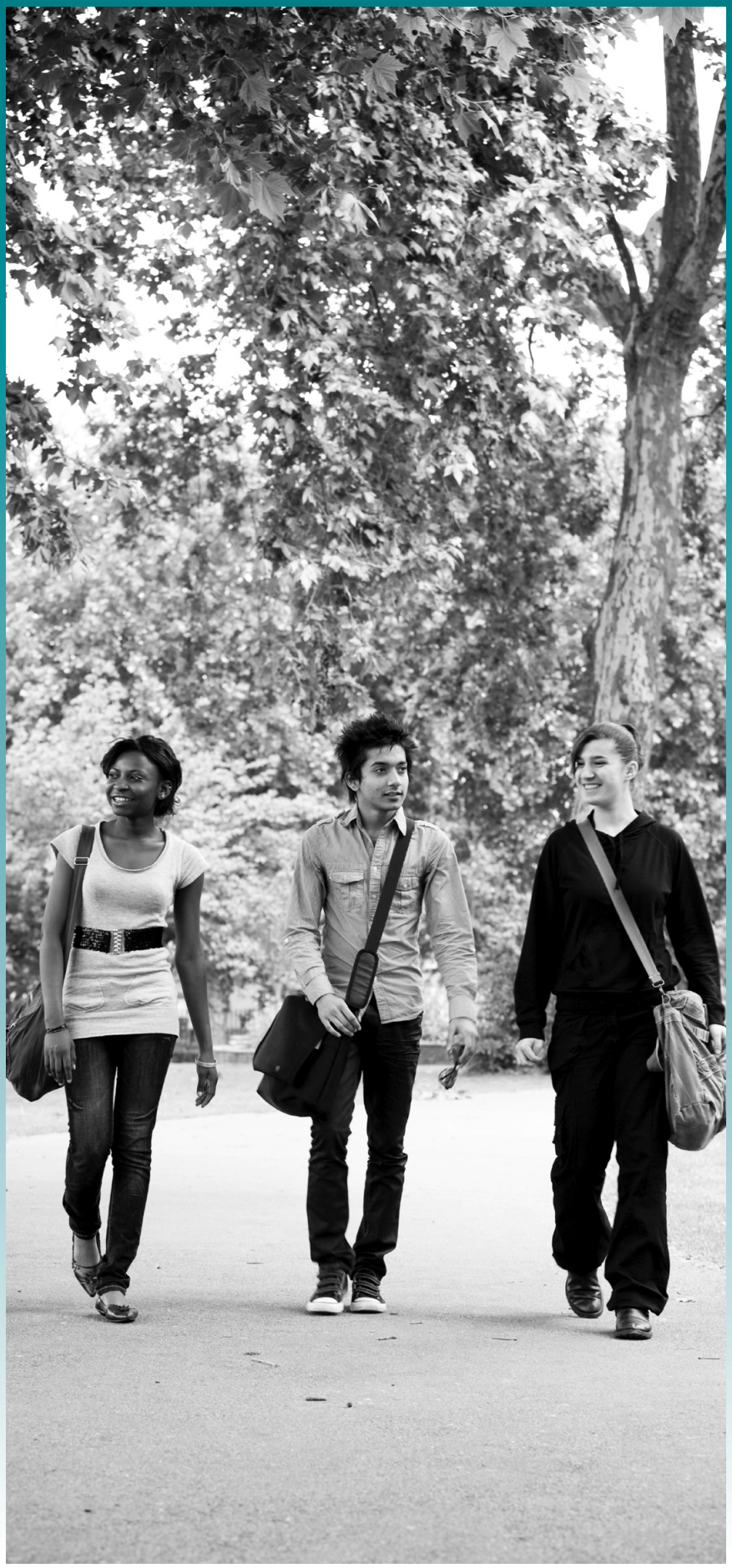

MATURE PROGRAMS OF STUDY: EXAMINING POLICY IMPLEMENTATION AT THE LOCAL LEVEL

Final Report

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Executive Summary

The 2006 Carl D. Perkins Career and Technical Education Act required that all career technical education (CTE) programs offer secondary to postsecondary programs of study (POS), which integrate rigorous academics, offer dual enrollment options, and lead to an industry-recognized degree or credential. Focused on improving students' transition to college and careers, all states are required to offer at least one POS. Because few models of POS existed at the time of the legislation, and there was little guidance available for CTE administrators, this project took a "backward mapping" approach to examining mature, POS-like programs. Three sites (i.e., three colleges and their feeder high schools) across the country were selected for this mixed-methods study in which we analyzed the factors that led to their success in order to inform policymakers and CTE administrators about the key components that might be needed to implement POS locally as well as to identify potential benefits of these programs for students.

This primarily descriptive, exploratory study has two parts: (a) a qualitative description of POS development and operation at each of the sites, and (b) a quantitative account of students' progression through POS. The findings point to several foundational components of POS as well as promising outcomes for students. Interviews conducted with high school and college instructors, administrators, and counselors in 2009 revealed the key requirements for making POS work, in particular: (a) a vision shared by multiple stakeholders of a seamless transition to college for students, (b) dedicated staffing for the purpose of creating linkages between colleges and local high schools and advising students, and (c) active advisory committees for each POS with representatives from local businesses. Perkins IV policy guidance for POS development, released in 2010 by the Office of Vocational and Adult Education (OVAE, 2010), after this study began, was compared with the findings from the three mature, POS-like sites. We determined that four of the ten OVAE components overlapped with the mature POS sites.

Over a three-year period from 2009 to 2012, including the transition out of high school into college or work, a sample of 213 high school juniors and seniors enrolled in POS at the three sites were tracked to examine their progression through their POS. Although only 30% of the students continued in the same POS in either college or work, participation in the POS in high school appeared to benefit students. High school transcript analyses showed a positive relationship between POS credits, academic