-need grants. Examples of this type of aid include the College Access Program (CAP) Grant and the Kentucky Educational Excellence Scholarship (KEES). Pell grants, unlike loans, do not have to be repaid and are given to need based individuals who are working towards an undergraduate degree. This variable is represented in the model as the percentage of high school graduates receiving a federal Pell grant. The average institutional grant is based off the discretion of the university. In this model, it is expected that these variables will have an impact on a students' college success.

The remaining variables, percent average daily attendance, average years of teaching experience, average number of national board certified teachers, student to teacher ratio, and student to computer ratio are also believed to be important control factors. Past research and literature have listed these indicators as having a potential effect on student achievement. It is expected that these variables will have a positive influence on a high school students' college success. The locale of the high school, whether or not it is located in a city, town, rural or suburban area and if the school is located in an Appalachian county, is also included. As a region, prior research has shown that being from Appalachia has a negative effect on student performance and therefore it is controlled for in this model. (Fowles, et. al, 2013) Lastly, the various student body demographics are included in the model. Students with different demographics could

have varying college success and therefore it's necessary that these student body characteristics be incorporated. However, it is important to note that the present research is not about the customary high school test scores, but rather about college outcomes. Therefore, these variables might or might not have the same significant effects commonly found.

The tables below give the reader a picture of what the average school in Kentucky looks like. Table 1 and Table 2 consist of descriptive statistics about the average Kentucky high school's make-up of teaching staff. On average, 12 institutions train nearly 70% of teachers. The remaining 30% come from of the other 17 teacher training institutions in Kentucky, as well as out-of-state teacher training institutions. Berea College makes up the smallest percentage of teachers trained at the average high school with a mere 1.34%. Western Kentucky University makes up the largest percentage of teachers trained at the average high school with 12.45%. However, the institution of teacher training varies from school-to-school. For example, one school has 88% of its teaching staff trained at Morehead State University (Kukla-Acevedo, Streams, Toma, 2009).

As seen in Table 3 college success in Kentucky is an issue. Of those students who graduate from high school less than 64% enroll in college. From that 64%, only about 8% of all graduates are on track to graduate in 4 years by completing 30 or more college level hours.

Table 4 displays the descriptive statistics of the high schools in Kentucky. On average, 46% of students are deemed college ready. The average high school GPA is a 2.85 and 90% of high school students who go to college start as a full-time student.

About half, 51% of Kentucky's high school students are on free and reduced priced lunch and 55% receive Pell grants in college. Looking ahead from high school to college, freshmen from Kentucky high schools have an average first-year college GPA of 2.26 while completing an average of 22.04 credit hours. Just under half, 49%, return to college for a second year.

Table 1: Descriptive Statistics of College Success and Teacher Training Institutions

Variables	Mean	Max	Standard Deviation	Variable Type
Average college GPA	2.26	2.97	.31	Dependent
Average credit hours completed	22.04	27.3	2.14	Dependent
Percent returning to college	48.9%	63.64%		Dependent
Percent of teachers trained at Alice Lloyd 2006-2008	1.38%	39%	4.10	Explanatory
Percent of teachers trained at Berea College 2006-2008	1.34%	37.67%	3.04	Explanatory
Percent of teachers trained at Campbellsville University 2006-2008	2.61%	70.67%	7.03	Explanatory
Percent of teachers trained at Eastern Kentucky University 2006-2008	11.48%	75.67%	14.12	Explanatory
Percent of teachers trained at Georgetown College 2006-2008	1.39%	18%	2.63	Explanatory
Percent of teachers trained at Morehead State University 2006-2008	12.22%	88%	20.79	Explanatory
Percent of teachers trained at Murray State University 2006-2008	8.51%	85.33%	18.92	Explanatory
Percent of teachers trained at Pikeville College 2006-2008	2.31%	60.67%	9.41	Explanatory
Percent of teachers trained at the University of Kentucky 2006-2008	9.55%	45.33%	8.64	Explanatory
Percent of teachers trained at the University of Louisville 2006-2008	4.52%	45%	9.24	Explanatory
Percent of teachers trained at Union College 2006-2008	2.12%	71%	7.98	Explanatory
Percent of teachers trained at Western Kentucky University 2006-2008	12.45%	83%	18.79	Explanatory

