

National Testing: Academic Achievement of CTE and Non-CTE Graduates

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Abstract

Career and Technical Education (CTE) programs at secondary and post-secondary levels are growing in popularity and enrollment. Evaluating the merit of educational programs is a required practice. This study examined the academic achievement of certified CTE high school graduates and non-CTE high school graduates in Nevada as measured by nationwide college testing. Results indicate ($p < .001$) that CTE certified students had statistically significantly higher ACT scores on the ACT composite, reading, math, science, and English assessments than those of general academic student graduates who took one or no CTE courses. Empirical studies have found CTE attracts a diverse audience of students including those who are economically challenged and historically perform at lower academic levels. The difference found in this study in which CTE certified graduates accomplished ACT composite scores 9% higher than non-CTE graduates deserves special attention given additional external challenges many CTE students experience. This study also illuminates the importance of students making serious commitments and seeing their CTE commitment through to certification.

Introduction

Within the Clark County School District (CCSD), the fifth largest school district in the nation consisting of 320,000 students, more schools are adding career academies within traditional high schools in addition to designated Career and Technical Academy schools. Advising and recruiting students to engage with CTE and complete a pathway to a career is a worthwhile and possibly life-changing experience for a student unaware of locally accessible opportunities. CTE certification opens the door to career opportunities and increased academic achievement, thus opening more doors to competitive colleges seeking students with higher grades and assessment marks on national academic examinations. There is a small but increasing literature base examining the academic performance of students who complete CTE pathways. These studies demonstrate a two-fold benefit to the CTE student: 1) student graduates with technical and employability skills which employers seek; and 2) improved and superior course and assessment marks when compared to general academic students who do not engage with CTE programs (Michaels & Barone, 2020). This study further explores the academic achievement of CTE students in one of the nation's largest school districts. The school district contains a well-developed CTE mission which has been tried and tested for decades.

Statement of the Problem

This study is continuation and expansion on a growing body of research examining and monitoring the progression of the CTE mission in the western United States. As more and more CTE programs are introduced and existing programs are refined, there is the ongoing need to determine how students who have completed a CTE pathway perform on state-mandated examinations required for graduation. High school programs and courses lose enrollment unless they can demonstrate the program contributes to academic success (Blowe & Price, 2012).

Many CTE courses are correlated academically to core classes such as English, mathematics, and science; thus, the curriculum covered in many CTE courses overlaps with content covered in core courses. A simple example of the overlap which could occur is a welding project. Students in a welding course are tasked with submitting a building plan for constructing a 10-foot-high fence surrounding a property. The plan asks students to include how much time and building materials need to be purchased to complete the project. In this situation, welding students would need to utilize drafting, geometric, and arithmetic skills taught in a core math classes. They also are tasked with effectively communicating the plan which taps into skills taught in core English and writing classes. This project examines bridges which occur between CTE and core academic settings—and how those bridges affect academic mastery.

Purpose of the Study

The purpose of this study was to investigate the academic achievement of CTE certified graduates and non-CTE graduates in the fifth largest school district in the United States. Students must pass an end-of-program Technical Assessment, a Workplace Readiness assessment, and maintain passing grades in their CTE pathway courses to receive certification. The academic subject areas covered in this study include: 1) science; 2) English; 3) reading; and 4) mathematics. By examining and reporting CTE students' performance on nationwide college-ready assessments, local career programs gain quantifiable and statistically significant evidence CTE certification influences core subject masteries.

As more industries shift towards automation and the need for specialized workers grows, Career and Technical Education (CTE) programs are ideal for supplying companies with qualified employees who are trained for modern and cutting-edge professions. Because states play a large role in developing and overseeing CTE programs, they carry the responsibility of maintaining a continuous research agenda to ensure that the CTE programs in which students enroll are high quality and will provide the opportunities students are promised (Jacob, 2017). High quality CTE programs may provide students with: 1) employment and internship opportunities; 2) newly gained knowledge of trades and skills available; 3) comradery with fellow CTE peers; 4) improved academic achievement; and 5) motivation to stay in school and perform better in academic courses.