credits, and grades, and the majority of students reported that being in a POS made them more motivated to stay in school and better prepared to make choices about college and career. In longitudinal analyses controlling for high school GPA, the number of POS courses taken in high school was significantly related to staying in the same career cluster in college and to earning a college credential. The number of dual credits earned while in high school was significantly negatively related to non-credit (remedial/developmental) courses in college and positively related to college GPA, staying in the same cluster, and earning a college credential. In addition, having a positive attitude toward the POS in high school was related to number of credits earned by the end of the first year of college. The majority of the 65% of the original sample that we were able to find in 2012 were still enrolled in postsecondary education (defined as two- and four-year colleges). An additional comparison of students in our sample (who had experienced the POS in high school) with a matched sample of students in the same major at the participating college in the largest site showed that POS students in our sample had higher college GPAs and took fewer remedial courses.

Mature Programs of Study: Examining Policy Implementation at the Local Level

In the United States, the employment outlook for students in the high school classes of 2006-2011 who have not enrolled in college is bleak. A recent study by Rutgers University showed that having a college credential is more important than ever to finding work as a young person (Van Horn, Zukin, Szeltner, & Stone, 2012). Unemployment has a long-term negative impact on the economy overall, as well as specifically on young adults, as they delay entry into career paths and earnings trajectories (Kurtzleben, 2012). Although the recession is a considerable part of the problem, educators are also realizing that the United States could be doing a better job to prepare students for college and careers, starting at a younger age.

Reports such as *Pathways to Prosperity* (Symonds, Schwartz, & Ferguson, 2011) and *Learning for Jobs* (Organisation for Economic Co-operation and Development, 2010) have suggested that other nations provide more structured career preparation for secondary and postsecondary students. These reports have mobilized U.S. policymakers and educators around the issue of linking secondary and postsecondary vocational training and work-based learning. Career and technical education (CTE) is becoming recognized by mainstream thought leaders as a viable means for introducing students to careers and beginning to build marketable skills during high school (Achieve, 2012; Alliance for Excellent Education, 2012; National High School Center and American Youth Policy Forum, 2012).