Source: 2013 Kentucky High School Feedback Report and the National Center for Education Statistics' Common Core Data set

Table 2: Average Teacher Training Background in Kentucky High Schools

Average Teacher Training Background
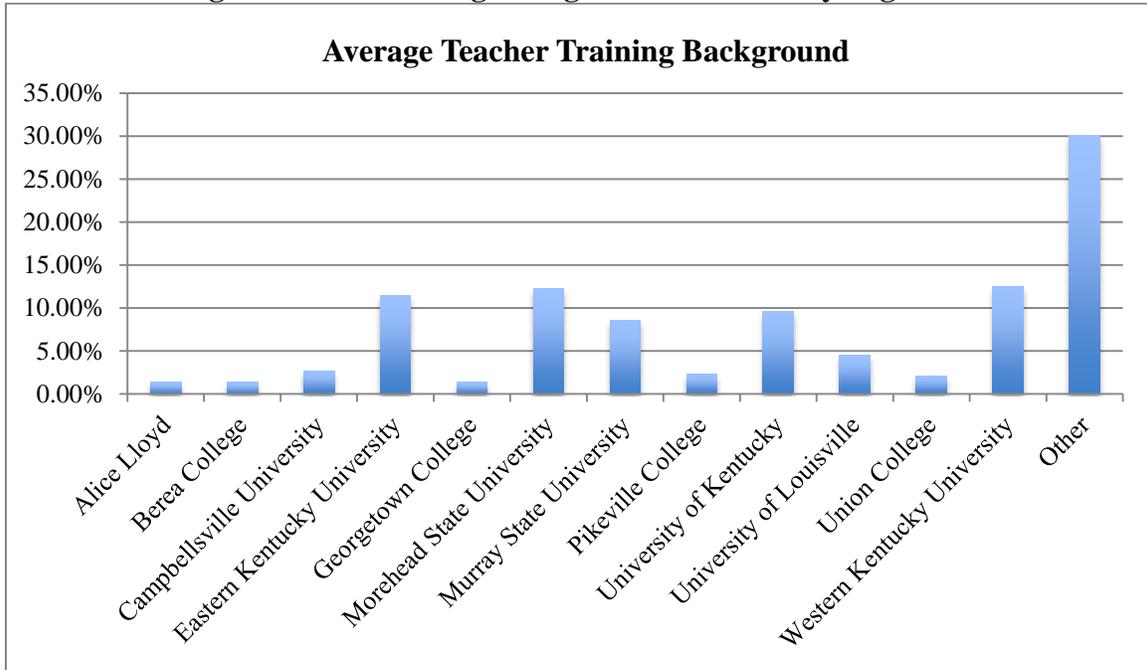
Table 3: College Success of High School Students in Kentucky for Academic Year 2010-2011

	Total	Percent
Graduated high school	41,262	
Attended semester of college	26,329	63.81%
Attend a year of college	22,179	53.75%
Returning for second year	20,009	48.49%
Earned 30 or more college level hours	3,203	7.76%

Source: 2013 Kentucky High School Feedback Report

Table 4: Descriptive Statistics of Control Variables that Affect Student Success

Variable	Number of High Schools	Mean	Standard Deviation
Average High School GPA	223	2.85	.20
Percent of students starting college full time	223	90.92%	6.31
Percent of students meeting KY's college readiness benchmarks	223	46.04%	15.08
Average Federal Loan amount received	227	$1939.80	$1261.01
Average Institution Grant amount received	227	$1004.66	$770.86
Average State Grant amount received	226	$1643.04	$284.41
Percent receiving Pell Grant	217	54.55%	15.16
Percent average daily attendance	227	91.51%	10.82
Average years of teacher experience	225	11.66	2.03
National Board Certified Teachers	227	2.70	8.24
Student to teacher ratio	223	16.51	2.34
Student to computer ratio	227	3.13	1.30
Percent of African American students	227	8.69%	13.39
Percent of Asian students	227	.76%	1.12
Percent of Hispanic students	227	1.67%	2.19
Percent of students with free and reduced lunch	225	50.85%	17.44
Location of students	227	3.11	1.04

Source: 2013 Kentucky High School Feedback Report and the National Center for Education Statistics' Common Core Data set