Significance of the Study

Despite large and regular investments made in CTE over the decades, there is a paucity of research on the impact of CTE on high-stakes testing. For example, on July 31st, 2018, President Trump signed the Strengthening Career and Technical Education for the 21st Century Act, a \$1.2 billion program last overhauled by Congress in 2006. For decades, billions of US taxpayer

dollars have been invested annually into CTE. Federal legislation has promoted CTE since its inception and continues to mandate the operation of CTE programs. However, few state and collegiate studies have been conducted to evaluate the merit of CTE federal legislation with regards to academic progress and state-mandated examinations such as the ACT. This study answers demands to continually monitor the merit of educational programs offered to high school students along with examining student achievement of CTE students in one of the largest school districts in the nation.

Literature Review

Although CTE courses use structured contextual learning similar to the training found in workplaces, CTE courses are often understood by students as elective courses designed to explore career options instead of focusing on one career sequence which leads to employment. This tendency for students to choose CTE courses only as electives creates difficulty for policy makers, educators, and teachers who are evaluating whether CTE pathways are contributing to goals set by legislation. Legislative goals may include factors such as an increased graduation rate, increased GPA marks, and adequate testing averages. Many educators have generally acknowledged skills acquired in CTE courses, experiential learning common in CTE, and career exploration driven by CTE, but they seldom receive a confirmation as to academic skills and knowledge built and strengthened in CTE courses. Perkins II and III grants supported the goal of encouraging CTE students to make a commitment by concentrating on one program area and completing certification in skill areas offering employment opportunities. Perkins II and III CTE funding opportunities were designed to promote school implementation and participation in “sequences” of CTE courses. The aim in modifications of the Perkins educational grants was to reverse the trend of students simply “exploring” CTE programs with limited interest and commitment, but instead to promote a culture of CTE “concentration” (Gordon & Schultz, 2020).

CTE Increases Student Achievement: State and District

When students concentrate on and complete CTE pathways it provides states with qualified employees and has a positive influence on student achievement. This effect was noticed by Castellano et al. (2012). Although the researchers could not verify differences in student achievement between 9th grade CTE students and 9th grade non-CTE students, by the conclusion of 10th grade student test scores, grade point averages, and progress towards graduation trended better for CTE students. The implications from the research outlined how CTE concentration cultivated a unique atmosphere of success, determination, and commitment. Researchers in Florida studied the assessment patterns of over 80,000 CTE students as they advanced in CTE pathways. Results revealed that performance on a state science test improved as a student’s coursework in a CTE program increased beginning with CTE samplers (1 to fewer than 3 occupational credits) through CTE concentrators (3 or more credits in at least one occupational area) (Israel et al., 2012).

Blowe and Price (2012) were motivated to study CTE student achievement upon realizing the *No Child Left Behind* legislation did not include CTE. The researchers analyzed 131 school divisions in the Commonwealth of Virginia covering the 2008, 2009, and 2010 school years. Their findings indicated CTE completers significantly outperformed non-CTE completers as measured by 11th grade reading and mathematics passage rates as well as higher graduation rates for CTE

students. In a similar study in Northern Nevada where the researchers studied the student achievement of CTE completers and non-CTE students in a large western school district, CTE completers had statistically significantly higher ACT scores on the ACT composite, reading, writing, math, science, and English assessments than those of general academic student graduates who took one or no CTE courses. The difference found in this study of CTE graduates accomplishing ACT composite scores 4% higher than non-CTE graduates deserves special attention given the additional external challenges many CTE students experience (Michaels & Barone, 2020). Palmer and Gaunt (2007) found CTE students often come from lower-SES brackets than non-CTE students, who frequently come from economically advantaged backgrounds. Additionally, Palmer and Gaunt (2007) found many CTE students experience non-traditional living arrangements. These studies were the motivation for diving deeper into studying CTE student achievement by again utilizing the national ACT examination as the measuring instrument for gauging academic mastery in one of the nation's largest school districts with well-developed CTE programs.