In particular, CTE programs of study (POS) may be a promising approach to increasing students' college and career readiness because they integrate academics and career-related technical skills in a sequence of courses leading to a postsecondary degree or credential. As defined in the Carl D. Perkins Career and Technical Education Act of 2006 (hereafter referred to as Perkins IV) legislation, a POS:

(a) incorporates secondary education and postsecondary elements,
(b) includes coherent and rigorous content aligned with challenging academic standards and relevant career and technical content in a coordinated, non-duplicative progression of courses that align secondary with postsecondary education to adequately prepare students to succeed in postsecondary education,
(c) includes the opportunity for secondary students to participate in dual or concurrent enrollment programs or other ways to acquire postsecondary education credits, and
(d) leads to an industry-recognized credential or certificate at the postsecondary level, or an associate degree [or successful transfer to a four-year institution] (Section 122(c)(1)(A).

The components of POS—such as curriculum integration and dual enrollment—are not new in the history of CTE as a vehicle for school reform (Lewis & Kosine, 2008). Initiatives of the 1990s such as youth apprenticeships, School-to-Work, and Tech Prep all provided a foundation for POS. Unlike previous efforts, however, POS in Perkins IV directly address the need to bridge the secondary-postsecondary divide (c.f. Venezia, Kirst, & Antonio, 2003) and challenge the field of CTE to increase program rigor by explicitly linking academic and CTE courses in a coherent framework leading to postsecondary education and credentials. The intent of POS is to improve CTE students' preparation and likelihood of success in both college and careers by providing more structured and logical pathways beginning in secondary school.

Since the introduction of the POS requirement in the 2006 Perkins IV legislation, state and local CTE staff have made great strides in developing and implementing POS. Many have developed more than one. In support of POS development, many states have adopted the 16 Career Clusters identified by the National Association of State Directors of Career-Technical Education Consortium (NASDCTEc), which systematically define the progression of skill acquisition from the secondary to the postsecondary level in career-oriented educational pathways. However, although there is momentum around POS development, POS are so new that longitudinal research exploring their nature and impact on student education and career outcomes has been lacking. In 2007, the National Research Center for Career and Technical Education (NRCCTE) launched three field-based studies of POS in order to address this gap in the research. This study, one of these three NRCCTE studies, used mature POS-like sites that had many of the legislated elements in place prior to 2006 to describe the process, structure, and outcomes of POS-like programs at the local level.

Background

Research evidence on POS has not yet borne final results, and longitudinal research on CTE students' educational pathways in general (not POS-specific) is limited. However, studies of career-based comprehensive high school reform (Castellano et al., 2007), high school career majors (Gore, Kadish, & Aseltine, 2003), secondary-postsecondary transition programs in CTE (Bragg et al., 2002; Lekes et al., 2007), and dual enrollment in CTE (Karp et al., 2007) have shown positive outcomes (for a summary, see Alfeld & Bhattacharya, 2011). In addition, research on career academies, which align the coursework for an entire cohort of students around a particular career focus (e.g., science, technology, engineering, and math [STEM] or finance), show that such a school reform model can "improve labor market preparation and successful school-to-work transitions without compromising academic goals and preparation for college" (Kemple, 2004, p. iii; Kemple & Willner, 2008).

In the decade prior to Perkins IV, separate efforts were made to implement and evaluate many of the components of CTE that later became part of the legislative definition of POS. Although many educators are interested in the first legislated component of POS—improving secondary-postsecondary transitions for students—only a few have focused on CTE programs specifically. The League of Innovations conducted the College and Career Transitions Initiative from 2001-2005 to "contribute to strengthening the role of community/technical colleges throughout the United States in easing student transitions between secondary and postsecondary education as well as transition to employment and improving academic performance at both the secondary and postsecondary levels" (League of Innovations, n.d.). According to the CCTI website, all of the sites made progress in reaching these goals; however, evaluation results are not available. More recently, the Concurrent Courses Initiative (CCI) in California has linked secondary and postsecondary levels by providing dual credit opportunities in CTE areas, and early findings are promising for student transition and achievement (Hughes, Edwards, & Karp, 2012).

