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Longitudinal Outcomes of CTE Participation:

P-16+ Transitions in Texas and the Rio Grande Valley

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POLICY BRIEF SUBMITTED TO THE ERC ADVISORY BOARD

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Executive Summary

Context

The jobs of tomorrow are here today. They require enhanced skill sets and higher levels of education. Attainment has already fallen behind economic development, though. To fill these gaps, policymakers have turned towards practices which lead to better transitions between high school, higher education, and the workforce. This study looks at one such reform model. It examines student outcomes associated with participation in *Career and Technology Education* (CTE), specifically Tech Prep programming. The study explores the benefits of participation in Tech Prep across P-16+ transitions in both Texas and the Rio Grande Valley (RGV)—an area known for its unique context and widespread implementation of Tech Prep.

Focus

The purpose of this study is to understand the ways in which non-traditional academic models, such as CTE Tech Prep, may be used to foster college and career transitions. The focus of research explores the impacts of Tech Prep participation on longitudinal outcomes related to the P-16+ pipeline. Specific questions guide research. These are:

(RQ1) What student- and school-level characteristics influence Tech Prep participation?

(RQ2) Relative to comparable students, what impact does Tech Prep participation have on high school transitions, higher education enrollment, developmental remediation, postsecondary attainment, and workforce participation?

Methods

Using data from the TEA (Texas Education Agency), THECB (Texas Higher Education Coordinating Board), and TWC (Texas Workforce Commission), cohorts of high school students graduated in 2009 and 2010 are tracked through four years of postsecondary access and five years of workforce participation. Methods consist of Propensity Score Matching (PSM) of students to control for selection bias. PSM includes a two-step process which first models the predicted probability of all students enrolling in Tech Prep, and then matches Tech Prep to non-Tech Prep students using a *nearest neighbor* sampling method. PSM creates a quasi-experimental control group for comparison. Multilevel logistic regression is then used to ascertain the odds of reaching each longitudinal outcome, including estimates of Tech Prep participation and models associated with the five key P-16+ areas.

Findings

Analysis suggests Tech Prep participation is inclusive of a more diverse set of students than traditional academic paths. Participation in Tech Prep during high school leads to gains across all P-16+ transition points. Tech Prep increases opportunities to transition to higher education after high school, providing stronger pathways to community college and greater access for traditionally disadvantaged students. When combined with academic rigor, Tech Prep participation works to improve enrollment and expands matriculation into four-year institutions. Importantly, Tech Prep interacts with a number of student traits, increasing the likelihood of postsecondary attainment. In addition, Tech Prep works to impact the odds of transitional and post-postsecondary employment. RGV area comparisons indicate significant regional variation; RGV is associated with greater odds of college readiness and higher rates postsecondary enrollment.

Implications

Results are numerous and provide strong evidence for the efficacy of Tech Prep models in the RGV, Texas, and beyond. Findings demonstrate the need for further, quantitative and qualitative review as expansion and implementation grow. They inform on the utility of Tech Prep programs as well as illustrate the possibilities of using longitudinal data to explore effects of educational models on student outcomes.

Moreover, implications connect to the greater policy discussion. Knowledge gained from this study offers insight into the current legislative stalemate over federal *Perkins* reauthorization and CTE funding. Additionally, it provides useful guidelines for Texas as schools and districts work to develop CTE programs in response to recent changes in graduation plans under *House Bill 5*.

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The jobs, careers, and industries of tomorrow are no longer blueprints for the future. They are here today (Organization for Economic Cooperation and Development [OECD], 2016). At the same time, world markets have become increasingly interconnected, interdependent, and competitive (Crist, Jacquart, & Shupe, 2002; Fletcher, Lasonen, & Hernandez, 2014; Ramsey, 1995). Global economies have shifted away from resource and manufacturing industries. Instead, they now look towards *information economi*es in which knowledge, technology, and services are important drivers of growth and wealth (Castells, 2010; OECD, 2016). Innovative industries—and their correspondingly novel career opportunities—call for increased skill sets and higher levels of education (Carnevale, Smith, & Strohl, 2010). Facing greater competition and enormous growth in previously undeveloped markets, America is now tasked with growing its educated labor supply.

THE JOBS OF TOMORROW

The need for more—and better—educated employees is predicated on several factors inherent in the workforce today. First, there is a growing shift in what job opportunities will be available to young workers. Second, existing gaps in education and employment are expanding.

Today many prime-age workforce members, those ages 25-54, are working in jobs that require a high school diploma or less (National Governor's Association [NGA], 2014). These jobs are quickly disappearing which will leave citizens unemployed or underemployed, stuck with low and unlivable wages (Carnevale et al, 2010). The retirement of the *baby boomer* generation, coupled with closures in previously popular industries, have shaped the forecast of replacement positions as well (Fitzsimmons, 1999; Symonds, Schwartz, & Ferguson, 2011). Estimates project that both replacement and new job opportunities will necessitate higher levels of educational attainment. Forecasts predict two-thirds of positions in the next decades will require some form of postsecondary education (Brown & Schwartz, 2014; Castellano, Stringfield, & Stone, 2003). A quarter of anticipated jobs will require some higher education though not necessarily a four-year degree (Carnevale et al, 2010). These include professions which demand either an industry recognized certificate or associate's degree.

A preponderance of research has shown that the lack of a high school degree in this current day relegates a person to a lifetime of poorly paid, unskilled labor opportunities (Seidman & Ramsey, 1995). Further, low postsecondary attainment levels keep many more from experiencing high-paid, middle class job opportunities (Carnevale et al, 2010; Castellano et al, 2003). Gaps between disadvantaged, underserved populations extend inequity (Kao & Thompson, 2003; Ross et al, 2012; Lumina, 2015; U.S. Department of Labor [USDOL], 2015). Shifting economies in combination with growing demand for skills and education in the future will only exacerbate inequalities—unless appropriate interventions are implemented.

POLICY CONTEXTS

Growing requirements in the workforce ahead have forced many to rethink policy connections between education and employment. Current policies do not sufficiently bridge barriers to postsecondary education which keep certain students from gaining the necessary skills for the jobs of tomorrow. To fill gaps and grow economies, policymakers have turned towards investing in practices which lead to better transitions between high school, higher education, and the workforce.

Commonly referred to as P-16+ pipelines, these are sets of initiatives which address disconnects in education and attempt to integrate the system for greater effectiveness (Bailey, 2009; Kleinman, 2001). P-16+ research concentrates on identifying which transitions in education have negative impacts on student potential, and what interventions connect transition points to help students reach greater attainment (Bragg & Durham, 2012; Callan, Finney, Kirst, Usdan, & Venezia, 2006; McClafferty, Jarsky, McDonough, & Nunez, 2009; Mustian, Mazzotti, & Test, 2013). Reforms focus on targeted, comprehensive, and/or non-traditional methods of providing educational services to students.

Career and Technical Education

Because traditional transitions and traditional approaches have not served all students well in the past, educators have turned focus to diverse options to meet requirements for academic achievement. These reforms meet college ready standards while also fulfilling student interests and developing career skills for the future. Technical coursework has been an ideal area for this type of reform implementation.

Vocational education historically focused on teaching skills at the detriment to academic content (Brown & Schwartz, 2014; Dare, 2006). In addition, programs were often separated and tracked away from academic paths and students, creating divisions which exacerbated gaps and inequalities (Castellano et al, 2003; Dare, 2006). The press for an educated workforce has demanded a new vocational learning platform. Through a series of reforms pushed by policymakers and practitioners alike, vocational education has been reshaped within past decades. Reform has promoted connections between technical content and growing workforce demands, content and academic skills, and content with postsecondary alignment (Aliaga, Kotamraju, & Stone, 2014).

The use of the term vocational education has fallen out of favor and been replaced with *Career and Technical Education* (CTE). Along with a name change, programs and funding have changed dramatically. The *Carl D. Perkins Vocational and Technical Education Act* (later the *Career and Technical Education Act*) passed in 1984 and was reauthorized at various times from 1990-2006. Federal *Perkins* legislation was a response to concerns that secondary schools were failing to develop students in the academic and technical skills needed for a 21st century economy. Policy connected to changing market demands for increased technology and information in a globalized, competitive workforce (Hershey, Silverberg, Owens, & Hulsey, 1998). Federal legislation was the basis for many changes to CTE including curricular improvements, modernization of technical skills, and expansion of programming to a wider population of students (Friedel, 2011).

CTE has become more integrated, rigorous, and complex, introducing technology and new career paths (Ramsey, 1995). Courses and programs have—and are still—working to integrate core academic standards alongside technical training (Stipanovic, Lewis, & Stringfield, 2012). Newly designed CTE courses offer exposure to career planning and job exploration; they provide industry exposure through hands-on experiences and mentoring (Hutchins & Akos, 2013; Rojewski & Hill, 2014). Program participation translates to both workforce training and postsecondary preparedness.

Studies have suggested the use of CTE may help with high school retention and graduation as well as lead to a greater probability of enrollment and persistence in higher education (Allen, 2012; Brown, 2003; Neild & Byrnes, 2014; Zinth, 2014). In addition, students with CTE backgrounds may be better prepared to take on higher paying jobs with or without further, postsecondary training (Mane, 1999). For the first time, technical programs—those sneered at as vocational education in the past—have been called upon to remedy gaps in educational transitions and attainment.

Tech Prep Programs

Important to *Perkins* legislation and CTE reform, has been the creation of advanced CTE programs—in more recent updates to legislation this is termed as Programs of Study (POS) models. These CTE programs offer integrated academic content, technical skills and experiences, and advanced opportunities through *credit based transition* models. Many advanced CTE programs offer internships, on-the-job training, and/or certification possibilities through dual credit courses. One such example is Tech Prep programming.

The goal of Tech Prep, or *Technical Preparation Programming*, programs is to create better articulation between high school and higher education. Programs engage students in career focused pathways, prepare students for college and careers, and allow for workplace exposure and mentoring (Bragg, 2000). Tech Prep programs are part of a regimented CTE course plan; they include a planned sequence of study in a defined field during high school which includes postsecondary training and leaves the student with some form of higher education credential upon completion (U.S. Department of Education [USDOE], 2016). Tech Prep programs involve complex partnerships with high schools, higher education providers, and local industries to fully implement and involve students in the curriculum. Partnerships are called regional consortia and they work articulating courses and curriculum across varying institutions. Through program implementation, Tech Prep models have the potential to create coherent transitions in the P-16+ pipeline while providing relevant and rigorous technical curriculum to all students.

Today Tech Prep programs are widespread. A survey of states in 2008 found that over half (29) have active, comprehensive Tech Prep programs (Brush, 2008). Tech Prep has been shown to equalize educational opportunities and expectations resulting in diminished academic tracking and increased participation by all types of students (Dare, 2006; Fishman, 2015). Studies have suggested the use of Tech Prep may help with high school retention and graduation (Cellini, 2006; Stone & Aliaga, 2005). Participation may also lead to a greater probability of enrollment and persistence in higher education (Bailey & Karp, 2003; Bragg, 2006). These findings are especially true for students at greater risk of dropping out and receiving an incomplete education (Bragg, Loeb, Gong et al, 2002; Brown, 2003). CTE Tech Prep programs are seen as promising reform models which can simultaneously inspire students to train at the postsecondary level while also keeping traditionally low performing students interested in education long enough to learn skills and content needed to secure a quality job (Cellini, 2006; Kim, 2014).

FOCUS OF THE STUDY

CTE Tech Prep has enormous potential in its design. The program is meant to be an attractive and challenging pathway to high school completion and higher education attainment. Practitioners today are expanding Tech Prep implementation and also working to provide similar, advanced CTE programs using its program components. At this point in time it is important to study the impacts of past CTE efforts in order to improve future endeavors.