The results of the 2017 Phi Delta Kappa (PDK) poll overwhelmingly showed strong public support for high schools positioning and preparing students for their adult working lives in addition to educating them in academic subjects. Highlights from the 2017 PDK poll include: 1) 82% of Americans encourage career and job skills even if it translates to students spending less time in academic classes; 2) 89% believe that schools in their community should offer licensing and certificate granting programs which students can utilize for employment in a field; and 3) 80% view technology and engineering courses as vital components of school quality (49th Annual PDK Poll, 2017).

CTE in the fifth largest school district

The Clark County School District in the state of Nevada reflects national dispositions and commitments to CTE. The district in its entirety serves over 320,000 students and over half of the high schools are designated as magnet schools or career academies. Both types of schools offer career pathways and certifications which lead to employment. Annually, Clark County graduates approximately 30,000 high school students with over 10 percent of graduates obtaining CTE certification in combination with their high school diplomas (CCSD, 2022).

CTE programs are available across the state and increasing with popularity. Although there is abundant access to CTE programs for students located in metro-urban areas, providing access to students living in rural locations is an ongoing challenge. During the 81st legislative session in 2021, several bills were passed which will have positive impacts for Nevada's students, educators, and families. Specifically, Assembly bill 38 revises provisions related to CTE. Bill 38 reduces previous burdens which created difficulties for school districts to engage stakeholders when attempting to implement and improve CTE programs (Demerjian, 2021). Many industries have a vested interest to help build CTE programs in already existing and established school districts and local colleges. These CTE programs become a cultivating and training arena from which companies hire from. Local industry professionals serve in an advisory capacity and monitor curriculums, trainings, and assessments of their future employees. This bill reduces bureaucratic hurdles school districts have faced when seeking partnerships with local industries.

Nevada has demonstrated year after year its commitment to the CTE realm of education. Regular legislative sessions include CTE when educational matters arise, regular and noticeable CTE investments are made statewide. During the 2020 fiscal year, Nevada collected \$11.4 million dollars via Perkins V funding. Prior to the COVID pandemic, Nevada collected \$36.4 million total from federal and state funding during the 2016 and 2017 biennium (Perkins Collaborative Resource Network, 2021).

Method

This study continues the new and interesting trend of researching the student achievement of CTE students, specifically, researching if the curriculums and tasks associated with CTE transfer to high stakes testing situations where the general academic skills of English, math, science, and reading are the focus. This is worthy of continued investigation to justify the existence and expansion of CTE programs in American schools. The focus of the study was to gauge the impact of CTE certification and non-CTE participation in Southern Nevada on the ACT assessment covering science, mathematics, reading, and English. The research findings offer stakeholders an inside look as to the effectiveness and merit of their local CTE mission.

Research Question 1: Are there statistically significant mean differences on the Composite ACT scores for CTE certified high school graduates and non-CTE general academic high school graduates? The composite score is the average of four ACT tests: English, mathematics, reading, and science.

Research Question 2: Are there statistically significant mean differences on the English ACT scores for CTE certified high school graduates and non-CTE general academic high school graduates?

Research Question 3: Are there statistically significant mean differences on the Math ACT scores for CTE certified high school graduates and non-CTE general academic high school graduates?

Research Question 4: Are there statistically significant mean differences on the Reading ACT scores for CTE certified high school graduates and non-CTE general academic high school graduates?

Research Question 5: Are there statistically significant mean differences on the Science ACT scores for CTE certified high school graduates and non-CTE general academic high school graduates?

Study Sample and School District Profile

A very large western school district with a well-developed CTE endorsement system for high school students was the setting for this study. The district serves over 320,000 students total across 360 schools. The district contains 49 high schools where 34 of the high schools are designated as *magnet schools* and *career and technical academies*. Both magnet schools and career and technical academies offer CTE pathways leading to certification.