The second POS component in the legislation is concerned with integrated coursework in a coherent sequence of courses from secondary to postsecondary. Research on curriculum integration has shown that combining CTE and academic coursework is challenging (Johnson,

Charner, & White, 2003), but that academic instruction in a CTE context can improve student achievement in math (Stone, Alfeld, & Pearson, 2008) and literacy (Park, Santamaria, Keene, & van der Mandele, 2010). In addition, a well-designed, coherent sequence of courses has been found to be one of the keys to successful dual enrollment programs (Hoffman, Vargas, & Santos, 2008); such a sequence is also a hallmark of CTE POS. One study shows that the sooner a student chooses a program—defined as taking nine credits in a single area—the more likely he or she is to earn a credential (Jenkins & Cho, 2012). POS help students select a career interest and focus their studies, which may help them complete college. The literature also shows that the more structured the college program is, the better. Specifically, this means "relatively little room for individuals to unintentionally deviate from paths toward completion, and with limited bureaucratic obstacles for students to circumnavigate" (Scott-Clayton, 2011).

By far the largest body of research is on the third component of POS in Perkins IV, the opportunity to take college level courses while in high school—a way for high school students to begin earning college credits and gaining college experience, particularly if the course is on a college campus (Speroni, 2010). Unlike AP courses, which are taught by high school teachers and geared toward top students, dual enrollment is available to a wider range of students and can be offered either at a high school or on a college campus (Allen, 2010).[1] Findings on dual enrollment as a postsecondary access and retention strategy have been upheld using different student populations and different methodologies (Community College Research Center, 2012; Hughes, 2012). Adelman (2005) found that earning credits prior to entering college reduces time to degree and therefore increases the likelihood of completion. More recent research confirms that dual enrollment students are more likely to enroll in college—and more likely to enroll in a four-year college—than their non-participating peers (Karp, Calcagno, Hughes, Jeong, & Bailey, 2007; Speroni, 2011; Rodriguez, Hughes, & Belfield, 2012). Additionally, dual enrollment is related to improved college grade point averages (GPAs), credit accrual, persistence to a second year of college, and likelihood of graduating from college (Allen & Dadgar, 2012; Eimers & Mullen, 2003; Karp et al., 2007; Kotamraju, 2005; Michaelowski, 2007; Rodriguez et al., 2012; Speroni, 2011; Swanson, 2008).

Increasingly, dual enrollment opportunities are being offered in CTE courses as opposed to academic courses.[2] Analyses of data from Florida showed that participants in CTE-focused dual enrollment were more likely to enter and persist in college and earn higher grades once there compared to their peers (Karp et al., 2007). The Concurrent Courses Initiative (CCI) in California, which uses a career-focused strategy and dual enrollment in secondary-postsecondary partnerships to engage students (Edwards et al., 2011; Golann & Hughes, 2008), is the initiative most closely resembling to POS to date. The CCI focuses on low-income youth who are struggling academically or within populations historically underrepresented in higher education (Belfield, Hughes, & Rodriguez, 2012). Participation in CCI has been found to be related to

[1] See Edwards, Hughes, and Weisberg (2011) for further information on six program features of dual enrollment: location of classes, type of instructor, course offerings, mix of students, type of credit, and timing of courses.

[2] However, the percentage of students participating is still relatively low. In 2009, according to the most recent

[2] However, the percentage of students participating is still relatively low. In 2009, according to the most recent national data available, less than 35% of high schools reported that students were taking dual credit courses in CTE. Of these, the majority reported that only between 1% to 5% of their students took such courses; interestingly, these were primarily taught at a CTE-focused high school or a postsecondary campus (National Assessment of Educational Progress [NAEP] Data Explorer).

higher high school graduation rates, higher four-year college enrollment rates (there was no effect on other types of college enrollment), more college credits accumulated up to two years into college, and greater persistence through college (Hughes, 2012). Researchers from the Community College Research Center (CCRC), who have been studying the model since 2007, concluded that the CCI study supports career-focused dual enrollment as a promising college transition strategy. In addition to allowing students to begin earning college credits, curricular pathways helped students see the links between college and careers (Belfield et al., 2012).