RESEARCH DESIGN

The purpose of this study is to better understand the ways in which advanced CTE models, such as Tech Prep, may be used to foster college and career transitions. The focus of research explores the impacts of CTE Tech Prep participation on longitudinal outcomes related to the P-16+ pipeline. Given the need for more rigorous assessment within the current body of CTE research, the design of this study aligns to criteria for research put forth by What Works Clearinghouse (WWC) standards (Fritz et al, 2012; Nimon, 2012). Specifically, the research design works to meet the evidence standards of strong, quasi-experimental studies of comparison groups (Gemici & Rojewski, 2007; WWC, 2014). Methods include propensity score matching of students to control for selection bias, and the multilevel modeling of logistic regression on a variety of outcomes associated with Tech Prep participation. The outcome variables investigated encompass high school transitions, higher education enrollment, developmental remediation, postsecondary attainment, and workforce participation. Findings are explored and connected to current contexts, CTE research, and education policies. They create multiple implications for both policymakers and practitioners. The analytic strategies used in this study work together to yield a rich set of findings which strengthen the connections between advanced CTE participation and student success.

Research Questions

The study is an exploration of the longitudinal outcomes related to participation in advanced CTE programming, Tech Prep. In addition, comparisons between the RGV LEAD (Rio Grande Valley Linking Academic and Economic Development) consortium area and the rest of Texas are investigated to identify impacts of implementation. For this study, one broad question covers the intent of analyses. How do advanced CTE programs, such as Tech Prep programming, affect student outcomes across the P-16+ pipeline? Specific questions guide research. These are:

RQ1. What student- and school-level characteristics influence Tech Prep participation?

RQ2. Relative to comparable students, what impact does Tech Prep participation have on high school transitions, higher education enrollment, developmental remediation, postsecondary attainment, and workforce participation?

METHODS

DATA

Information for the study comes from the Texas Education Research Center (ERC) clearinghouse. The ERC hosts access to high quality, longitudinal data from the Texas Education Agency (TEA), the Texas Higher Education Coordinating Board (THECB), and the Texas Workforce Commission (TWC). Multiple data sets from all three state agencies are combined using a unique identifier in order to track students over time and different educational settings. Using this resource, high school graduate cohorts from 2009 and 2010 are matched against both higher education and workforce information to ascertain information on selected student outcomes. Data sets include information on student demographics and high school participation, postsecondary enrollment and course taking behaviors, higher education graduation files, and workforce participation and wages.[1] Data collection and coding decisions for ERC data are relatively similar to FETPIP (Florida Education and Training Placement Information) methodologies. This State Longitudinal Data System (SLDS) provides information on students over time and from several agency sources. Researchers in the CTE field have praised their reporting methods and requirements as rigorous means of evaluating impact measures across educational transition points (Bragg, 2000; Sambolt & Blumenthal, 2013).

PROPENSITY SCORING

Statistical procedures are used to control bias in observational characteristics which differ across Tech Prep participants and other students. Limiting bias occurs through a process of matching comparable students or groups. *Propensity Score Matching* (PSM) is employed to create a control group for use in comparison to Tech Prep participation. PSM modeling creates a match based on the predicted probability a student will enroll in the treatment; in this case CTE Tech Prep programming (Rosenbaum & Rubin, 1983; 1984). PSM consists of two stages, 1) creating a propensity score and 2) matching propensities to form a control and treatment group.

First, propensity scores are developed by determining the odds of enrollment in Tech Prep for all students. Estimated propensity scores are calculated for each student as the probability of treatment given a number of characteristics or covariates. The formula for propensity scores can be explained as such: $e(x)$ is the propensity score, P the probability, $T = 1$ the treatment indicator with values of 1 for treatment and 0 for control, and X a set of observed covariates the treatment is conditional upon (Thoemmes, 2012).

$$e(x) = P(T = 1 \mid X)$$

The model above estimates propensity scores which include both student and school-indicators combined to create a balanced PSM sample (Guo & Fraser, 2010; Heckman, Lalonde, & Smith, 1999). The estimated probability of Tech Prep participation—the propensity score—is saved as a variable for all students. Each student in the treatment group (Tech Prep participants) is matched to a student not in the group. Using a *nearest neighbor* technique, a Tech Prep student is first selected. Their propensity score is matched to a subject with the closest, or most similar, propensity. That student enters the control group and is taken out of the pool of potential matches (i.e., matching without replacement). The selection and matching process is repeated until there are no longer untreated students which can be matched to a Tech Prep student (Austin, 2011; Haviland, Nagin, & Rosenbaum, 2007).

The PSM model is calculated using *probit* regression then matched using the nearest neighbor technique with no replacement and a caliper of (.001). It created a smaller sub-sample of the original data, drawing only treatment and control matched cases. The PSM procedure resulted in a parsimonious model, creating a balanced sample of treated and non-treated cases. Balancing tests revealed the uneven distribution of student and school indicators diminished with the use of PSM allowing for greater specificity in Tech Prep comparisons (Caliendo & Kopeinig, 2005; West et al, 2014).

HIERARCHICAL LINEAR REGRESSION

Inferential analysis is conducted upon the sample created by the PSM procedure to explore impacts of participation in Tech Prep compared to the matched control group. Outcomes are

[1] Over 130 individual data files from the Texas ERC were merged to create the longitudinal data sample.

measured at varying points along the P-16+ pipeline. As students are nested within several different structures and institutions, multilevel hierarchical modeling is applied for all statistical procedures (Nimon, 2012; Stevens, 2009). This type of modeling, sometimes referred to as *Hierarchical Linear Modeling* (HLM), allows for better statistical estimates as it takes into consideration the clustering of students within schools. Models also consider the effect of such clusters. Multilevel equations are able to control for the school a student attended when identifying results, and also provide meaningful context based on estimates of campus characteristics (Gelman & Hill, 2007; Raudenbush & Bryk, 2002).

Outcomes associated with P-16+ pipeline transitions are dichotomous in nature, with yes or no outcomes. As such, statistical analysis employs the use of logistic regression which takes restricted outcomes and forms odds out of the probability of a successful outcome, or a yes in a yes/no situation. Each covariate in the model predicts the difference in the odds that the outcome of interest will occur. Using predictor variables to formulate an odds estimate for the outcome of interest, it may then be turned back into a probability of occurrence (Gelman, & Hill, 2007; Stevens, 2009). In this way, equation models such as these will be fitted for each outcome of interest.

$$\ln(\pi_{ij}) = (\beta_0 + \beta_1 x_{1ij} + \beta_2 x_{2ij} + \beta_3 x_{1ij} x_{2ij} \ldots + \varepsilon_i)$$

$$\beta_{0j} = \gamma_{00} + \gamma_{01} W_{1j} \ldots + u_{0j}$$

$$\beta_{1j} = \gamma_{10}$$

In this equation, the dependent variable is the log odds of student i in high school j experiencing the outcome of interest (e.g., enrollment, attainment, etc). The β terms are the estimates of the impact of the student-level covariates (x_{ij}) on the log odds. Coefficients β_{1-3} are recurrent; they suggest the relationship between a student-level predictor (x_{1ij}), Tech Prep participation (x_{2ij}) and the interaction between the two variables $(x_{1ij}x_{2ij})$. In the intercept, β_0: W_{1j} represents level-two school characteristics related to the outcome in the model, and μ_{0j} represents high school within-campus effects.

Base modeling starts with all student- and campus-level variables as well as all potential interactions between Tech Prep and student-level indicators. When interactions are found to be insignificant, the model is trimmed to only significant interactions and main effects. This form of backwards modeling continues iterations until the best fitting model converges. Final models contain all student- and campus-level effect estimates—regardless of significance—and significant interaction estimates.

Analysis for the study is comprised of multilevel modeling of logistic regression on a selection of 18 outcomes. The full sample of 2009 and 2010 cohorts is used to identify factors important to Tech Prep participation (*N*=534,035). To explore the impacts of Tech Prep participation at varying transition points on the P-16+ pipeline, the PSM sample is employed (*n*=232,268). Special attention in modeling is given to the relationship between Tech Prep participation and outcomes, Tech Prep in relation to other student characteristics, and membership within the RGV LEAD area as a measure of consortia implementation. Outcome modeling is organized into participation then the five P-16+ transition areas with additional sub-analysis:

Tech Prep Participation

Post-High School Transitions
- Transitioning to Higher Education Within a Year of High School Graduation
- Transitioning to a Community College Within a Year of High School Graduation
- Transitioning to a University Within a Year of High School Graduation
- Transitioning to the Workforce Within a Year of High School Graduation

Postsecondary Enrollment
- Enrolling in Higher Education Within Four Years of High School Graduation
- Enrolling in a Community College Within Four Years of High School Graduation
- Enrolling in a University Within Four Years of High School Graduation

Postsecondary Attainment
- Earning a Higher Education Credential
- Earning an Associate's Degree
- Earning a Bachelor's Degree
- Earning a Higher Education Certificate

Developmental Need
- Participating in Developmental Coursework While Enrolled in Higher Education
- Participating in Mathematics Developmental Coursework While Enrolled in Higher Education
- Participating in Reading Developmental Coursework While Enrolled in Higher Education
- Participating in Writing Developmental Coursework While Enrolled in Higher Education

Workforce Participation
- Transitioning to the Workforce Within a Year of Earning a Postsecondary Credential
- Transitioning to the Workforce (Two Jobs) Within a Year of Earning a Postsecondary Credential

SELECTED FINDINGS

WHAT INFLUENCES TECH PREP PARTICIPATION

The first research question of the study—what student- and school-level characteristics influence Tech Prep participation—is examined with the full data sample from 2009 and 2010 high school graduation cohorts (see Table 1). Of individual student traits, gender is significantly related to Tech Prep. Women are slightly more likely to participate; this is contraindicative to past research which found greater participation with male students (Bragg et al, 2002). Hispanic students and students of low-SES backgrounds are more likely to enroll in Tech Prep. This does follow participation rates of other studied Tech Prep programs (Bragg et al, 2002; Brown, 2003; Stone & Aliaga, 2005). Though individual students from disadvantaged groups are more likely to participate, greater proportions of minority or low-SES students at the campus-level negatively affect participation. This suggests that schools serving disadvantaged populations struggle to provide Tech Prep opportunities to their students.

Students in special populations or special programs are less likely to engage in CTE Tech Prep. LEP (Limited English Proficient), special education, and Gifted and Talented (GT) students all have lower odds of participation. Negative associations indicate that the largest block of participants come from students not enrolled in any sort of targeted support or enrichment programs. To this end, Tech Prep is meeting the demand of providing opportunities for the middle majority—students whom are neither high nor low achieving. As most of the middle majority fails to enroll or complete postsecondary education, it is a positive indicator that Tech Prep programs may be used to boost P-16+ attainment for these types of students (Bragg, 2000; Cellini, 2006; Parnell, 1985). However, more recent changes to CTE guidelines and policies press for wider enrollment by all types of students (Friedel, 2011). These findings indicate Tech Prep in Texas is lacking inclusive CTE programming for all its students.

Like prior studies of Tech Prep participation, students enrolled in the program are more likely to exhibit traits of academic achievement and rigor (Cellini, 2006). Tech Prep is associated with passing Texas State accountability exams (i.e., TAKS [Texas Assessment of Knowledge and Skills Test]) in both reading and mathematics. Moreover, positive associations are made between Tech Prep and college-ready diploma plans in Texas, both RHSP (Recommended High School Plan) and DAP (Distinguished Achievement Plan). Lastly, dual credit courses are positively connected to Tech Prep participation, increasing the predicted probability of enrollment with each additional course taken. These findings are similar to past studies which found CTE and Tech Prep students are generally more successful, or at least similar, in high school achievements when compared to traditional academic paths (Bailey & Karp, 2003; Cellini, 2006; Dare, 2006). Specifically, past studies point to growth in math scores and higher levels of overall achievement, comparable to gains accumulated while completing a RHSP or DAP degree (Kim, 2014; Stone & Aliaga, 2005).