The study sample involved approximately 30,000 graduated high school student ACT scores from the school district. From the 30,000 students, 3,285 were CTE certified, had undertaken the ACT examination, and had graduated high school. These 3,285 students were compared to 3,285 non-CTE high school graduates who also undertook the ACT examination. The 3,285 non-CTE graduates were selected at random from the original target population of 30,000. The CTE

certified graduates successfully obtained high school CTE credentials in one of the following program clusters: 1) Agriculture and Natural Resources; 2) Architecture and Construction; 3) Arts, A/V technology and Communication; 4) Business Management and Administration; 5) Education and Training; 6) Finance; 7) Government and Public Administration; 8) Health Science; 9) Hospitality and Tourism; 10) Human Services; 11) Information Technologies; 12) Law, Public Safety, Corrections, and Security; 13) Manufacturing; 14) Marketing; 15) Science, Technology, Engineering, and Mathematics; and 16) Transportation, Distribution, and Logistics. Convenience sampling recommended by Creswell & Creswell (2018) was the sampling strategy used for this study. The 2019 graduation cohort was selected for this study.

Data Collection

This study was a joint project conducted by members from the University of Nevada - Reno, University of Nevada - Las Vegas, and the College and Career Readiness department within the Clark County School District. Every year, high schools across Nevada administer the ACT during the winter season. Nevada high schools administer and collect testing data in accordance with national ACT protocols. The ACT is the leading college admission test measuring students' academic progress and their ability to complete college-level work. The ACT surpassed the Scholastic Aptitude Test (SAT) in total test takers and all four-year colleges and universities in the US accept the ACT (ACT, 2018). Nevada is one of 25 states requiring students to undergo the ACT to graduate high school (State of Nevada Department of Education, 2012). The ACT is regarded as a high-stakes assessment because it is linked to important outcomes such as students receiving a high school diploma, locating employment, and future educational placements (Yell, Katsiyannis, Collins & Losinski, 2012). High achievement on the ACT examination could lead to a student securing enrollment at a competitive university which they have worked tirelessly to be accepted into. For these students, the ACT will likely be the most important high-stakes assessment they have ever faced.

Research Design

This project employed quantitative research methodologies in determining if there were statistically significant differences between CTE certified high school graduates and high school graduates who undertook one or no CTE courses during their high school careers. The study analyzed differences in student achievement as measured by ACT scores for CTE-certified high school graduates and high school graduates who were non-CTE participants. A one-way MANOVA statistical test and five univariate ANOVA tests were employed (Field, 2009).

Data Analysis

Microsoft Excel and IBM's *Statistical Package for the Social Sciences* (SPSS) were used to conduct calculations. Statistics were generated for the combination of all ACT scores, the ACT composite score, and each individual ACT score by subject area. Descriptive statistics such as averages and standard deviations were studied first to provide a general understanding of the data before searching for statistical significances.

The MANOVA analysis was used to evaluate whether the test averages between the two cohorts (CTE certified and non-CTE) posted differences of statistical significance. In simpler terms, the researchers were curious to investigate if there were score average cohort differences and if there were differences, were they random or was there a certain factor creating higher scores in one

cohort. After locating statistical significance using the stringent alpha level of ($\rho < .001$), it was clear there was a phenomenon occurring commanding further investigation. After locating high significance on the combination of dependent variables, independent ANOVA tests were run to locate specifically which dependent variables were posting significances. The same stringent p level of .001 was used during the ANOVA tests. Permission to conduct the study was obtained from the participating universities and school district.