Model

There are two research questions that this study attempts to address. First, the research attempts to assess whether a high school's concentration of teachers from particular Kentucky training programs has a significant effect on the average college success of the high school's graduates. Average college success can consist of several different indicators. This study looks at six outcomes as dependent variables. The outcomes are average first-year college GPA, average hours completed, percentage of students returning for a second year, percent of students receiving a GPA above a 3.0, percent of students completing 30 plus hours in their first year, and the average college math GPA. Average first-year college GPA, average hours completed, and the percent of students returning for a second-year are standard outcomes for college success. However, looking at the outcomes of a GPA above a 3.0 and completing 30 plus hours tells us

whether or not students are on track to graduate in 4 years and are excelling in their studies. The analysis also looks at the outcome of college math GPA for another interesting perspective of student performance. As a reminder, these are the average outcomes for the 2009-2010 high school graduates from particular high schools for their first year of college in 2010-2011.

The second research question seeks to evaluate whether or not variability among teacher training institutions in a high school will have an impact on the average high school students' college success. Is it a benefit to have a teaching staff from the same teacher training institutions, or from a variety of teacher training backgrounds, or is there no effect at all?

An ordinal least square regression is used to examine the relationships in the data. The regression was run six different times with a different dependent variable of student success. The following model was estimated:

$$\square_{CS} = \square_0 + \square_1 \square_{CS} + \square_2 \square_{CS} + \square_3 H_{CS}$$

Y denotes the dependent variable that measures the college success outcome. T represents the explanatory variable of the various teacher-training institutions. X denotes the various control variables examples including funding sources, ethnicity, computers and student-teacher ratio, and average daily attendance. H denotes the Herfindahl index. The Herfindahl index is a measure of market concentration. The closer the high school's teaching staff is to being from one teacher training institution, the higher the market's concentration and the lower its competition. Lastly, All estimations are robust, i.e. heteroscedasticity (differing variances) resulting from either high school size or high school variability of student ability is corrected in the models. While some collinearity is

inevitably present, it never exceeds the typical line of 95% (vif of 20) and all variables should be in the model.

Research Question One Hypothesis

The null hypothesis (H_0) is that a teacher's training institution is not related to the average high school students' college success. The alternative hypothesis (H_1) is that a teacher's training institution does affect the average high school students' college success.

Research Question Two Hypothesis

The null hypothesis (H_0) is that the level of competition among teacher training institutions in a high school is not related to the average high school students' college success. The alternative hypothesis (H_1) is that the level of competition among teacher training institutions in a high school does affect the average high school students' college success.

Analysis and Findings

Due to the changing dependent variable of college success, six regression equations were tested. All of the models have high r-squares ranging from 57% to 82%, indicating that the models explain the average change in college success, ceteris paribus. Each regression yields various results and attempting to catalog them would be boring and uninformative. Tables 8, 9, and 10 in the appendix display all results from the six regression analyses tested. However, there are several main findings that are discussed. Alice Lloyd College is the teacher training institution that seems to provide teachers, who on average, produce high school students that are successful in college. Many control variables also seem to make a statistically significant impact on college success. Teacher

variability, percent of students deemed college ready, Appalachian high schools and financial variables are frequently significant in the model as well.

Alice Lloyd College

When looking at the teacher training institutions on average, teachers trained from Alice Lloyd are associated with a 0.012 (p<0.01) point increase in the average high school student's college GPA, holding all other independent variables constant. Further, on average having a higher percentage of teachers trained at Alice Lloyd increasedhte percentage of students earning above a 3.0 College GPA. In the analysis a one percent increase in the share of teachers from Alice Lloyd can increase the percent of students who achieved this accomplishment by 0.04% (p0<0.1). Similar results are found with the influence on college math GPA, positively raising a students' grade point average, on average, by 0.019 (p<0.01). However, teachers from Alice Lloyd have more of a positive effect than just their influence on GPAs. Additionally, they statistically have an influence on whether or not college students return for a second year. For every 10% increase in the proportion of teachers trained from Alice Lloyd there is a 3% (p<0.01) increase in average percent of students returning for a second year of college.

To provide some perspective about Alice Lloyd, further research was done to see where Alice Lloyd was making an impact. Of the 227 high schools there are only 55 high schools with teachers trained from Alice Lloyd. Of the 55, there are only 17 high schools not located in Appalachia. Table 5 shows the top 5 high schools where the highest percentage of teachers trained from Alice Lloyd are located. Additionally, Alice Lloyd is a private institution that does not charge tuition for students from their service area. The

service area is a central Appalachian 108-county service area consisting of counties from Kentucky, Ohio, Tennessee, Virginia, and West Virginia.