There has been little research on the fourth legislated component of POS, which encompasses college credentials and employment outcomes of CTE participation. Research on Tech Prep programs in CTE showed better labor market outcomes for participants than non-participants (Bragg et al., 2002), and Kemple and Willner (2008) found better labor market outcomes for career academy participants than non-participants, though only among males. There is potential for more research examining POS outcomes using state longitudinal data systems (SLDS) and taking a return on investment (ROI) approach (Kotamraju & Mettille, 2012).

Although not specifically about CTE, the implications of this body of research suggest that POS in CTE areas with clear secondary-postsecondary sequences and transition supports may help POS students succeed in college compared to students who do not participate in POS.

The Current Study

Research on various other strategies to improve student engagement and "college and career readiness"[3] form the evidence base regarding some elements of POS. However, research is needed specifically on key elements of CTE POS, how practice relates to policy, and whether POS have the intended benefits for students. The objective of this study is to determine the critical components of the structure and process of POS and provide preliminary evidence on whether and how POS affect students.

We offer a descriptive analysis of three mature, POS-like sites using a two-pronged approach: (1) case studies and thematic analysis of key factors of local POS, and how these map onto the legislation and subsequent policy guidance, and (2) longitudinal analyses of student survey and transcript data to understand how students experience POS. An integration of the findings and the implications for the field unites the two approaches in the concluding discussion.

We do not claim that this study represents a rigorous evaluation of the effects of POS; this was not its purpose. A rigorous experimental study of the effect of POS on students is being conducted by another team of researchers at the NRCCTE (see Castellano, Sundell, Overman, & Aliaga, 2011). Rather, the current study used a backward mapping approach to provide an overview of what POS following Perkins IV might look like in operation, along with a snapshot

[3] Experts are still in conflict about how to define career and college readiness as well as how to measure it (Gewertz, 2012; Porter & Polikoff, 2012). According to the National High School Center and American Youth Policy Forum (2012), the four dimensions of college and career readiness are *knowledge* (academic, career, 21st century), *productive dispositions and behavior* (self-concept, self-management), *engagement*, and *navigational skills* (including so-called "college knowledge").

of what students might experience in POS. The POS developed in the United States after the passage of Perkins IV are likely to be more prescribed, and outcomes for students even more positive, than what we found at the three sites participating in this study. Prior to the passage of Perkins IV, these sites achieved goals similar to those intended for POS in the legislation—and they did so without federal legislation, aid, guidance, or support. Formal guidance from the U.S. Department of Education's Office of Vocational and Adult Education (OVAE, 2010) regarding POS was not issued until early 2010. The POS-like programs at our sites, which were all initiated a decade earlier, may not reflect all of the elements OVAE has suggested are necessary for rigorous POS. However, we believe that this study may provide educators and policymakers with a glimpse into what POS might look like for high schools, colleges, and students as they continue to be developed and implemented, and what the challenges and successes have been. Such insights might have implications for future policy.

Sample and Method

Site Selection

In collaboration with other NRCCTE POS researchers, we reviewed previous policy regarding each of the Perkins IV POS components in addition to other relevant documents (e.g., an early version of the POS self-assessment for states developed by the National Research Center for Career and Technical Education, 2009) and project materials (e.g., the surveys developed for the National Assessment of Career and Technical Education, or NACTE). Research from the fields of career counseling and career identity development (Lewis & Kosine, 2008); CTE transition (Bragg et al., 2002; Castellano, Stringfield, & Stone, 2007; Lekes et al., 2007); recent research on career pathway programs (Pierce, 2001), career academies (Kemple, 2004), credit-based transition programs (Bailey & Karp, 2003; Karp et al., 2007); and school-to-career programs (Furstenberg & Neumark, 2005) also informed our study. Finally, we drew on the NRCCTE's literature review (Lewis & Kosine, 2008) on the history of CTE programming within the context of transition to postsecondary education and the postsecondary experience. These various lenses contributed to our understanding of what a "mature" POS might or should look like.[4]

Rather than search for sites that incorporated all four critical components in the legislation, which would have been next to impossible given the short time span that had elapsed since the enactment of the legislation, our primary selection criteria for mature POS sites for this study was the first component. Specifically, a site was considered eligible if it had a strong link between secondary and postsecondary levels and evidence that students had been completing both portions of the POS for at least two, but preferably three, consecutive years.