Results

The descriptive analysis provided an overview of the data. The data for this study included 6,570 cases with five scores attached to each case. There were 3,285 CTE-certified high school graduate cases (50%) and 3,285 general high school graduate non-CTE cases (50%). The mean scores of the CTE certified graduates and non-CTE students indicated students who underwent and completed a CTE pathway through certification had higher mean scores on the dependent variables in comparison to the general non-CTE students. Specifically, CTE certified high school graduates had a mean score of 20.71 out of 36 on the ACT composite score whereas general academic high school graduates had a mean score of 17.17. CTE certified high school graduates had a mean score of 19.76 out of 36 on the ACT English score whereas general academic high school graduates had a mean score of 15.95. CTE certified high school graduates had a mean score of 20.36 out of 36 on the ACT Math score whereas general academic high school graduates had a mean score of 17.44. CTE certified high school graduates had a mean score of 21.30 out of 36 on the ACT reading score whereas general academic high school graduates had a mean score of 17.48. CTE certified high school graduates had a mean score of 20.78 out of 36 on the ACT science score whereas general academic high school graduates had a mean score of 17.22. Please see Table 1 for a graphical display of means and standard deviations for ACT composite score, ACT Math score, ACT Science score, ACT English score, and ACT Reading score by student type.

Table 1. Means and standard deviations for ACT composite score, ACT Math score, ACT Science score, ACT English score, and ACT Reading score by student type

Assessment	Student Category	M	SD
ACT Composite	CTE Certified	20.71	4.40
	General Student	17.17	4.52
ACT English	CTE Certified	19.76	4.59
	General Student	15.95	5.06
ACT Math	CTE Certified	20.36	4.67
	General Student	17.44	4.21
ACT Reading	CTE Certified	21.30	5.86
	General Student	17.48	5.76
ACT Science	CTE Certified	20.78	4.55
	General Student	17.22	4.76

Overall Combination MANOVA—RESULT

MANOVA results revealed statistically significant mean differences with a large effect among the type of high school student graduate (CTE certified vs. general academic high school graduate) on the combination of dependent variables [Pillai's Trace, $V = .148$, $F(5, 6564) = 228.9$, $p < .001$, multivariate $\eta^2 = .148$].

RESEARCH QUESTION 1—RESULTS

After it was discovered there is a statistically significant difference on the combination of ACT scores, individual analysis of variance was conducted on each ACT component. Questions one through five are the results of the individual analysis of each ACT score.

Are there statistically significant mean differences on the Composite ACT scores for CTE certified high school graduates and non-CTE general academic high school graduates? The univariate test on the individual ACT composite dependent variable revealed statistically significant mean differences with a large effect between the two groups of students [$F(1, 6568) = 1033.167$, $p < .001$, partial $\eta^2 = .136$]. Therefore, CTE curricula influences student achievement in the academic subjects of English, reading, mathematics, and science as measured by national testing.

RESEARCH QUESTION 2—RESULTS

Are there statistically significant mean differences on the English ACT scores for CTE certified high school graduates and non-CTE general academic high school graduates? The univariate test on the individual ACT English dependent variable revealed statistically significant mean differences with a large effect between the two groups of students [$F(1, 6568) = 1021.837$, $p < .001$, partial $\eta^2 = .135$]. Therefore, CTE curricula influences student achievement in the academic subject of English as measured by national testing.

RESEARCH QUESTION 3—RESULTS

Are there statistically significant mean differences on the Math ACT scores for CTE certified high school graduates and non-CTE general academic high school graduates? The univariate test on the individual ACT Math dependent variable revealed statistically significant mean differences with a medium to large effect between the two groups of students [$F(1, 6568) = 708.920$, $p < .001$, partial $\eta^2 = .097$]. Therefore, CTE curricula influences student achievement in the academic subject of math as measured by national testing.

RESEARCH QUESTION 4—RESULTS

Are there statistically significant mean differences on the Reading ACT scores for CTE certified high school graduates and non-CTE general academic high school graduates? The univariate test on the individual ACT Reading dependent variable revealed statistically significant mean differences with a medium effect between the two groups of students [$F(1, 6568) = 810.942$, $p < .001$, partial $\eta^2 = .110$]. Therefore, CTE curricula influences student achievement in the academic subject of reading as measured by national testing.