Table 5: Top 5 High Schools with Highest Percent of Teachers from Alice Lloyd

High School	Percent of teachers from Alice Lloyd
Knott County Central High School	39.0%
South Floyd High School	36.3%
Jenkins Independent School	26.3%
Hazard High School	17.7%
Sheldon Clark High School	14.7%

Other Institutions

Five other institutions appear to have an effect on student performance—Berea College, Georgetown College, Union College, University of Kentucky, and Western Kentucky University. Table 6 shows the categories in which the other statistically significant universities affect the various student achievement categories. Tables 7,8, and 9 provide the magnitude and level of significance in the Appendix for further clarification.

Table 6: Positive/Negative Impact of various Training Institutions on College Success

	Berea	Georgetown	Union	UK	WKU
AVG College GPA		+			
GPA > 3.0		+	+		
Math GPA		+	+		
Hours 30+	--				
Completed Hours				--	
Return for 2nd year				+	+

-- = negative significance, += positive significance, blank = not statistically significance

Variation in Teaching Staff

The second research analysis sought to evaluate whether or not hiring from a mix of teacher-training institutions in a high school would have an impact on the school students' college success. The Herfindahl index used to evaluate this was statistically significant in two regression equations. Having more uniformity in the training programs of a school's teachers is associated with a 0.318 ($p<0.1$) point decrease in average college GPA. Since the closer the high school's teaching staff is to being from one teacher training institution, the higher the market's concentration and the lower its competition, this means every time there is a decrease in teacher training share (resulting in more training diversity) then there is a 0.318 increase in average GPA. Additionally, there is a 0.147 ($p<0.05$) point decrease in the percent of a high school's graduates earning a GPA

above 3.0, on average. This means every time there is a decrease in teacher training share then there is a 0.147 percent increase in average students with a 3.0 GPA or above. These results seem to indicate that it is beneficial to have a teaching staff from a variety of training programs.

College Readiness

Having a higher proportion of students in a school deemed college ready is consistently and positively associated with student performance gains in college. To begin, schools with higher proportions of students meeting this standard have a 0.406 (p<0.05) increase in average college GPA. Moreover, they are likely to complete an average of 2.056 (p<.05) more college credit hours than those not deemed college ready. The college readiness standards also seem to be an indicator of schools with graduates who are on track to graduate in four years. On average, they have a 13.8% (p<0.01) increase in students who are earning 30 plus college credit hours. Furthermore, they have a 15.5% (p<.01) increase on average in students achieving a 3.0 GPA or higher.

Appalachian Location

High schools in Appalachia were statistically significant in various regression equations as increasing the students' performance. This is an counterintuitive result because past studies focusing on students in Appalachia have often found lower test scores. However, students from Appalachia are more likely to succeed in college compared to other counties because fewer students from this district actually go to college. The data confirms this with a t-test to estimate the probability the statistics reflect random variation. The two sample t-test results indicate that 64% of non-

Appalachian high school students attend at least a semester of college compared to 61%

of Appalachian high school students. These differences are statistically significant

(t=3.49; p<0.01).

If the high school is located in Appalachia it is associated with a .621 (p<0.05)

point increase in average hours completed. Additionally, 3% (p<0.05) of students from

Appalachia are more likely to complete an average of 30 plus hours of college credit. On

average, students from Appalachian are associated with a 4.5% (p<0.05) return rate for a

second year.

Financial Variables

Institutional grants, state grants, federal loans, and Pell grants have a statistically

significant impact on student performance. All of the financial variables have a positive

and significant effect on average credit hours completed. A thousand dollar increase in

state grant dollars resulted in 2 (<0.01) additional credit hours completed, on average. A

thousand dollar increase in federal loans and institutional grants has a 0.4 (p<0.01) and

0.6 (p<0.01) average increase, respectively. The percent of students receiving a GPA of

3.0 and higher is also affected by institutional and state grants. A thousand dollar increase

in state grant results in a 8% (p<0.05) increase while an increase in institutional grants

have a 2% (p<0.1) increase for the percent of students achieving above a 3.0. Institutional

grants play an important role on keeping students on track for graduating in four years. A

thousand dollar increase led to a 2% increase in average percentage of students earning

30 plus credit hours. State grants, on average, can raise GPAs by 0.2 (p<0.01), for every

thousand dollars. However, state grants, on average, are associated with a 7% (p<0.05)

decrease in the average percent of students who return to college for a second year. Pell grants are statistically significant in five of the six regressions and are always negatively impacting the student performance. This is contrary to the other financial aid variables, however, this most likely serves as an indicator of low-income due to the nature of the grant.