To identify a pool of mature, POS-like sites with secondary-postsecondary connections in CTE, we solicited nominations from CTE state directors, staff from the Association for Career and Technical Education (ACTE), CTE researchers, and others involved in POS-related CTE efforts. We received almost 40 nominations and conducted internet and telephone screenings to determine whether these sites could be considered a mature POS based on the above criteria. Following scouting visits to eight of the sites with most potential to collect further evidence

[4] The term *mature* was selected by OVAE to avoid the impression that any one site is a model or example; rather, the term suggests that a site is simply more advanced than others in implementing the POS components.

about the connection between secondary and postsecondary levels, four sites were selected for inclusion in the study; three agreed to participate. A representative from the fourth site told us they were too busy to host visitors and provide information for a longitudinal study.

Sample Characteristics

Each of the three participating mature POS sites[5] is anchored by a community college with multiple area high schools feeding into it. Desert College, located in a large city in the Southwest United States, is the largest of the three and has the most diverse population. The other two sites, River College and Northern College, are both located in smaller cities in the Midwest with industrial manufacturing bases. Each college was asked to nominate two to three of their most mature POS for us to examine. Although Table 1 lists characteristics of each community in the study for the purpose of providing context, only those high schools offering strong POS—and whose districts and/or principals approved participation—were included in the study. The final sample therefore included six participating high schools that fed into Desert College, six regular high schools and one alternate high school that fed into River College, and three high schools that fed into Northern College. Table 1 below presents information on each of the sites and the cities in which they are located. Following the table is a brief description of each site, excerpted from a set of case studies included in Appendix H.[6]

Table 1
Selected Mature POS Sites: 2009 Community Data

	Community		Students			
Site	City Pop.	Region	Total	Minority	Area Served	Selected POS
Desert College	521,999	Southwest Large, urban	22,759	53%	9 districts (largest has 13 regular high schools, 9 alternative schools, 22 charter schools)	Culinary Arts Construction Tech Film Tech
Northern College	66,948	Upper Midwest, Small city	3,909	<6%	27 districts, but primarily 5-6 high schools in 3-4 surrounding districts	Auto Tech Welding
River College	55,516	Southern Midwest, Small city	5,435	4.5%	14 high schools, including 2 vocational centers, across 6 counties	Mechatronics Industrial Maintenance

Desert College plays a central role in postsecondary education for an urban, largely Hispanic population in the Southwest that consists of many first-generation college students. In 2000, with large enrollments in technical areas, the college began to explore ways to build pipelines that

[5] All site names have been masked to protect their identities.
[6] See http://bit.ly/TUignU.

started preparing students at the high school level to enter the college. In 2001, Perkins funds were used to support a staff person to head this effort. By 2006, three full-time staff members were employed by the Office of High School Relations (OHSR). The sole function of this office is to work with area high schools on recruitment, articulation, credits, and enrollment. The college has articulation agreements in multiple CTE areas with four feeder districts. Every program at the college is required to have an advisory board that includes secondary, postsecondary, and business/industry representatives. Its CTE programs are highly attuned to the needs of both students and employers in the region; some students are even recruited to work before they have finished their programs. Due largely to the college's outreach to high schools, dual enrollment has more than doubled in the last few years. Staff in the OHSR nominated three POS as being their strongest in terms of numbers of students: culinary arts, construction technology, and film technology.

Northern College is the linchpin of a regional Tech Prep consortium that includes 27 school districts in this small city. Northern is also co-located with the local workforce center. The college's articulation/dual enrollment programs started in the late 1990s and early 2000s in response to the need for expanded CTE programs at the secondary level that high schools could not have afforded to implement alone. Area high school CTE teachers were retiring, threatening the continuation of the programs, so the schools approached the college to discuss collaborating and sharing resources to continue to offer relevant CTE programs to students. Stakeholders from area colleges, high schools, businesses, and workforce development were brought in to discuss program ideas and initiatives taking place elsewhere. In addition to Tech Prep, initial funding to launch new training programs to fill jobs in manufacturing came from a state sector grant as well as from local industry. The college has a POS website showing which programs are offered at each high school and how each program connects with the college. The college website links to a state website that provides information about POS options available throughout the state. The Director of Academic Partnerships nominated two POS as their strongest in terms of the number of students participating: welding and auto tech.