Several campus-level indicators prove significant in the odds of Tech Prep participation. An Acceptable state accountability rating has a positive impact on Tech Prep participation compared to schools which failed to meet accountability requirements. Schools rated as Exemplary, the highest accountability rating in Texas at the time of the study, do not have significant differences. This indicates that the highest performing schools do just as well as Acceptable campuses in supporting advanced CTE participation. Large schools—those with enrollments over 750 students—correspond to a greater predicted enrollment in CTE Tech Prep than others. This is perhaps due to the greater availability of programming or resources usually found at larger schools (Lee & Loeb, 2000; Leithwood & Jantzi, 2009). And, lastly, RGV LEAD schools have much larger odds of Tech Prep participation when compared to Texas schools as a whole. This suggests differences between the RGV area and the state in implementation.

In all, findings suggest Texas models of Tech Prep draw in a more diverse student group compared to the traditional academic population. Texas Tech Prep students are even slightly more diverse compared to past research studies (Bragg et al, 2002; Stone & Aliaga, 2005). Results show Tech Prep as a positive tool for both middle and high achieving campuses though low achieving campuses, and those serving high proportions of disadvantaged students, demonstrate less success with participation. The state, like many other implementers, has typified difficulties in including special populations of students (Gottfried, Bozick, Rose, & Moore, 2014). However, modeling suggests Tech Prep is a promising and viable program for P-16+ interventions.

P-16+ TRANSITIONS IN TEXAS

The second research question explores the impacts of CTE Tech Prep participation on longitudinal outcomes related to the P-16+ pipeline. These are calculated using a quasi-experimental sample which has been propensity scored and matched to decrease selection bias. The odds of each outcome occurrence are determined using multilevel logistic regression; in all, 17 models are presented which study specific impacts of student traits, academic indicators, and campus characteristics (see Tables 2-18). Added to model equations are interactions between student-level information and Tech Prep participation. Regression models are organized into five key areas along the P-16+ pipeline.

High School Transitions

High school transitions refer to the year after high school graduation and include four models: participating in any form of higher education, attending either a community college or university, and transitioning to the workforce. Findings are viewed in Tables 2-5. Overall, students from disadvantaged backgrounds and low achieving students are less likely to enter higher education, and have slightly greater odds of working after high school. These models produce the largest amount of Tech Prep interactions in connection with student traits. As an example, female students in Tech Prep have a 66% predicted probability of enrolling in higher education after high school while women in the control group only show a 54% likelihood of transition.

In keeping with prior studies, Tech Prep participation results in greater odds of enrollment in higher education for students, particularly students from disadvantaged backgrounds (Bragg et al, 2002; Brown, 2003). Student achievement and rigor also plays a role, especially in the transition to the university level. In all, there are differences between postsecondary institution types as students transition from high school to higher education. Students from disadvantaged backgrounds and lower achievement groups (e.g., LEP, special education) are more likely to enter community colleges than universities. These differences are often positively moderated by Tech Prep participation. Significant interactions show Tech Prep has its best success in preparing students for enrollment at two-year institutions rather than the university level. Several studies have found that while Tech Prep is positively associated with enrollment in community colleges, participants are somewhat less likely to enroll in four-year institutions (Bailey & Karp, 2003; Bragg et al, 2002; Cellini, 2006). This suggests participation may divert students directly into two-year institutions directly following high school at the expense of university enrollment. This may be due to curriculum associated with the Tech Prep program or rather due to the institutionalized structures of Tech Prep itself. Programs require partnerships between secondary and postsecondary institutions. Partnership funds, staff, and programs may all work to push students towards the partnering community college in order to continue a Tech Prep program or enroll for a different course of study. Interactions with Tech Prep in this study do provide some evidence that participation broadens opportunities and helps to increase successful transitions at all levels.

There are few impacts Tech Prep has on the decision to enter the workforce within a year of high school graduation. Only special education and the number of CTE courses interact with Tech Prep to increase the odds of workforce participation. Findings provide evidence that CTE and Tech Prep participation may help prepare special education students for career transitions (Gottfried et al, 2014; Rabren, Carpenter, Dunn, & Carney, 2014). Other indicators suggest race and ethnicity have a strong influence as to whether or not a student joins the workforce upon completing their high school diploma.

Postsecondary Enrollment

Three models estimate the odds of enrollment in higher education up to four years after high school graduation: overall, community college, and university attendance. Tables 6-8 illustrate regression outputs. Many interactions between Tech Prep and student traits impact enrollment over time; these provide for greater odds of postsecondary access for Tech Prep students. Impacts are often the largest at the community college level. In cases where students have lower odds of enrollment (e.g., days absent, LEP, special education), Tech Prep moderates the effect, enhancing the odds of participation. For example, special education students in Tech Prep have a 53% predicted probability of postsecondary enrollment compared to special education students in the control group with a lower chance at 40%. These findings suggest that participation in Tech Prep increases enrollment for students less likely to attend higher education due to special needs or decreased motivation (Gottfried et al, 2014; Stone & Aliaga, 2005)

There are increases to the odds of enrolling at the university level for Tech Prep students who participated in dual credit and CTE courses while in high school. This suggests advanced courses, and dual coursework in particular, may improve four-year matriculation patterns. The patterns are consistent with research that links dual credit to positive postsecondary outcomes (Allen, 2010; An, 2013; Hoffman et al, 2009; Kleiner & Lewis, 2009; Lerner & Brand, 2006). Dual-CTE corresponds to a negative interaction, though. Findings suggest Texas CTE courses require more consideration, building better connections to college and career readiness. Study interactions with dual-CTE run counter to available research (Wonacott, 2002; Stipanovic et al, 2012).

Developmental Education

Developmental coursework, or DE, are split into four regression models: participation in any form of DE, and participation in a math course, reading, and/or writing DE course (see Tables 9-12). The majority of student traits positively impact odds of enrollment in DE; students from disadvantaged backgrounds or those enrolled in special programs often have the highest odds of participating in developmental remediation.

Participation with Tech Prep, in past research, has been linked with greater postsecondary preparedness (Castellano et al, 2003; Plank, DeLuca, & Estacion, 2008). This study finds positive relationships with readiness as well. Low-SES students who participated in Tech Prep have lower odds—a 46% probability of developmental coursework—compared to low-SES control peers with a probability of 55% developmental enrollment. Tech Prep interacts with indicators of achievement and rigor as well. While increased achievement decreases the odds of DE, participation in Tech Prep lowers the odds of DE even further. Indicators of achievement which Tech Prep interacts with include: dual credit, CTE, dual-CTE, and college ready diplomas. Tech Prep is associated with greater odds of DE participation in mathematics modeling according to dual credit, CTE courses, and DAP diplomas. This indicates that Tech Prep students with higher achievement according to these traits may still have deficiencies in college ready math leading to non-credit bearing courses. Working in the transition year increases odds of developmental enrollment. Tech Prep interacts with transition employment to decrease odds of DE participation. Overall, Tech Prep programs have mostly positive impacts on college readiness.

Postsecondary Attainment

Tables 13-16 show results for attaining a postsecondary credential including gaining any credential, attaining an associate's degree, earning a bachelor's degree, and/or obtaining a higher education certificate. These odds are calculated only for students who enrolled in higher education. Many student traits impact attainment models without interacting with Tech Prep. They most often have negative influences on the odds of obtaining a higher education credential, particularly a bachelor's degree. Students from traditionally disadvantaged backgrounds do have somewhat greater odds of completing an associate's degree.

Tech Prep increases the chances of attaining a higher education credential, especially given indicators of academic achievement and rigor. Participation in Tech Prep interacts with gender, dual credit, CTE, and college diploma type (e.g., RHSP and DAP) to strengthen the predicted probability of earning a postsecondary credential. Tech Prep interacts with gender, special education, GT, and CTE to increase the odds of attaining an associate's degree. Positive interactions between Tech Prep and absences, dual credit, and CTE are found in the bachelor's degree model, though Tech Prep has negative impacts in combination with diploma types. Gender, CTE, and dual-CTE all positively interact with Tech Prep in the odds of obtaining a higher education certificate.

Past research on Tech Prep either found modest impacts in gaining semester credit hours or no relationship between the program and postsecondary attainment (Bragg, 2006; Neumark & Joyce, 2001; Neumark & Rothstein, 2004). In this study, Tech Prep is positively associated with a number of predictors, and participation expands the possibility of postsecondary attainment. Specifically, Tech Prep students who transition to higher education the year after high school have greater odds of attainment (e.g., an 86% predicted probability compared to 78% for non-Tech Prep peers). Tech Prep helps women to earn a degree and enhances the impacts of CTE in earning a credential at two- and four-year institutions. Students who are involved with the program and also take rigorous coursework in high school (e.g., dual credit courses, college ready diploma plans, etc.) are more likely to succeed in higher education than similar students in the control group. These findings provide evidence that Tech Prep is a viable tool for success beyond traditional academic tracks (Bragg, 2000).

Workforce Participation

CTE participation has previously been connected to greater workforce outcomes compared to traditional academic students in both the year after high school graduation and seven years out (Bishop & Mane, 2004; Castellano et al, 2003). Individual traits such as gender or degree attained also relate to long term earning capacity in connection with CTE (Maguire, Starobin, Laanan, & Friedel, 2012). This study finds similar trends in CTE Tech Prep participation. Tables 17-18 describe the odds of workforce participation within a year of completing a postsecondary credential.

Several student traits positively impact the odds of working after the completion of a postsecondary credential. Women have greater odds of employment as do students from each ethnic group. Tech Prep participation is associated with lower proportions of women and higher proportions of Black students who take on second jobs. Achievement is, for the most part, linked to greater workforce participation. Working within the transition year after high school leads to a greater probability of working within the transition year after higher education—larger odds still for Tech Prep students(71-72% probability). Students with certificates are associated with the highest probability of workforce participation followed by students with bachelor's and associate's degrees (which share similar chances of employment). Tech Prep slightly increases the odds of having a job after earning a bachelor's degree.

Summary of Longitudinal Findings

Findings provide strong evidence for the efficacy of Tech Prep models in Texas and beyond. Tech Prep participation increases opportunities to transition to higher education after high school, providing stronger pathways to community college and greater odds for traditionally disadvantaged students. When paired with increased rigor and CTE coursework, program participation works to improve enrollment over time and expand matriculation into four-year institutions.

Tech Prep has positive impacts on college readiness as well, decreasing the chances of developmental remediation. Importantly, Tech Prep interacts with a number of student traits, increasing the likelihood of postsecondary attainment at all levels. After postsecondary graduation, Tech Prep moderates the odds of workforce participation. Tech Prep is shown to have far reaching impacts on students long after they complete their high school careers. Impacts vary across P-16+ transitions, institutions, and types of students. Findings suggest Tech Prep is a valuable option to increase P-16+ transitions either for targeted populations or entire campuses.

THE RIO GRANDE VALLEY

The RGV area and RGV LEAD consortium are particularly important to the study. Its location and makeup provide a microcosm to some of the most pressing demographic issues facing educational attainment and postsecondary transitions. The RGV hosts a large percentage of minority students, high amounts of poverty, traditionally low percentages of educational attainment, and is geographically located in areas less likely to have access to postsecondary pathways or workforce opportunities (Lumina, 2015; Ross et al, 2012; U.S. Census Bureau [USCB], 2016). Outcomes learned from such an area would be of significant interest to national models of intervention as well as other state and local reform interventions (Allen, 2012).