Limitations

There are several limitations in this analysis. Unfortunately the Kentucky High School Feedback Report data only includes one year, the 2009-2010 high school graduates college success for the 2010-2011 academic year, their first year of college. The data also do not include indicators of the college readiness of high school students who went to out-of-state or private in-state institutions. This could potentially lead to bias as the individuals who go to private or out-of-state institutions could have a higher level of student achievement. The data do not include measures of college readiness for students at private high schools or of teacher experience or training. Similarly, the National Center for Education Statistics' Common Core Data set is limited. This data set provides teacher information for years 2001-2008 but not for the years matching the school data, 2009-2010. While the data regarding teacher-training institutions is not provided for the observed high school graduates' senior year, it has information about the teachers' training institution for the students' freshman-junior year. This is still useful information because it is not merely one year of high school teachers that shape a high school students' college readiness, but their whole high school experience. In addition, there is little variability between the percentages of teachers in a school from specific training institutions from year to year. To test this an analysis of variance was run for all

teacher-training institutions. Table 7 displays the analysis of variance for each of the

teacher training institutions. The within-group mean square estimates population variance

based on the differences between the groups. Only the University of Kentucky had

significant differences between the years, however, the portion of variance was marginal,

making up only .06%. The majority of the variance (96.2%) for the University of

Kentucky was still between schools Therefore, the author is confident that using the mean

of 2006-2008 represents the true 2009 value because the values from 2006-2008 didn't

vary.

Finally, there are 29 teacher-training institutions in Kentucky; but the Common

Core data set only contains information regarding 12 of them. However, the teachers

trained from these institutions comprise about 70% of Kentucky's teaching staff as seen

in Table 8 identifying the descriptive statistics of this data set.

Table 7: Analysis of Variance for Teacher Training Institutions

Teacher Training Institution	Mean Squared
Alice Lloyd	0.22
Berea College	0.88
Campbellsville University	1.75
Eastern Kentucky University	3.38
Georgetown College	0.05
Morehead University	2.51
Murray State University	5.76
Pikeville College	2.50
University of Kentucky	**12.62
University of Louisville	2.20
Union College	0.72
Western Kentucky University	3.09

*p<0.1, **p<0.05, ***p<0.01

Recommendations

In regards to teacher training institutions, a few matter in some equations, but

Alice Lloyd is notably significant and positive in many cases. Although a small

percentage of all teachers, the estimated effect net of all the other controls is quite strong. It appears that this training program is producing teachers who have an impact on their high school students' college success. Policy makers could more closely investigate the teacher-training curriculum and practice of Alice Lloyd to assess whether they could offer best-practice examples for other Kentucky teacher training programs. It would be extremely helpful to understand what exactly about Alice Lloyd College's teacher training program has led to the observed result.

While the value of a policy goal of increasing the percentage of high school graduates who are deemed college ready students is obvious, this research shows that the policy goal is important and efforts to achieve it should be continued, or even expanded. Students deemed college ready were more likely to have completed more college hours on average, have a higher college GPA, and were more likely to have completed above 30 semester hours and have a GPA above a 3.0. This indicates that not only are they prepared for college, but also they are on track to graduate in 4 years. Policymakers should continue to implement curriculum improvements and other support services that help students become 'college ready.'

Financial aid variables also seemed to be a significant indicator of college success. State grants, institutional grants, and federal loans were statistically significant in improving various measures of the performance of a high school's graduates. Therefore, we can conclude that financial aid is helpful to students and should not be reduced if student success in college is the goal.

Finally, the Herfindahl index was statistically significant in the regression

equations with average college GPA and percent of average students with a 3.0 GPA or higher as the dependent variable. Both results indicate that if there is a decrease in teacher training share (meaning an increase in the diversity of teacher training programs represented in the school) then there will be an increase in the dependent variables indicating successful college performance. Therefore it appears beneficial for schools to have a diverse teaching staff made up of teachers trained in a variety of teacher training institutions.