River College is located in an industrial town with fairly close ties among education, business, and government. The college is fed by 14 high schools (including two vocational centers) in six counties. Due to an arm of the college called the Odyssey program—begun in 1998 to serve high school students—River College has the highest enrollment of high school students in the state, with 1,700 high school students dually enrolled (30% of their total college enrollment). The college began developing dual enrollment options around 2002 to provide needed skills to the younger generation in a town with an aging working population. Its curricula are set in collaboration with the local workforce investment board, and agreements between the college and area high schools are individually tailored by Odyssey program staff to the needs of each high school, including providing distance learning when necessary for rural schools. The college has tried to simplify the articulation agreement process for each feeder high school to fulfill the vision that every student should be able to graduate from high school with some college credit. The Director of the Odyssey program nominated two popular POS for this study: mechatronics (a combination of mechanical engineering and electronics) and industrial maintenance.

Research Questions and Methodological Approaches

We used a mixed-methods approach (Creswell, 2003) to the design and data collection according to each of the research questions:

1. **What do mature POS sites look like? What are their key elements? How do they align with Perkins IV?** Qualitative data were used to answer this set of questions.

2. **What effect do POS have on students? Do they help students' engagement, achievement, and/or transition to college?** Quantitative data were used to answer these questions.

We first discuss the qualitative approach, including the guiding theoretical frameworks for the study, and then present the quantitative approach to the study's research design and data collection methods.

Qualitative approach. To understand how mature POS evolved and how they work, it was necessary to explore them from the ground up rather than imposing a top-down theoretical or policy lens. We used a combination of two qualitative research methods—backward mapping and case studies—that have been helpful to other researchers when analyzing complex social structures and relationships. These methods facilitate understanding of the components and mechanisms that contribute to desired policy outcomes. As Recesso (1999) noted, "the policy exists to create change at the local level, but it is the locality which ultimately decides how the policy's intent will be adapted to meet its needs" (p. 30).

Backward mapping. Much like reverse engineering in technical fields, backward mapping is an approach that can help "unpack" a social program or policy implementation. The idea is that the analysis starts at the very end of the process—the outcome—and works backward to examine the inputs. This requires a rich understanding of the actors and their relationships and motivations, which is why most backward mapping uses case studies (Elmore, 1980) or profiles (Recesso, 1999) to understand local implementation of policies.

Case studies. "Case studies emphasize detailed contextual analysis of a limited number of events or conditions and their relationships. [The case study research method has been described as] an empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used…case study research generally answers one or more questions which begin with 'how' or 'why'" (Soy, 1997).

Combination. We developed a working hypothesis (Yin, 2009) of POS based on prior relevant research, which was slightly revised in the second year of the study to reflect guidance released by OVAE regarding the 10 components of POS. We assumed that the purpose of POS is to make career pathways more transparent for students and to support them in each step toward obtaining a credential. The model presented in Figure 1 shows the variables hypothesized to result in successful POS outcomes. Because the backward mapping approach starts at the very end of the process—the outcome—and works backward to each successive level of

implementation in order to understand how the outcome was achieved, Figure 1 starts at the end with the desired outcome of POS—the smooth transition of students from secondary to postsecondary in a particular career area—and moves backward in time to what needed to happen to reach that point. The case studies (see Appendix H) allowed us to explore to what extent each of these elements contribute to mature POS.