RESEARCH QUESTION 5—RESULTS

Are there statistically significant mean differences on the Science ACT scores for CTE certified high school graduates and non-CTE general academic high school graduates? The univariate test on the individual ACT Science dependent variable revealed statistically significant mean differences between the two groups of students [$F(1, 6568) = 1033.169$, $p < .001$, partial $\eta^2 = .128$]. Therefore, CTE curricula influences student achievement in the academic subject of science as measured by national testing.

Summary

Using a one-way MANOVA, the research questions examining differences in student achievement between CTE certified graduates and non-CTE graduates were answered. The effects of student type (CTE or general) on the dependent variables were reviewed from Pillai's Trace. The results indicated there were significant effects of student type on all dependent variables. Based on the MANOVA findings, five one-way univariate ANOVA tests were conducted. All five ANOVA tests yielded statistically significant results indicating student type influenced all ACT scores.

Findings, Implications for Further Research and Reflections

The purpose of this quantitative study was to investigate the academic performance of CTE-certified high school graduates and non-CTE high school graduates in the Clark County School District as measured by the ACT composite, math, science, English, and reading scores. This study examined ACT assessment scores submitted to the Department of Education for the entire

graduating class of 2019 in the nation's fifth largest school district covering over 40 high schools in the state of Nevada. There was one independent variable with two levels based on CTE concentration status: 1) CTE certified high school graduate; and 2) non-CTE participant high school graduate.

The focal point of this research project was to continue evaluating whether CTE concentration and certification is a productive educational endeavor which contributes to academic masteries required by national testing. The notion that CTE helps job-related skill development and exposure is well understood; this research base illuminates the academic effect of CTE certifications educational institutions offer. The study is intended to be a resource to supply quantifiable data to schools when making decisions regarding curriculum and program evaluation.

Discussion of Findings

First, in the study populations CTE certified graduates earned significantly higher average scores on all ACT subject areas measured in this study. More specifically and focusing on what colleges and universities review when evaluating applications for admittance; the ACT composite score for certified CTE graduates was 9.8% percentage points higher than non-CTE graduates for the 2019 Clark County graduating class. These results suggest that CTE-certified graduates outperform their non-CTE counterparts across core subjects taught in America's pk-12 schools and colleges. Secondly, the subject areas where differentials between CTE certified graduates and non-CTE graduates were greatest were English and reading. CTE-certified graduates averaged scores on ACT English and reading which were over 10% points higher than non-CTE graduates. ACT science scores were 9% points higher for CTE-certified graduates and ACT math scores approximately 8% points higher. Thirdly, statistical significance with a medium to high effect was located for each research question. This confirms and validates the hypothesis that there is a phenomenon occurring when students complete and receive CTE certification, and the phenomenon is driving up scores on important and determining assessments.

Implications for Practice

The results of this project signal that CTE certification has a large effect on student achievement and college preparation. When local schools and school districts make decisions regarding CTE maintenance, reduction, expansion, or improvement, the results from this study should be reviewed as it clearly displays CTE certified graduates achieve significantly higher test scores at crucial junctions. It can be assumed if CTE certified graduates are accomplishing higher assessment marks on national examinations, they are accomplishing higher semester grades in their high school courses, thus, posting higher overall Grade Point Averages.

Previous research and sentiments report mixed reviews regarding the academic culture and achievement of students who pursue occupational tracks while in high school and college. Negative outlooks regarding occupational tracks have been common for decades and have served as stimulus and motivation to conduct this project in Nevada. The researcher's curiosity prompted this investigative study which fulfilled the goal of investigating how CTE certified students are performing on well-known and established academic assessments. CTE programs are said to be modernized and academic when compared to their predecessor known as vocational education. This project helps validate claims that CTE programs have evolved to

become modern and cutting-edge with the additional benefit of significantly boosting academic achievement across core subject areas.

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