Conclusions

The first research questions asks whether or not the percentage of teachers in a high school from a specific teacher training institution has an effect on that high school's graduates' college success, and the answer is "Yes." Having a higher concentration of teachers trained by Alice Lloyd College has a positive and statistically significant impact on the average college GPA, percent with a GPA above a 3.0, average math GPA, and the percent of students returning for a second year among the graduates of that high school. Having a greater share of teachers trained from Georgetown College has a positive and statistically significant relationship with a high school students' average college GPA, percent with a GPA above a 3.0, and average math GPA. Additionally, having more teachers trained at Western Kentucky and Union College has a positive effect on the percent of students above a 3.0. Increasing the percentage of teachers from Union College has a positive and statistically significant effect on the average college students' math GPA. Lastly, hiring a greater percentage of teachers trained at the University of Kentucky had a negative impact on the average number of semester hours completed, controlling for other factors. Increasing the percentage of teachers trained at Berea

College had a negative impact on the percent of students who completed 30 plus semester hours. In conclusion, we can reject our null hypothesis.

The second research question was whether or not variability among teacher training institutions represented in a high school will have an impact on the average high school students' college success. We can also reject the null hypothesis for this research question. As the Herfindahl index indicated, it is beneficial to have a mix of teachers trained by various institutions.

Further research should be constructed when additional years of the Kentucky High School Feedback Report are produced. It would be beneficial to do this study using panel data over time. Such analysis could incorporate more factors and, as a result, be more accurate.

In particular, special attention should be given to examining the teacher training program conducted by Alice Lloyd College and examining whether there is a relationship between the teaching location of graduates of the program and the unexpected result that students from high schools in Appalachia counties perform better on average than students from other counties, once they enter college.

Table 8: Predicting College GPA and Average Completed Hours

Variable	College GPA		Average Completed Hours	
Morehead	.003 (.003)		-.002 (.011)	
EKU	.002 (.002)		-.012 (.010)	
UK	.001 (.002)		-.026 (.011)	**
WKU	.002 (.002)		-.002 (009)	
Union	.006 (.004)		-.008 (.017)	
Berea	.005 (.004)		.009 (.021)	
Georgetown	.011 (.006)	*	-.042 (.033)	
Murray	.003 (.003)		-.004 (.010)	
Campbellsville	-.001 (.003)		-.003 (.011)	
Louisville	.002 (.002)		-.017 (.010)	
Alice Lloyd	.012 (.003)	***	.000 (.018)	
Pikeville	.001 (.002)		-.015 (.011)	
Appalachian High School	.060 (.066)		.621 (.270)	**
Start College Full Time	.775 (.311)	**	14.815 (1.648)	***
College Ready	.406 (.187)	**	2.056 (.954)	**
High School GPA	.090 (.128)		-.812 (.589)	
State Grant Amount	.000 (.000)	***	.002 (.000)	***
Federal Loan Amount	-.000 (.000)		.000 (.000)	***
Institution Grant Amount	.000 (.000)		.001 (.000)	***
Federal Loan Missing Values	-.048 (.060)		.715 (.356)	**
Institution Grant Missing Values	.000 (.000)		.704 (.290)	**
% Receiving Pell Grant	-.615 (.227)	***	-3.658 (1.186)	***
Average Daily Attendance	-.002 (.010)		.026 (.048)	
Student to Computer Ratio	.009 (.012)		.011 (.049)	
Average Teacher Experience	-.000 (.008)		-.002 (.040)	
Student to Teacher Ratio	-.001 (.007)		.023 (.034)	
National Board Certification Teacher	-.000 (.000)		-.008 (.005)	
% Asian students	.011 (.014)		.081 (.068)	
% Hispanic students	-.001 (.007)		-.000 (.036)	
% African American students	-.003 (.002)		.017 (.010)	
% Free and Reduced Price Lunch	-.002 (.002)		-.019 (.010)	
City Location				
Suburban Location	.030 (.062)		-.094 (.319)	
Town Location	-.075 (.066)		-.093 (.326)	
Rural Location	.007 (.061)		-.173 (.335)	
Herfindahl Index	-.318 (.187)	*	1.02 (.280)	
__cons	1.119 (.948)		5.640 (4.559)	