Findings from all multilevel logistic regressions show RGV LEAD areas vary significantly from the rest of Texas. This suggests differences in implementation, especially when controlling for the types of schools and types of students within the RGV area. Quantitative results fit with prior qualitative reviews of Texas implementation which indicate variability across Texas consortia (Brown, 2001; Waller & Waller, 2004). It also holds with the larger research surveys which find variations between implementation consortia and models (D'Amico, Morgan, Katsinas, & Friedel, 2015; Hershey et al, 1998).

First, RGV area students are more likely to participate in Tech Prep. Students from the RGV LEAD consortium have 8.62 greater odds of enrollment compared to students from other Texas areas. This is a huge advantage in the probability of participation, holding all else constant. RGV LEAD is the single largest predictor of Tech Prep participation in a model with many significant covariates.

When looking at transitions within a year of high school graduation, students from RGV LEAD areas have greater odds of enrollment in all higher education models. These findings indicate RGV is successful in transitioning students to all levels of postsecondary institutions—community colleges and universities. When modeling postsecondary enrollment over time, RGV LEAD is significantly related to all models. Students from RGV area high schools, overall and at the university level, are more likely attend higher education. At the community college level, RGV students are slightly less likely to enroll over time. These findings suggest that the RGV consortium is doing its strongest work at pushing students towards four-year institutions.

RGV is not significantly related to DE participation overall and corresponds to a lower predicted probability of math DE participation. This indicates students from RGV LEAD areas are just as prepared as students from in and around Texas—if not better prepared in math—to take credit-bearing courses upon entry to higher education. RGV negatively impacts the odds of completing a postsecondary credential. When breaking down models into the type of credential, RGV LEAD is negatively associated with the odds of earning an associate's degree but has a slightly positive relationship with the odds of earning a bachelor's degree. These findings are somewhat frustrating given that prior models in the study suggest RGV is linked to higher enrollment. The positive associations between enrollments paired with negative connections with attainment replicate prior studies. These show a limited impact of individual Tech Prep programs/models on higher education completion (Neumark & Joyce, 2011). RGV LEAD students are associated with lower odds of workforce participation upon high school graduation. In a similar manner, students from the RGV consortium area have lower odds of employment after completing a postsecondary credential. These findings suggest there are limitations to employment for RGV students in multiple P-16+ transition points.

Overall, modeling shows RGV has further work to accomplish getting students enrolled and through higher education to a postsecondary credential and career. Strengths to date include the transitions of students to higher education within a year of completing high school, indicators of college readiness shown by decreased need for developmental education, and increased pathways for students into the university pipeline.

IMPLICATIONS FOR THE FUTURE

Tech Prep works towards preparing students for the jobs of tomorrow in the classrooms of today. Programming is aimed at reducing persistent gaps in educational attainment through increasing transition pathways to higher education. The need to assess the efficacy of these interventions is vital to understanding their use and potential in the wider framework of educational reform. Research to date has been limited and many in the field are aware of the lack of rigorous efforts connecting programs to student outcomes (Rojewski et al, 2012).

The current study helps better inform past research and examine the impacts of such models in preparing students for college and career outcomes. Given the specific coding used in Texas data, this study is able to correctly identify students involved in CTE Tech Prep. Explicit definitions provided in data are superior to past studies which have relied on self identification or complicated coding definitions (Aliaga et al, 2014; Bragg et al 2002; Hershey et al, 1998; Stipanovic et al, 2012). As such, it provides a more reliable estimate for Tech Prep comparisons.

In addition, the study includes the use of quasi-experimental matching methods to decrease selection bias; these create comparison groups which control for student and school characteristics (Bozick & Dalton, 2012; Lewis & Overman, 2008; Rojewski & Xing, 2013). Modeling in the study goes beyond simplistic methods found in many practitioner evaluations of programs (Fritz et al, 2012; Gemici & Rojewski, 2007; Rojewski et al, 2012). It utilizes hierarchical methods to best identify impacts of Tech Prep, accounting for students nested within schools (Cohen et al, 2003; Nimon, 2012). Multilevel models are able to control for the school a student attended when identifying results, and also provide meaningful context based on estimates of campus characteristics.

Findings from the current study add to research by replicating and extending associations between Tech Prep and P-16+ outcomes. They find positive associations between participation and postsecondary enrollment (Bailey & Karp, 2003; Bragg et al, 2002; Cellini, 2006). Tech Prep participation increases opportunities to transition to higher education after high school, providing stronger pathways to community college and greater odds for traditionally disadvantaged students. When paired with increased rigor and CTE coursework, Tech Prep participation works to improve enrollment over time and expands matriculation into four-year institutions. Models show varied but favorable relationships between Tech Prep and postsecondary attainment, differing from previous research (Neumark & Joyce, 2011). Findings also suggest there is implementation variability in the state as RGV LEAD areas are linked, specifically, to greater odds of enrollment (Brown, 2001; Waller & Waller, 2004). These results display great complexity across longitudinal outcomes. They create a host of possibilities for using Tech Prep as either a targeted or comprehensive P-16+ reform.

FUTURE EXPLORATION

Further study should follow students through even longer time points to assess postsecondary outcomes at six year intervals, and identify enrollment in graduate studies as part of post-postsecondary measures. Also, more detailed analysis of workforce participation is yet to be completed. These should investigate salary differentials according to participation. One piece of Tech Prep which was not measured in the study is the completion of a Tech Prep program (only Tech Prep participation was included in the current study). Additional research should combine high school and higher education data to identify the characteristics which impact Tech Prep program completion, resulting in a higher education credential. The current study provides strong evidence that Tech Prep participation has meaningful impacts on P-16+ transitions. Future research into the Texas Tech Prep program, and similar advanced CTE models such as POS (Programs of Study), will advance research and practice even more.

CHALLENGES FOR PRACTITIONERS

Information from this study works to inform future implementation efforts for Tech Prep but also wider reform contexts. Findings may be linked to the focus of P-16+ alignment and articulation, college and career readiness standards, and support for educational attainment in underserved students. These connections are vital to current reforms in CTE which hope to expand Tech Prep models to a more diverse selection of industries and students through similar CTE POS models.

Research suggests CTE courses and programs have—and are still—working to integrate core academic standards alongside technical training (Stipanovic et al, 2012). Reforms focus on incorporating academic rigor and vertical alignment between secondary and postsecondary curriculum (Brown, 2001; Castellano et al, 2008). There have been improvements within Tech Prep implementation. Curriculum content and standards are becoming more applied, but it is a gradual process (Bragg, 2000; Bragg & Reger, 2002; Hershey et al, 1998). Findings from this study suggest positive impacts of CTE Tech Prep but also persistent limitations and gaps in the program, specifically in promoting widespread readiness at university levels and perseverance to degree attainment. There is need for additional alignment and deeper, qualitative review of Tech Prep in Texas to better understand what components may best work to foster success.

IMPORTANCE OF CONTEXT

Within the effort to implement enhanced CTE and Tech Prep, understanding the context of reform is important. It allows for better crafted local policy and informed practitioners—those able to understand what will work in their specific circumstances. The Valley area and RGV

LEAD consortium are included in this study to help better understand some of the contextual implications of reform. RGV LEAD is a well developed example of regional consortia created under federal *Perkins* legislation and other state policies. As such it is an ideal region to view the impacts of Tech Prep through student participation. More importantly, the geographic area of the RGV provides a unique context to study educational reform for disadvantaged students.

Findings suggest that Tech Prep is a viable P-16+ model, especially in the RGV area and particularly for its underserved population of students. This study only tells part of the story though. Models suggest that RGV LEAD implementation of Tech Prep differs from the state as a whole and results in significantly greater odds of completing various P-16+ transitions. While models control for individual characteristics and campus-level differences, these findings do not indicate *why* RGV LEAD is associated with greater participation in Tech Prep or higher levels of postsecondary enrollment.

To better understand RGV LEAD impacts and implementation, a breakdown of the P-16+ partnership and specific Tech Prep components should be explored. Barriers and challenges should be compared to achievements in implementing Tech Prep over time. Within the study, other comprehensive and targeted reform initiatives must be connected to implementation to provide a full picture of the college ready improvements in the area. Bright areas—those schools or districts with high levels of success in Tech Prep—should be highlighted to find best practices. This type of qualitative review would provide a more complete picture of implementation paired with the present quantitative findings. In addition, a study of implementation would provide a roadmap for others looking to create or modify their own Tech Prep programs.

POLICY PRESSURES AND REFORM

Requirements of existing accountability standards for academic achievement have put pressures on schools to improve in all areas, including technical education (Anderson, 2008; Chadd & Drage, 2006). *Perkins IV* legislation took steps towards requiring accountability practices by imposing performance indicators for CTE Tech Prep, many of which educators thought would be too burdensome given data restrictions between K-12 and higher education (Friedel, 2011; Klein et al, 2014). Since then, CTE programs have expanded in size and scope. CTE is often combined as part of comprehensive school reforms. Advanced CTE courses are now linked to initiatives such as school choice and curriculum standards redesign (Asunda et al, 2015; Castellano et al, 2003; Ramsey, 1995). Further expansion and focus in CTE areas will only increase calls for accountability and changes to both federal and state policy contexts (Fletcher et al, 2014; Maguire et al, 2012).

The need for accurate information on the long-term impacts of CTE and Tech Prep participation is greater than ever. Accountability practices have been reshaped under the ESSA (*Every Student Succeeds Act*) reauthorization of ESEA (*Elementary and Secondary Education Act*). Upcoming CTE legislation coupled with recently changed accountability standards will force practitioners and policymakers to gather more information on current and potential programs that may impact student success.

FEDERAL LEGISLATION

Future changes to both federal and state/local CTE policies are imminent. Federal legislators have finally taken up the reauthorization of *Perkins* legislation (Klein, 2015; Boyd et al, 2015).

Hearings on *Perkins* reauthorization started soon after the passage of ESSA, and in September 2016 the House voted to pass a reauthorization of the legislation. Entitled the *Strengthening Career and Technical Education for the 21st Century Act*, this bill has bipartisan support and passed 405-5. The proposed legislation provides states and local education agencies (i.e., school districts) greater freedom in CTE goals and accountability. It allows for flexibility in spending and focuses federal dollars based on the number of students taking CTE (Ujifusa, 2016). This differs from past versions of *Perkins* which proportioned monies based on CTE programs and courses (Friedel, 2011).

A Republican-backed Senate version of *Perkins* reauthorization contains language which has currently stalled passage of the legislation. It requires the Department of Education (DOE) to cede most of its control over federal CTE dollars and reduces most, if not all, accountability measures. Hearings on the bill have been cancelled in the Senate. Though unlikely, the earliest reauthorization may occur is in the lame duck session between the 2017 election and inauguration (Stratford, 2016; Ujifusa, 2016).

The two largest points of contention which as are yet to be determined in *Perkins* reauthorization are the level of accountability which CTE courses and programs will face, and the number of CTE courses which will define a student as CTE for funding purposes. Former *Perkins* legislation—those which first outlined Tech Prep programming—required accountability in the form of tracking longitudinal outcomes. This has proved difficult given existing data capacities in education (Friedel, 2011; Klein et al, 2014). The argument for future legislation is whether to fold CTE into existing accountability measures, much like current state accountability standards. Or, to provide for greater flexibility and less accountability, as the ESEA reauthorization to ESSA has brought about less accountability and oversight at the federal level (Stratford, 2016).

It is likely funding in *Perkins* reauthorization legislation will not be specific to programs, but rather allotted to states and districts according to student participation. The number of courses which define a student as a CTE participator or CTE concentrator (e.g., enrolled in an advanced CTE program like Tech Prep) have not been finalized. Grouping requirements, the numbers of courses needed to reach a specific level of CTE, and occupational/career markers all vary between programs and states (Aliaga eta al, 2014; Cox et al, 2015; Meer, 2007; Stone & Aliaga, 2005). That considered, an average student today completes 3.6 CTE credits during their high school career (Aliaga et al, 2014). This study found the average number of CTE courses for all students at 5.26 and 5.98 for the PSM sample. This suggests Texas has greater than average enrollment, perhaps supporting positive impacts found in the study as well as enhanced future funding possibilities.