*p<0.1, **p<0.05, ***p<0.01

Table 9: Predicting Percent Returning for a 2nd year and Percent of Students with 30+ Hours

Variable	% Return for a 2nd year		% with 30+ hours	
Morehead	-.000 (.001)		.001 (.000)	
EKU	-.001 (.001)		.001 (.000)	
UK	.002 (.001)	*	-.000 (.001)	
WKU	-.000 (.001)		.001 (.000)	
Union	.000 (.001)		.000 (.001)	
Berea	.001 (.001)		-.003 (.001)	***
Georgetown	.002 (.003)		.002 (.002)	
Murray	.000 (.001)		.001 (.001)	
Campbellsville	.001 (.001)		-.001 (.001)	
Louisville	.000 (.001)		-.001 (.001)	
Alice Lloyd	.003 (.001)	***	.000 (.001)	
Pikeville	-.000 (.001)		.000 (.000)	
Appalachian High School	.045 (.018)	**	.033 (.014)	***
Start College Full Time	.489 (.123)	***	.059 (.085)	
College Ready	.133 (.083)		.138 (.043)	***
High School GPA	.217 (.042)	***	.025 (.033)	
State Grant Amount	-.000 (.000)	**	.000 (.000)	
Federal Loan Amount	-.000 (.000)		.000 (.000)	
Institution Grant Amount	.000 (.000)		.000 (.000)	***
Federal Loan Missing Values	.002 (.028)		-.012 (.018)	
Institution Grant Missing Values	-.012 (.025)		.027 (.016)	*
% Receiving Pell Grant	.067 (.081)		-.118 (.057)	**
Average Daily Attendance	.013 (.004)	***	-.002 (.002)	
Student to Computer Ratio	.004 (.004)		.003 (.003)	
Average Teacher Experience	.005 (.004)		-.003 (.002)	
Student to Teacher Ratio	-.001 (.003)		-.001 (.002)	
National Board Certification Teacher	.000 (.000)		-.000 (.000)	
% Asian students	.007 (.009)		.003 (.003)	
% Hispanic students	-.001 (.003)		-.001 (.002)	
% African American students	.002 (.001)	***	.000 (.000)	
% Free and Reduced Price Lunch	-.001 (.001)		-.001 (.000)	**
City Location				
Suburban Location	.011 (.018)		.010 (.014)	
Town Location	.012 (.020)		-.004 (.015)	
Rural Location	-.010 (.018)		.010 (.015)	
Herfindahl Index	-.014 (.066)		-.043 (.044)	
__cons	-1.835 (.368)		.166 (.207)	

*p<0.1, **p<0.05, ***p<0.01

Table 10: Predicting Percent of Students above a 3.0 and the Average College Math GPA

Variable	% of students above a 3.0		Average College Math GPA	
Morehead	.001 (.001)		.002 (.003)	
EKU	.001 (.001)		.004 (.004)	
UK	-.000 (.001)		.004 (.004)	
WKU	.001 (.001)	*	.003 (.003)	
Union	.002 (.001)	**	.012 (.005)	**
Berea	.002 (.002)		-.004 (.005)	
Georgetown	.009 (.003)	***	.021 (.011)	*
Murray	.001 (.001)		.004 (.003)	
Campbellsville	.001 (.001)		-.007 (.004)	
Louisville	.000 (.001)		.003 (.003)	
Alice Lloyd	.004 (.002)	*	.019 (.006)	***
Pikeville	.001 (.001)		-.001 (.004)	
Appalachian High School	.034 (.022)		.046 (.097)	
Start College Full Time	.111 (.127)		1.535 (.546)	***
College Ready	.155 (.067)	**	.224 (.301)	
High School GPA	.022 (.043)		.110 (.183)	
State Grant Amount	.000 (.000)	**	.000 (.000)	
Federal Loan Amount	-.000 (.000)		.000 (.000)	
Institution Grant Amount	.000 (.000)	*	.000 (.000)	
Federal Loan Missing Values	-.032 (.023)		.031 (.107)	
Institution Grant Missing Values	.037 (.021)	*	.088 (.098)	
% Receiving Pell Grant	-.189 (.077)	**	-.801 (.336)	**
Average Daily Attendance	-.001 (.003)		.015 (.016)	
Student to Computer Ratio	.002 (.004)		.023 (.016)	
Average Teacher Experience	-.001 (.003)		.004 (.014)	
Student to Teacher Ratio	-.002 (.004)		-.011 (.011)	
National Board Certification Teacher	-.000 (.000)		.002 (.002)	
% Asian students	.004 (.005)		.031 (.021)	
% Hispanic students	.003 (.002)		.014 (.010)	
% African American students	-.001 (.001)		-.010 (.003)	***
% Free and Reduced Price Lunch	-.000 (.001)		.005 (.003)	
City Location				
Suburban Location	.009 (.021)		.184 (.087)	**
Town Location	-.029 (.022)		-.010 (.100)	
Rural Location	.002 (.022)		.124 (.095)	
Herfindahl Index	-.147 (.074)	**	-.269 (.268)	
__cons	.167 (.301)		-1.596 (1.564)	

*p<0.1, **p<0.05, ***p<0.01

Works Cited

Berger, Mark & Toma, Eugenia (1994). Variation in state education policies and effects on student performance . *Journal of Policy Analysis and Management*, *13*, pg. 477-491.

Boyd, D. J., Grossman, P. L., Lankford, H., Loeb, S., & Wycoff, J. (2009). Teacher preparation and student achievement. *Educational Evaluation and Policy Analysis*, *31*(4), pp.416-440.

Clotfelter, C. T., Ladd, H. F., & Vigdor, J. L. (Working Paper 2828). How and why do teacher credentials matter for student achievement . *National Bureau of Economic Research*.

Clotfelter, C. T., Ladd, H. F., & Vigdor, J. L. (2006). Teacher student matching and the assessment of teacher effectiveness. *The Journal of Human Resources*, *41*(4), pp.778-820.

Common Core of Data. (n.d.). *National Center for Education Statistics*. Retrieved from https://nces.ed.gov/ccd/

Darling-Hammond, L. (2000). How teacher education matters. *Journal of Teacher Education, 51(3),* 166-173.

Fowles, Jacob; Butler, J. S.; Cowen, Joshua M.; Streams, Megan E.;Toma, Eugenia F. "Public Employee Quality in a Geographic Context: A Study of Rural Teachers," The American Review of Public Administration, 2013. doi: 10.1177/0275074012474714.

Goldhaber, D., & Brewer, D. (2000). Does teacher certification matter? high school teacher certification status and student achievement. *American Education Research Association*, *22*(2), pp.129-145.

Goldhaber, D. (2007). Everyone's doing it, but what does teacher testing tell us   about teacher effectiveness? . *The Journal of Human Resources*, *42*(4), pp.765   794.

Harris, D. N., & Sass, T. R. (2008). Teacher training, teacher quality and student achievement. *National Center for Analysis of Longitudinal Data in Education Reserch*,

Harris, D. N., & Sass, T. R. (2011). Teacher training, teacher quality and student achievement. *Journal of Public Economics*, *95*(7-8), pp.798-812.

Henry, Gary T., et al. (2011). The Impact of Teacher Preparation on Student Learning in North Carolina Public Schools.

Kane, T. J., Rockoff, J. E., & Staiger, D. O. (n.d.). What does certification tell us about teacher effectiveness? Evidence from new york city. *National Bureau of Economic Research*.

Kentucky Department of Education, (2010). *Unified strategy for college and career readiness: Senate bill 1*.

Kukla-Acevedo, S., Streams, M., & Toma, E. (2009), Evaluation of teacher preparation programs: A reality show in Kentucky

McGrew, C. Kentucky Center for Education and Workforce Statistics, (2013). *2013 Kentucky high school feedback reports-college going and college success: Technical notes*. Retrieved from website: http://kcews.ky.gov/reports/2013HSFRTechNotes.pdf

"Research Spotlight on Alternative Routes to Teacher Certification." *National Education Association*. N.p.. Web. 1 Dec 2013.

Rivkin, S. G., Hanushek, E. A., & Kain, J. F. (2005). Teachers, schools, and academic achievement. *Econometrica*, *73*(2),   pp. 417-458.

Rockoff, J. E. (2004). The impact of individual teachers on student achievement: Evidence from panel data. *The American Economic Review*, *94*(2), pp.247-252.