However the new *Perkins* legislation is codified, the current study helps to inform policy as it describes longitudinal impacts of Tech Prep participation across a wide and diverse state. It is a model for additional POS which include CTE and credit based curriculum in an effort to improve P-16+ transitions. Further, it allows for greater planning for the future distributions of funds across models and students in relation to CTE and advanced CTE participation.

STATE LEGISLATION

Federal policy contexts are not the only area in which this study may inform changes in CTE policy. The state of Texas has increased CTE participation through reforms in its graduation plans, or diplomas. Passed in 2013 (and implemented for incoming freshman in the 2014-2015 school year), *House Bill 5* reshaped its RHSP and DAP graduation plans into the Foundation

High School Program (FHSP). This new diploma plan involves basic courses, has possible advanced features, and requires students to select an endorsement program (Education Service Center 20 [ESC20], 2016). Endorsements include core and elective courses which result in the selection of a career cluster. These new graduating requirements have pushed CTE to the forefront of reform as all students are required take a greater number of CTE courses in fulfillment of their career cluster. Further, it has increased opportunities to expand Tech Prep programs and similar CTE POS, which fulfill endorsement requirements while also providing dual enrollment opportunities.

Findings from this study are particularly important as they show Tech Prep as a promising tool to bridge gaps in P-16+ transitions while also fulfilling new diploma requirements. Interactions between Tech Prep and previous iterations of college ready degrees (e.g., RHSP, DAP) impact student outcomes in several models. These outcomes, as well as other findings, inform new graduation policies. Results from the study can be used to plan and implement FHSP diploma programs while also increasing college readiness in other areas linked to CTE and Tech Prep.

THE FUTURE OF REFORM

The jobs, careers, and industries of tomorrow are upon us today. Attainment has already fallen behind economic development, though. An incomplete education will not provide students with the skills needed in current or future economies (Carnevale et al, 2010; Castellano et al, 2003). To fill gaps, reforms must bridge transitions between high school, higher education, and the workforce.

The growth of CTE and advanced CTE (i.e., Tech Prep), which utilize career-based curriculums paired with credit based transitions, are a promising tool to meet academic and labor demands. These strategies offer an additional pathway to higher education beyond the traditional route of academic/college preparation. They have the potential to engender success in a wider selection of students, those students who often fail to enroll and succeed in traditional pathways (Dare, 2006; Parnell, 1985). This study adds to the greater discussion on P-16+ transition models by providing valuable information as to the long-term impacts of CTE programs. Results are numerous and provide strong evidence for the efficacy of Tech Prep models in the RGV, Texas, and beyond.

This study allows policymakers and practitioners alike to search out best practices using the detailed impact models and interactions studied. These may lead to comprehensive reforms and/or targeted Tech Prep models to reach certain students. Findings inform on the utility of Tech Prep programs as well as illustrate the possibilities of using longitudinal data to explore effects of educational models on student outcomes. Additionally, the exploration of outcomes for students participating in advanced CTE across a large state with a diverse student population provides helpful insight into the proficiencies and challenges faced by all states and local levels. Longitudinal outcomes and measures may help shape greater CTE policy reform as well as accountability policies or performance indicators across the broader educational spectrum. The analytic strategies used in this study work together to yield a rich set of findings which strengthen the connections between advanced CTE participation and student success.

APPENDIX: REGRESSION TABLES

Table 1. Odds of Participating in a Tech Prep Program in High School

	Coefficient	SD
FIXED EFFECTS		
Intercept, γ_{00}	-3.063	0.095
Student (Level 1), β_{1j}...		
Grad Year (2009), γ_{10}	-0.102**	0.009
Days Absent, γ_{20}	-0.002**	0.000
Gender (Female), γ_{30}	0.047**	0.008
Low-SES, γ_{40}	0.104**	0.009
Black, γ_{50}	0.018	0.022
Hispanic, γ_{60}	0.146**	0.020
White, γ_{70}	-0.004	0.019
LEP, γ_{80}	-0.648**	0.028
Special Education, γ_{90}	-0.085**	0.016
Gifted & Talented, γ_{100}	-0.354**	0.014
Met Exit Math, γ_{110}	0.198**	0.012
Met Exit Reading, γ_{120}	0.097**	0.018
Dual Credit, γ_{130}	0.068**	0.003
RHSP Diploma, γ_{140}	0.163**	0.013
DAP Diploma, γ_{150}	0.173**	0.018
School (Level 2), β_{0j}		
RGV, γ_{01}	2.154**	0.298
Percent Low-SES, γ_{02}	-0.005**	0.002
Percent White, γ_{03}	0.019**	0.002
Rated Acceptable, γ_{04}	0.115**	0.031
Rated Exemplary, γ_{05}	-0.011	0.029
Small School, γ_{06}	-0.042	0.080
Large School, γ_{07}	0.251**	0.084
	Variance	**SD**
RANDOM EFFECTS		
Institution (Intercept), u_{0j}	4.674	0.216

Note. **p<.01, *<.05
Students=534,035 High Schools=1,776

Table 2. Odds of Transitioning to Higher Education
Within a Year of High School Graduation

	Coefficient	SD		Coefficient	SD
FIXED EFFECTS					
Intercept, γ_{00}	-1.698**	0.070			
Student (Level 1), β_{1j}...			**Interactions**		
Grad Year (2009), γ_{10}	0.066**	0.010			
Days Absent, γ_{20}	-0.027**	0.001	*TPxAbsent*, γ_{200}	-0.004**	0.001
Gender (Female), γ_{30}	0.177**	0.013	*TPxSex*, γ_{210}	0.102**	0.019
Low-SES, γ_{40}	-0.344**	0.012			
Black, γ_{50}	0.100*	0.038	*TPxBlack*, γ_{220}	-0.167**	0.053
Hispanic, γ_{60}	-0.400**	0.035	*TPxHisp*, γ_{230}	-0.204**	0.049
White, γ_{70}	-0.132**	0.034	*TPxWhite*, γ_{240}	-0.246**	0.049
LEP, γ_{80}	-0.447**	0.054	*TPxLEP*, γ_{250}	-0.264**	0.076
Special Education, γ_{90}	-0.320**	0.028	*TPxSPED*, γ_{260}	0.236**	0.038
Gifted & Talented, γ_{100}	0.289**	0.026	*TPxGT*, γ_{270}	0.084*	0.036
Tech Prep, γ_{110}	0.406**	0.068			
Met Exit Math, γ_{120}	0.358**	0.014			
Met Exit Reading, γ_{130}	0.444**	0.034	*TPxRead*, γ_{280}	-0.120*	0.047
Dual Credit, γ_{140}	0.253**	0.006	*TPxDC*, γ_{290}	0.017*	0.008
CTE, γ_{150}	0.014**	0.002			
Dual CTE, γ_{160}	-0.146**	0.011			
RHSP Diploma, γ_{170}	0.953**	0.020	*TPxRHSP*, γ_{300}	-0.103**	0.024
DAP Diploma, γ_{180}	1.172**	0.024			
Transition Work, γ_{190}	0.797**	0.010			
School (Level 2), β_{0j}					
RGV, γ_{01}	0.446**	0.065			
Percent Low-SES, γ_{02}	-0.002*	0.001			
Percent White, γ_{03}	-0.001	0.001			
Rated Acceptable, γ_{04}	0.065	0.037			
Rated Exemplary, γ_{05}	-0.006	0.031			
Small School, γ_{06}	-0.122**	0.039			
Large School, γ_{07}	0.159**	0.039			
	Variance	**SD**			
RANDOM EFFECTS					
Institution (Intercept), u_{0j}	0.172	0.010			

Note. **p<.01, *<.05 *Students=232,268, High Schools=1,704*

Table 3. Odds of Transitioning to a Community College Within a Year of High School Graduation

	Coefficient	SD		Coefficient	SD
FIXED EFFECTS					
Intercept, γ_{00}	-1.693**	0.071			
Student (Level 1), β_{1j}...			**Interactions**		
Grad Year (2009), γ_{10}	0.086**	0.010			
Days Absent, γ_{20}	-0.010**	0.001	*TPxAbsent*, γ_{200}	-0.003*	0.001
Gender (Female), γ_{30}	0.138**	0.013	*TPxSex*, γ_{210}	0.046*	0.018
Low-SES, γ_{40}	-0.184**	0.011			
Black, γ_{50}	-0.102*	0.038	*TPxBlack*, γ_{220}	-0.197**	0.051
Hispanic, γ_{60}	-0.003	0.035	*TPxHisp*, γ_{230}	-0.152**	0.046
White, γ_{70}	-0.020	0.034	*TPxWhite*, γ_{240}	-0.153**	0.046
LEP, γ_{80}	-0.199**	0.054	*TPxLEP*, γ_{250}	-0.289**	0.076
Special Education, γ_{90}	-0.165**	0.027	*TPxSPED*, γ_{260}	0.206**	0.035
Gifted & Talented, γ_{100}	-0.557**	0.025	*TPxGT*, γ_{270}	0.136**	0.034
Tech Prep, γ_{110}	0.324**	0.064			
Met Exit Math, γ_{120}	-0.023	0.014			
Met Exit Reading, γ_{130}	0.271**	0.034	*TPxRead*, γ_{280}	-0.109*	0.046
Dual Credit, γ_{140}	0.032**	0.004			
CTE, γ_{150}	0.053**	0.002	*TPxCTE*, γ_{290}	-0.027**	0.003
Dual CTE, γ_{160}	0.051**	0.009			
RHSP Diploma, γ_{170}	0.459**	0.016			
DAP Diploma, γ_{180}	-0.225**	0.028	*TPxDAP*, γ_{300}	0.149**	0.030
Transition Work, γ_{190}	0.733**	0.010			
School (Level 2), β_{0j}					
RGV, γ_{01}	0.112	0.072			
Percent Low-SES, γ_{02}	0.001	0.001			
Percent White, γ_{03}	0.002**	0.001			
Rated Acceptable, γ_{04}	0.028	0.036			
Rated Exemplary, γ_{05}	-0.074*	0.030			
Small School, γ_{06}	-0.075	0.041			
Large School, γ_{07}	0.062	0.041			
	Variance	**SD**			
RANDOM EFFECTS					
Institution (Intercept), u_{0j}	0.217	0.011			

Note. **p<.01, *<.05 *Students=232,268, High Schools=1,704*

Table 4. Odds of Transitioning to a University

Within a Year of High School Graduation

	Coefficient	SD		Coefficient	SD
FIXED EFFECTS					
Intercept, γ_{00}	-5.165**	0.104			
Student (Level 1), $\boldsymbol{\beta_{1j}}$...			**Interactions**		
Grad Year (2009), γ_{10}	0.028*	0.012			
Days Absent, γ_{20}	-0.037**	0.001	*TPxAbsent,* γ_{200}	-0.004*	0.002
Gender (Female), γ_{30}	0.069**	0.016	*TPxSex,* γ_{210}	0.054*	0.023
Low-SES, γ_{40}	-0.255**	0.015			
Black, γ_{50}	0.143**	0.029			
Hispanic, γ_{60}	-0.815**	0.027			
White, γ_{70}	-0.358**	0.026			
LEP, γ_{80}	-1.128**	0.092			
Special Education, γ_{90}	-1.002**	0.051			
Gifted & Talented, γ_{100}	0.632**	0.024	*TPxGT,* γ_{220}	0.080*	0.033
Tech Prep, γ_{110}	-0.003	0.025			
Met Exit Math, γ_{120}	1.162**	0.029			
Met Exit Reading, γ_{130}	0.975**	0.057			
Dual Credit, γ_{140}	0.220**	0.005	*TPxDC,* γ_{230}	0.026**	0.008
CTE, γ_{150}	-0.038**	0.003	*TPxCTE,* γ_{240}	0.029**	0.004
Dual CTE, γ_{160}	-0.116**	0.017	*TPxDCTE,* γ_{250}	-0.088**	0.019
RHSP Diploma, γ_{170}	1.706**	0.039			
DAP Diploma, γ_{180}	2.396**	0.042			
Transition Work, γ_{190}	0.227**	0.017	*TPxTRWK,* γ_{260}	-0.114**	0.024
School (Level 2), $\boldsymbol{\beta_{0j}}$					
RGV, γ_{01}	0.621**	0.098			
Percent Low-SES, γ_{02}	-0.002	0.001			
Percent White, γ_{03}	-0.005**	0.001			
Rated Acceptable, γ_{04}	0.069	0.051			
Rated Exemplary, γ_{05}	0.139**	0.038			
Small School, γ_{06}	-0.181**	0.057			
Large School, γ_{07}	0.220**	0.056			
	Variance	**SD**			
RANDOM EFFECTS					
Institution (Intercept), u_{0j}	0.404	0.023			

Note. **p<.01, *<.05 *Students=232,268, High Schools=1,704*

Table 5. Odds of Transitioning to the Workforce
Within a Year of High School Graduation

	Coefficient	SD		Coefficient	SD
FIXED EFFECTS					
Intercept, γ_{00}	-0.321**	0.055			
Student (Level 1), β_{1j}...			**Interactions**		
Grad Year (2009), γ_{10}	0.018	0.013	*TPxGrad*, γ_{200}	-0.041*	0.018
Days Absent, γ_{20}	0.013**	0.001			
Gender (Female), γ_{30}	0.036**	0.009			
Low-SES, γ_{40}	-0.036**	0.011			
Black, γ_{50}	0.650**	0.025			
Hispanic, γ_{60}	0.695**	0.023			
White, γ_{70}	0.868**	0.023			
LEP, γ_{80}	-0.763**	0.034			
Special Education, γ_{90}	-0.370**	0.024	*TPxSPED*, γ_{210}	0.144**	0.032
Gifted & Talented, γ_{100}	-0.100**	0.016			
Tech Prep, γ_{110}	0.132**	0.014			
Met Exit Math, γ_{120}	-0.101**	0.014			
Met Exit Reading, γ_{130}	0.073**	0.022			
Dual Credit, γ_{140}	-0.018**	0.004			
CTE, γ_{150}	0.029**	0.002	*TPxCTE*, γ_{220}	-0.028**	0.003
Dual CTE, γ_{160}	0.015	0.009			
RHSP Diploma, γ_{170}	-0.144**	0.016			
DAP Diploma, γ_{180}	-0.447**	0.022			
Transition HE, γ_{190}	0.791**	0.010			
School (Level 2), β_{0j}					
RGV, γ_{01}	-0.267**	0.045			
Percent Low-SES, γ_{02}	0.000	0.001			
Percent White, γ_{03}	0.003**	0.001			
Rated Acceptable, γ_{04}	0.063	0.034			
Rated Exemplary, γ_{05}	-0.123**	0.027			
Small School, γ_{06}	0.086*	0.031			
Large School, γ_{07}	-0.081*	0.029			
	Variance	**SD**			
RANDOM EFFECTS					
Institution (Intercept), u_{0j}	0.072	0.005			

Note. **p<.01, *<.05 *Students=232,268, High Schools=1,704*

Table 6. Odds of Enrolling in Higher Education

Within Four Years of High School Graduation

	Coefficient	SD		Coefficient	SD
FIXED EFFECTS					
Intercept, γ_{00}	-1.334**	0.067			
Student (Level 1), β_{1j}...			**Interactions**		
Grad Year (2009), γ_{10}	0.109**	0.010			
Days Absent, γ_{20}	-0.018**	0.001	*TPxAbsent,* γ_{200}	-0.004**	0.001
Gender (Female), γ_{30}	0.199**	0.014	*TPxSex,* γ_{210}	0.117**	0.020
Low-SES, γ_{40}	-0.346**	0.012			
Black, γ_{50}	0.285**	0.040	*TPxBlack,* γ_{220}	-0.201**	0.057
Hispanic, γ_{60}	-0.372**	0.036	*TPxHisp,* γ_{230}	-0.235**	0.051
White, γ_{70}	-0.070	0.036	*TPxWhite,* γ_{240}	-0.272**	0.052
LEP, γ_{80}	-0.574**	0.051	*TPxLEP,* γ_{250}	-0.170*	0.071
Special Education, γ_{90}	-0.390**	0.026	*TPxSPED,* γ_{260}	0.264**	0.034
Gifted & Talented, γ_{100}	0.312**	0.028	*TPxGT,* γ_{270}	0.114**	0.040
Tech Prep, γ_{110}	0.227**	0.051			
Met Exit Math, γ_{120}	0.350**	0.014			
Met Exit Reading, γ_{130}	0.367**	0.023			
Dual Credit, γ_{140}	0.259**	0.007	*TPxDC,* γ_{280}	0.032**	0.009
CTE, γ_{150}	0.010**	0.002			
Dual CTE, γ_{160}	-0.171**	0.012			
RHSP Diploma, γ_{170}	0.854**	0.016			
DAP Diploma, γ_{180}	1.075**	0.025			
Transition Work, γ_{190}	0.956**	0.010			
School (Level 2), β_{0j}					
RGV, γ_{01}	0.494**	0.064			
Percent Low-SES, γ_{02}	-0.003**	0.001			
Percent White, γ_{03}	-0.002**	0.001			
Rated Acceptable, γ_{04}	0.083*	0.038			
Rated Exemplary, γ_{05}	0.021	0.032			
Small School, γ_{06}	-0.123**	0.039			
Large School, γ_{07}	0.173**	0.039			
	Variance	**SD**			
RANDOM EFFECTS					
Institution (Intercept), u_{0j}	0.162	0.010			

Note. **p<.01, *<.05 *Students=232,268, High Schools=1,704*

Table 7. Odds of Enrolling in a Community College
Within Four Years of High School Graduation

	Coefficient	SD		Coefficient	SD
FIXED EFFECTS					
Intercept, γ_{00}	-1.906**	0.071			
Student (Level 1), β_{1j}...			**Interactions**		
Grad Year (2009), γ_{10}	0.206**	0.012			
Days Absent, γ_{20}	0.012**	0.001			
Gender (Female), γ_{30}	0.179**	0.011			
Low-SES, γ_{40}	-0.076**	0.014			
Black, γ_{50}	-0.232**	0.036	*TPxBlack*, γ_{210}	-0.085*	0.034
Hispanic, γ_{60}	-0.060*	0.030			
White, γ_{70}	-0.141**	0.029			
LEP, γ_{80}	-0.286**	0.045			
Special Education, γ_{90}	-0.064*	0.024			
Gifted & Talented, γ_{100}	-0.496**	0.019			
Tech Prep, γ_{110}	0.020	0.020			
Met Exit Math, γ_{120}	-0.201**	0.018			
Met Exit Reading, γ_{130}	0.052	0.028			
Dual Credit, γ_{140}	-0.065**	0.004			
CTE, γ_{150}	0.042**	0.003	*TPxCTE*, γ_{220}	-0.030**	0.004
Dual CTE, γ_{160}	0.078**	0.010			
RHSP Diploma, γ_{170}	-0.007	0.020			
DAP Diploma, γ_{180}	-0.699**	0.026			
Transition HE, γ_{190}	3.092**	0.017			
Transition Work, γ_{200}	0.560**	0.012	*TPxTRWK*, γ_{230}	0.154**	0.023
School (Level 2), β_{0j}					
RGV, γ_{01}	-0.164*	0.070			
Percent Low-SES, γ_{02}	0.000	0.001			
Percent White, γ_{03}	0.000	0.001			
Rated Acceptable, γ_{04}	0.011	0.043			
Rated Exemplary, γ_{05}	-0.076*	0.034			
Small School, γ_{06}	-0.053	0.042			
Large School, γ_{07}	0.067	0.042			
	Variance	**SD**			
RANDOM EFFECTS					
Institution (Intercept), u_{0j}	0.195	0.011			

Note. **p<.01, *<.05 *Students=232,268, High Schools=1,704*

Table 8. Odds of Enrolling in a University

Within Four Years of High School Graduation

	Coefficient	SD		Coefficient	SD
FIXED EFFECTS					
Intercept, γ_{00}	-5.980**	0.095			
Student (Level 1), β_{1j}...			**Interactions**		
Grad Year (2009), γ_{10}	0.030*	0.012			
Days Absent, γ_{20}	-0.029**	0.001	*TPxAbsent*, γ_{210}	-0.006**	0.002
Gender (Female), γ_{30}	0.064**	0.012			
Low-SES, γ_{40}	-0.214**	0.015			
Black, γ_{50}	0.041	0.032			
Hispanic, γ_{60}	-0.751**	0.030			
White, γ_{70}	-0.378**	0.029			
LEP, γ_{80}	-0.540**	0.076			
Special Education, γ_{90}	-0.758**	0.040			
Gifted & Talented, γ_{100}	0.567**	0.027	*TPxGT*, γ_{220}	0.101*	0.037
Tech Prep, γ_{110}	0.007	0.023			
Met Exit Math, γ_{120}	0.923**	0.024			
Met Exit Reading, γ_{130}	0.752**	0.048			
Dual Credit, γ_{140}	0.195**	0.006	*TPxDC*, γ_{230}	0.050**	0.009
CTE, γ_{150}	-0.040**	0.003	*TPxCTE*, γ_{240}	0.022**	0.004
Dual CTE, γ_{160}	-0.135**	0.018	*TPxDCTE*, γ_{250}	-0.073**	0.020
RHSP Diploma, γ_{170}	1.319**	0.032			
DAP Diploma, γ_{180}	1.984**	0.036			
Transition HE, γ_{190}	3.250**	0.021			
Transition Work, γ_{200}	-0.160**	0.018	*TPxTRWK*, γ_{260}	-0.101**	0.025
School (Level 2), β_{0j}					
RGV, γ_{01}	0.683**	0.088			
Percent Low-SES, γ_{02}	-0.006**	0.001			
Percent White, γ_{03}	-0.005**	0.001			
Rated Acceptable, γ_{04}	-0.003	0.050			
Rated Exemplary, γ_{05}	0.180**	0.037			
Small School, γ_{06}	-0.164**	0.053			
Large School, γ_{07}	0.198**	0.051			
	Variance	**SD**			
RANDOM EFFECTS					
Institution (Intercept), u_{0j}	0.309	0.018			

Note. **p<.01, *<.05 *Students=232,268, High Schools=1,704*

Table 9. Odds of Participating in Developmental Coursework
While Enrolled in Higher Education

	Coefficient	SD		Coefficient	SD
FIXED EFFECTS					
Intercept, γ_{00}	-0.602**	0.098			
Student (Level 1), β_{1j}...			**Interactions**		
Grad Year (2009), γ_{10}	0.094**	0.013			
Days Absent, γ_{20}	0.007**	0.001			
Gender (female), γ_{30}	0.227**	0.013			
Low-SES, γ_{40}	0.182**	0.022	*TPxSES*, γ_{220}	-0.091**	0.027
Black, γ_{50}	0.395**	0.037			
Hispanic, γ_{60}	0.648**	0.035			
White, γ_{70}	0.200**	0.034			
LEP, γ_{80}	0.482**	0.080			
Special Education, γ_{90}	0.407**	0.035			
Gifted & Talented, γ_{100}	-1.099**	0.026			
Tech Prep, γ_{110}	-0.235**	0.067			
Met Exit Math, γ_{120}	-0.937**	0.036	*TPxMath*, γ_{230}	0.187**	0.048
Met Exit Reading, γ_{130}	-0.260**	0.042			
Dual Credit, γ_{140}	-0.194**	0.008	*TPxDC*, γ_{240}	-0.051**	0.012
CTE, γ_{150}	0.051**	0.003	*TPxCTE*, γ_{250}	-0.037**	0.004
Dual CTE, γ_{160}	0.127**	0.021	*TPxDCTE*, γ_{260}	0.064*	0.024
RHSP Diploma, γ_{170}	-0.417**	0.036	*TPxRHSP*, γ_{270}	0.165**	0.047
DAP Diploma, γ_{180}	-1.465**	0.049	*TPxDAP*, γ_{280}	0.358**	0.063
Transition HE, γ_{190}	0.315**	0.020			
Transition Work, γ_{200}	0.284**	0.021	*TPxTRWK*, γ_{290}	-0.082**	0.029
CCR Standard, γ_{210}	1.788**	0.019	*TPxCCR*, γ_{300}	0.085**	0.026
School (Level 2), β_{0j}					
RGV, γ_{01}	-0.140	0.077			
Percent Low-SES, γ_{02}	0.005**	0.001			
Percent White, γ_{03}	-0.002*	0.001			
Rated Acceptable, γ_{04}	0.045	0.051			
Rated Exemplary, γ_{05}	-0.102*	0.040			
Small School, γ_{06}	0.008	0.049			
Large School, γ_{07}	0.044	0.048			
	Variance	**SD**			
RANDOM EFFECTS					
Institution (Intercept), u_{0j}	0.222	0.013			

Note. **p<.01, *<.05 *Students=157,209, High Schools=1,634*

Table 10. Odds of Participating in Mathematics Developmental Coursework While Enrolled in Higher Education

	Coefficient	SD		Coefficient	SD
FIXED EFFECTS					
Intercept, γ_{00}	-1.248**	0.088			
Student (Level 1), β_{1j}...			**Interactions**		
Grad Year (2009), γ_{10}	0.106**	0.013			
Days Absent, γ_{20}	0.006**	0.001			
Gender (female), γ_{30}	0.265**	0.013			
Low-SES, γ_{40}	0.152**	0.021	*TPxSES, γ_{220}*	-0.100**	0.026
Black, γ_{50}	0.358**	0.036			
Hispanic, γ_{60}	0.633**	0.034			
White, γ_{70}	0.223**	0.034			
LEP, γ_{80}	0.120	0.066			
Special Education, γ_{90}	0.161**	0.031			
Gifted & Talented, γ_{100}	-1.014**	0.026			
Tech Prep, γ_{110}	0.119**	0.028			
Met Exit Math, γ_{120}	-0.711**	0.022			
Met Exit Reading, γ_{130}	-0.028	0.038			
Dual Credit, γ_{140}	-0.174**	0.008	*TPxDC, γ_{230}*	-0.032**	0.010
CTE, γ_{150}	0.047**	0.003	*TPxCTE, γ_{240}*	-0.031**	0.004
Dual CTE, γ_{160}	0.160**	0.013			
RHSP Diploma, γ_{170}	-0.264**	0.025			
DAP Diploma, γ_{180}	-1.291**	0.043	*TPxDAP, γ_{250}*	0.204**	0.046
Transition HE, γ_{190}	0.310**	0.020			
Transition Work, γ_{200}	0.265**	0.020	*TPxTRWK, γ_{260}*	-0.073*	0.028
CCR Math Standard, γ_{210}	1.622**	0.014			
School (Level 2), β_{0j}					
RGV, γ_{01}	-0.365**	0.078			
Percent Low-SES, γ_{02}	0.003*	0.001			
Percent White, γ_{03}	-0.002*	0.001			
Rated Acceptable, γ_{04}	0.044	0.049			
Rated Exemplary, γ_{05}	-0.090*	0.040			
Small School, γ_{06}	-0.016	0.049			
Large School, γ_{07}	0.090	0.048			
	Variance	**SD**			
RANDOM EFFECTS					
Institution (Intercept), u_{0j}	0.232	0.014			

Note. **p<.01, *<.05 *Students=157,209, High Schools=1,634*

Table 11. Odds of Participating in Reading Developmental Coursework While Enrolled in Higher Education

	Coefficient	SD		Coefficient	SD
FIXED EFFECTS					
Intercept, γ_{00}	-2.575**	0.124			
Student (Level 1), β_{1j}...			**Interactions**		
Grad Year (2009), γ_{10}	0.043*	0.020			
Days Absent, γ_{20}	-0.003*	0.002	*TPxAbsent,* γ_{220}	-0.005*	0.002
Gender (female), γ_{30}	0.147**	0.019			
Low-SES, γ_{40}	0.270**	0.023			
Black, γ_{50}	0.155*	0.058			
Hispanic, γ_{60}	0.299**	0.056			
White, γ_{70}	-0.361**	0.057			
LEP, γ_{80}	0.580**	0.075			
Special Education, γ_{90}	0.633**	0.037			
Gifted & Talented, γ_{100}	-1.431**	0.060			
Tech Prep, γ_{110}	-0.215**	0.065			
Met Exit Math, γ_{120}	-0.759**	0.035	*TPxMath,* γ_{230}	0.149**	0.048
Met Exit Reading, γ_{130}	-0.500**	0.042			
Dual Credit, γ_{140}	-0.681**	0.022			
CTE, γ_{150}	0.039**	0.005	*TPxCTE,* γ_{240}	-0.041**	0.006
Dual CTE, γ_{160}	0.593**	0.027			
RHSP Diploma, γ_{170}	-0.348**	0.032			
DAP Diploma, γ_{180}	-1.174**	0.058			
Transition HE, γ_{190}	0.536**	0.041	*TPxTRHE,* γ_{250}	0.137*	0.058
Transition Work, γ_{200}	0.091**	0.022			
CCR Read Standard, γ_{210}	2.958**	0.022			
School (Level 2), β_{0j}					
RGV, γ_{01}	0.001	0.099			
Percent Low-SES, γ_{02}	0.014**	0.001			
Percent White, γ_{03}	0.004**	0.001			
Rated Acceptable, γ_{04}	-0.205**	0.068			
Rated Exemplary, γ_{05}	-0.096	0.063			
Small School, γ_{06}	0.066	0.069			
Large School, γ_{07}	-0.063	0.066			
	Variance	**SD**			
RANDOM EFFECTS					
Institution (Intercept), u_{0j}	0.360	0.024			

Note. **p<.01, *<.05 *Students=157,209, High Schools=1,634*

Table 12. Odds of Participating in Writing Developmental Coursework
While Enrolled in Higher Education

	Coefficient	SD		Coefficient	SD
FIXED EFFECTS					
Intercept, γ_{00}	-1.872**	0.112			
Student (Level 1), $\boldsymbol{\beta_{1j}}$...			**Interactions**		
Grad Year (2009), γ_{10}	-0.058**	0.019			
Days Absent, γ_{20}	-0.002*	0.001			
Gender (female), γ_{30}	-0.114**	0.018			
Low-SES, γ_{40}	0.271**	0.021			
Black, γ_{50}	0.161**	0.053			
Hispanic, γ_{60}	0.229**	0.052			
White, γ_{70}	-0.242**	0.052			
LEP, γ_{80}	0.470**	0.069			
Special Education, γ_{90}	0.522**	0.035			
Gifted & Talented, γ_{100}	-1.383**	0.056			
Tech Prep, γ_{110}	-0.060	0.032			
Met Exit Math, γ_{120}	-0.582**	0.024			
Met Exit Reading, γ_{130}	-0.450**	0.039			
Dual Credit, γ_{140}	-0.659**	0.024	*TPxDC,* γ_{220}	-0.056*	0.023
CTE, γ_{150}	0.037**	0.005	*TPxCTE,* γ_{230}	-0.034**	0.006
Dual CTE, γ_{160}	0.619**	0.027			
RHSP Diploma, γ_{170}	-0.373**	0.030	*TPxDAP,* γ_{240}	0.252*	0.089
DAP Diploma, γ_{180}	-1.330**	0.078			
Transition HE, γ_{190}	0.153**	0.026			
Transition Work, γ_{200}	0.061**	0.020			
CCR Write Standard, γ_{210}	2.265**	0.027	*TPxCCRW,* γ_{250}	0.082*	0.036
School (Level 2), $\boldsymbol{\beta_{0j}}$					
RGV, γ_{01}	-0.001	0.088			
Percent Low-SES, γ_{02}	0.011**	0.001			
Percent White, γ_{03}	0.002*	0.001			
Rated Acceptable, γ_{04}	-0.096	0.064			
Rated Exemplary, γ_{05}	-0.070	0.058			
Small School, γ_{06}	0.039	0.062			
Large School, γ_{07}	-0.022	0.060			
	Variance	**SD**			
RANDOM EFFECTS					
Institution (Intercept), u_{0j}	0.275	0.019			

Note. **p<.01, *<.05 *Students=157,209, High Schools=1,634*

Table 13. Odds of Enrolled Students Earning a Higher Education Credential

	Coefficient	SD		Coefficient	SD
FIXED EFFECTS					
Intercept, γ_{00}	-3.620**	0.110			
Student (Level 1), β_{1j}…			**Interactions**		
Grad Year (2009), γ_{10}	-0.010	0.013			
Days Absent, γ_{20}	-0.054**	0.001			
Gender (female), γ_{30}	0.608**	0.019	*TPxSex, γ_{220}*	-0.134**	0.026
Low-SES, γ_{40}	-0.105**	0.017			
Black, γ_{50}	-0.662**	0.035			
Hispanic, γ_{60}	-0.140**	0.031			
White, γ_{70}	0.000	0.029			
LEP, γ_{80}	0.316**	0.077			
Special Education, γ_{90}	-0.026	0.042			
Gifted & Talented, γ_{100}	0.251**	0.019			
Tech Prep, γ_{110}	0.744**	0.094			
Met Exit Math, γ_{120}	0.575**	0.046	*TPxMath, γ_{230}*	-0.214**	0.059
Met Exit Reading, γ_{130}	0.034	0.051			
Dual Credit, γ_{140}	0.112**	0.005	*TPxDC, γ_{240}*	0.023**	0.007
CTE, γ_{150}	-0.008*	0.003	*TPxCTE, γ_{250}*	0.022**	0.004
Dual CTE, γ_{160}	-0.039**	0.011			
RHSP Diploma, γ_{170}	0.557**	0.050	*TPxRHSP, γ_{260}*	-0.263**	0.063
DAP Diploma, γ_{180}	1.183**	0.055	*TPxDAP, γ_{270}*	-0.400**	0.068
Transition HE, γ_{190}	1.251**	0.042	*TPxTRHE, γ_{280}*	-0.167**	0.058
Transition Work, γ_{200}	-0.195**	0.014			
Developmental Ed., γ_{210}	-0.555**	0.015			
School (Level 2), β_{0j}					
RGV, γ_{01}	-0.122*	0.057			
Percent Low-SES, γ_{02}	-0.003**	0.001			
Percent White, γ_{03}	0.001	0.001			
Rated Acceptable, γ_{04}	-0.038	0.051			
Rated Exemplary, γ_{05}	0.064	0.033			
Small School, γ_{06}	-0.047	0.040			
Large School, γ_{07}	0.095*	0.037			
	Variance	**SD**			
RANDOM EFFECTS					
Institution (Intercept), u_{0j}	0.090	0.007			

Note. **p<.01, *<.05 *Students=157,209, High Schools=1,634*

Table 14. Odds of Enrolled Students Earning an Associate's Degree

	Coefficient	SD		Coefficient	SD
FIXED EFFECTS					
Intercept, γ_{00}	-5.185**	0.149			
Student (Level 1), β_{1j}...			**Interactions**		
Grad Year (2009), γ_{10}	-0.017	0.020			
Days Absent, γ_{20}	-0.040**	0.002			
Gender (female), γ_{30}	0.388**	0.030	*TPxSex*, γ_{220}	-0.082*	0.039
Low-SES, γ_{40}	0.079**	0.024			
Black, γ_{50}	-0.469**	0.059			
Hispanic, γ_{60}	0.264**	0.051			
White, γ_{70}	0.088	0.051			
LEP, γ_{80}	0.207*	0.105			
Special Education, γ_{90}	-0.339**	0.098	*TPxSPED*, γ_{230}	0.299*	0.120
Gifted & Talented, γ_{100}	-0.438**	0.051	*TPxGT*, γ_{240}	0.232**	0.065
Tech Prep, γ_{110}	0.191**	0.038			
Met Exit Math, γ_{120}	0.509**	0.043			
Met Exit Reading, γ_{130}	0.215**	0.074			
Dual Credit, γ_{140}	0.081**	0.007			
CTE, γ_{150}	0.047**	0.005	*TPxCTE*, γ_{250}	-0.014*	0.006
Dual CTE, γ_{160}	-0.009	0.015			
RHSP Diploma, γ_{170}	0.626**	0.053			
DAP Diploma, γ_{180}	0.463**	0.060			
Transition HE, γ_{190}	1.071**	0.049			
Transition Work, γ_{200}	-0.104**	0.021			
Developmental Ed., γ_{210}	0.235**	0.031	*TPxDE*, γ_{260}	-0.141**	0.040
School (Level 2), β_{0j}					
RGV, γ_{01}	-0.122	0.100			
Percent Low-SES, γ_{02}	0.004*	0.001			
Percent White, γ_{03}	0.006**	0.001			
Rated Acceptable, γ_{04}	-0.134	0.074			
Rated Exemplary, γ_{05}	0.010	0.055			
Small School, γ_{06}	-0.077	0.066			
Large School, γ_{07}	-0.009	0.063			
	Variance	**SD**			
RANDOM EFFECTS					
Institution (Intercept), u_{0j}	0.323	0.023			

Note. **p<.01, *<.05 *Students=157,209, High Schools=1,634*

Table 15. Odds of Enrolled Students Earning a Bachelor's Degree

	Coefficient	SD		Coefficient	SD
FIXED EFFECTS					
Intercept, γ_{00}	-7.302**	0.232			
Student (Level 1), β_{1j}...			**Interactions**		
Grad Year (2009), γ_{10}	-0.033	0.018			
Days Absent, γ_{20}	-0.069**	0.002	*TPxAbsent*, γ_{220}	-0.011**	0.003
Gender (female), γ_{30}	0.779**	0.018			
Low-SES, γ_{40}	-0.342**	0.025			
Black, γ_{50}	-0.389**	0.045			
Hispanic, γ_{60}	-0.405**	0.039			
White, γ_{70}	0.033	0.035			
LEP, γ_{80}	-0.754**	0.251			
Special Education, γ_{90}	-0.837**	0.111			
Gifted & Talented, γ_{100}	0.553**	0.022			
Tech Prep, γ_{110}	0.283	0.146			
Met Exit Math, γ_{120}	1.200**	0.085			
Met Exit Reading, γ_{130}	0.805**	0.155			
Dual Credit, γ_{140}	0.153**	0.006	*TPxDC*, γ_{230}	0.038**	0.008
CTE, γ_{150}	-0.058**	0.005	*TPxCTE*, γ_{240}	0.029**	0.006
Dual CTE, γ_{160}	-0.139**	0.015			
RHSP Diploma, γ_{170}	1.117**	0.115	*TPxRHSP*, γ_{250}	-0.407*	0.147
DAP Diploma, γ_{180}	2.016**	0.117	*TPxDAP*, γ_{260}	-0.414*	0.149
Transition HE, γ_{190}	1.933**	0.056			
Transition Work, γ_{200}	-0.265**	0.018			
Developmental Ed., γ_{210}	-1.498**	0.027			
School (Level 2), β_{0j}					
RGV, γ_{01}	0.220*	0.077			
Percent Low-SES, γ_{02}	-0.013**	0.001			
Percent White, γ_{03}	-0.006**	0.001			
Rated Acceptable, γ_{04}	-0.014	0.074			
Rated Exemplary, γ_{05}	0.092*	0.042			
Small School, γ_{06}	-0.011	0.055			
Large School, γ_{07}	0.296**	0.051			
	Variance	**SD**			
RANDOM EFFECTS					
Institution (Intercept), u_{0j}	0.152	0.013			

Note. **p<.01, *<.05 *Students=157,209, High Schools=1,634*

Table 16. Odds of Enrolled Students Earning a Higher Education Certificate

	Coefficient	SD		Coefficient	SD
FIXED EFFECTS					
Intercept, γ_{00}	-3.515**	0.199			
Student (Level 1), β_{1j}…			**Interactions**		
Grad Year (2009), γ_{10}	-0.011	0.031			
Days Absent, γ_{20}	-0.021**	0.002			
Gender (female), γ_{30}	-0.142*	0.050	*TPxSex*, γ_{220}	-0.172*	0.063
Low-SES, γ_{40}	0.020	0.038			
Black, γ_{50}	-0.312*	0.122			
Hispanic, γ_{60}	0.586**	0.110			
White, γ_{70}	0.497**	0.110			
LEP, γ_{80}	0.596**	0.113			
Special Education, γ_{90}	0.321**	0.065			
Gifted & Talented, γ_{100}	-0.673**	0.065			
Tech Prep, γ_{110}	0.456**	0.048			
Met Exit Math, γ_{120}	0.040	0.052			
Met Exit Reading, γ_{130}	-0.241**	0.075			
Dual Credit, γ_{140}	-0.144**	0.014			
CTE, γ_{150}	0.101**	0.008	*TPxCTE*, γ_{230}	-0.034**	0.010
Dual CTE, γ_{160}	0.331**	0.043	*TPxDCTE*, γ_{240}	0.109*	0.041
RHSP Diploma, γ_{170}	-0.286**	0.055			
DAP Diploma, γ_{180}	-0.681**	0.075			
Transition HE, γ_{190}	0.082	0.049			
Transition Work, γ_{200}	0.064	0.034			
Developmental Ed., γ_{210}	-0.359**	0.033			
School (Level 2), β_{0j}					
RGV, γ_{01}	-0.189	0.129			
Percent Low-SES, γ_{02}	0.015**	0.002			
Percent White, γ_{03}	0.011**	0.002			
Rated Acceptable, γ_{04}	0.016	0.107			
Rated Exemplary, γ_{05}	-0.187*	0.083			
Small School, γ_{06}	0.060	0.084			
Large School, γ_{07}	-0.437**	0.083			
	Variance	**SD**			
RANDOM EFFECTS					
Institution (Intercept), u_{0j}	0.487	0.038			

Note. **p<.01, *<.05 *Students=157,209, High Schools=1,634*

Table 17. Odds of Transitioning to the Workforce Within a Year of Earning a Postsecondary Credential

	Coefficient	SD		Coefficient	SD
FIXED EFFECTS					
Intercept, γ_{00}	-0.222	0.208			
Student (Level 1), β_{1j}...			**Interactions**		
Grad Year (2009), γ_{10}	0.006	0.028			
Days Absent, γ_{20}	-0.003	0.002			
Gender (female), γ_{30}	0.106**	0.029			
Low-SES, γ_{40}	0.056	0.039			
Black, γ_{50}	0.569**	0.072			
Hispanic, γ_{60}	0.564**	0.057			
White, γ_{70}	0.397**	0.052			
LEP, γ_{80}	-0.003	0.173			
Special Education, γ_{90}	-0.231*	0.098			
Gifted & Talented, γ_{100}	-0.019	0.050	*TPxGT,* γ_{250}	-0.166*	0.071
Tech Prep, γ_{110}	-0.192**	0.055			
Met Exit Math, γ_{120}	0.132	0.076			
Met Exit Reading, γ_{130}	0.245*	0.117			
Dual Credit, γ_{140}	0.013	0.007			
CTE, γ_{150}	0.013*	0.005			
Dual CTE, γ_{160}	-0.040*	0.020			
RHSP Diploma, γ_{170}	-0.068	0.086			
DAP Diploma, γ_{180}	-0.267**	0.091			
Transition HE, γ_{190}	0.090	0.073			
Transition Work, γ_{200}	0.885**	0.039	*TPxTRWK,* γ_{260}	0.265**	0.056
Developmental Ed., γ_{210}	0.078*	0.039			
Associate, γ_{220}	0.314**	0.044			
Bachelor, γ_{230}	0.393**	0.056	*TPxBD,* γ_{270}	0.193**	0.059
Certificate, γ_{240}	0.552**	0.058			
School (Level 2), β_{0j}					
RGV, γ_{01}	-0.184*	0.068			
Percent Low-SES, γ_{02}	0.004**	0.001			
Percent White, γ_{03}	0.003**	0.001			
Rated Acceptable, γ_{04}	0.104	0.097			
Rated Exemplary, γ_{05}	0.027	0.051			
Small School, γ_{06}	0.011	0.069			
Large School, γ_{07}	-0.046	0.058			
	Variance	**SD**			
RANDOM EFFECTS					
Institution (Intercept), u_{0j}	0.031	0.009			

Note. **p<.01, *<.05 *Students=39,874, High Schools=1,399*

Table 18. Odds of Transitioning to the Workforce (Two Jobs) Within a Year of Earning a Postsecondary Credential

	Coefficient	SD		Coefficient	SD
FIXED EFFECTS					
Intercept, γ_{00}	-1.950**	0.171			
Student (Level 1), β_{1j}...			**Interactions**		
Grad Year (2009), γ_{10}	-0.010	0.022			
Days Absent, γ_{20}	0.003	0.002			
Gender (female), γ_{30}	0.283**	0.033	*TPxSex, γ_{250}*	-0.140**	0.046
Low-SES, γ_{40}	0.037	0.031			
Black, γ_{50}	0.570**	0.076	*TPxBlack, γ_{260}*	0.221*	0.082
Hispanic, γ_{60}	0.430**	0.054			
White, γ_{70}	0.274**	0.052			
LEP, γ_{80}	0.064	0.145			
Special Education, γ_{90}	-0.195*	0.083			
Gifted & Talented, γ_{100}	-0.067*	0.031			
Tech Prep, γ_{110}	-0.046	0.054			
Met Exit Math, γ_{120}	0.065	0.060			
Met Exit Reading, γ_{130}	0.087	0.102			
Dual Credit, γ_{140}	0.010	0.006			
CTE, γ_{150}	0.005	0.004			
Dual CTE, γ_{160}	-0.008	0.016			
RHSP Diploma, γ_{170}	-0.113	0.065			
DAP Diploma, γ_{180}	-0.280**	0.069			
Transition HE, γ_{190}	0.048	0.059			
Transition Work, γ_{200}	0.673**	0.035	*TPxTRWK, γ_{270}*	0.151**	0.050
Developmental Ed., γ_{210}	0.038	0.029			
Associate, γ_{220}	0.279**	0.034			
Bachelor, γ_{230}	0.318**	0.037			
Certificate, γ_{240}	0.514**	0.041			
School (Level 2), β_{0j}					
RGV, γ_{01}	-0.094	0.052			
Percent Low-SES, γ_{02}	0.003**	0.001			
Percent White, γ_{03}	0.003**	0.001			
Rated Acceptable, γ_{04}	-0.114	0.074			
Rated Exemplary, γ_{05}	-0.044	0.039			
Small School, γ_{06}	0.002	0.050			
Large School, γ_{07}	-0.022	0.044			
	Variance	**SD**			
RANDOM EFFECTS					
Institution (Intercept), u_{0j}	0.011	0.005			

Note. **p<.01, *<.05 *Students=39,874, High Schools=1,399*

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