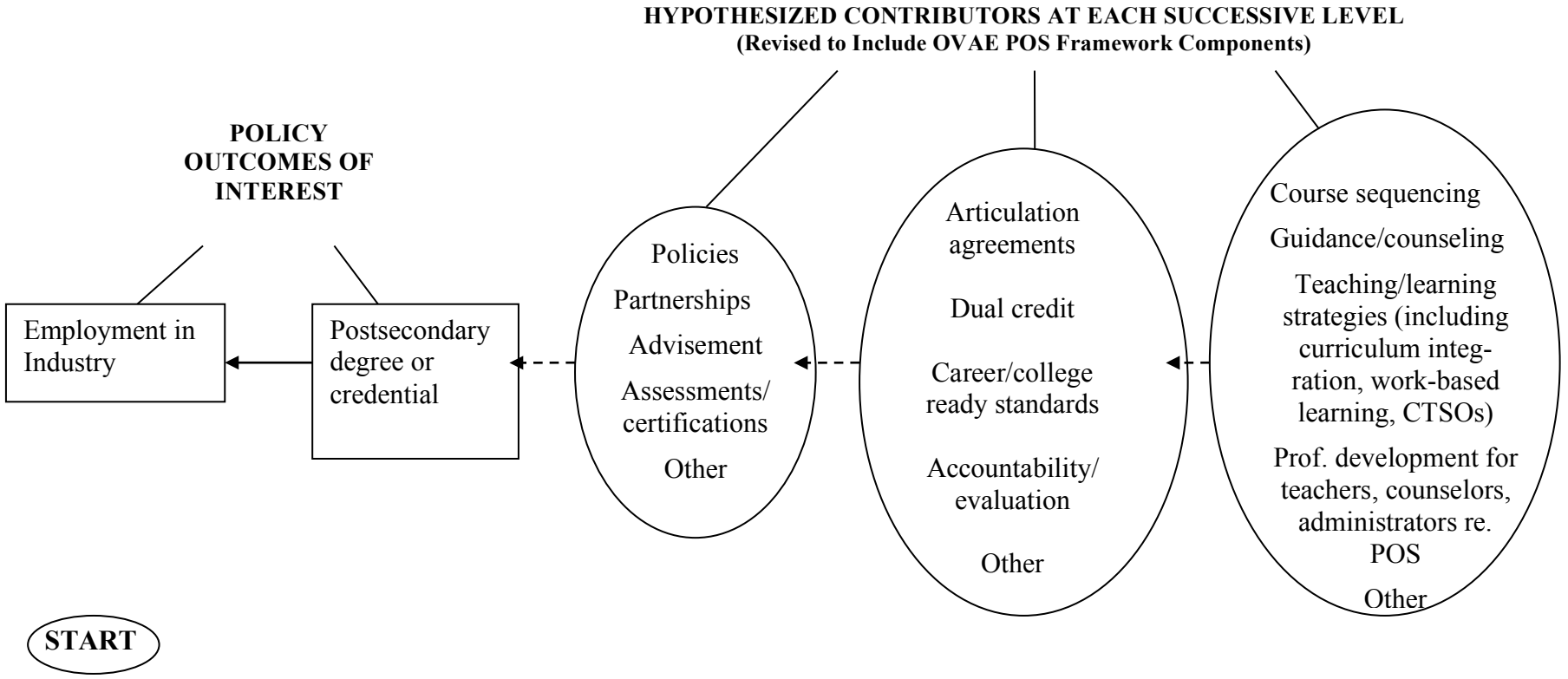


FIGURE 1. Backward mapping successful POS outcomes.

Quantitative approach. Because students typically begin a CTE POS in their junior year and because we wanted to examine the entire transition period from junior year to the second year of college, two cohorts of CTE students (juniors and seniors) from each of the high schools in the selected sites were studied for a period of three years. We examined their secondary and postsecondary experience, academic and technical achievements, and initial work-related experiences. This time frame includes the students' last one to two years of high school and the first one to two years of postsecondary education and/or work. As a visual aid to help the reader understand our study design, Figure 2 depicts the points of data collection in the life of the students in our sample. The youngest cohort of students was in 11th grade and the oldest in 12th when data collection began in Spring 2009. The final round of data collection took place three years later in the spring and summer of 2012 after both cohorts had transitioned out of high school. All results reported here are derived from student surveys and high school and college transcripts.[7]

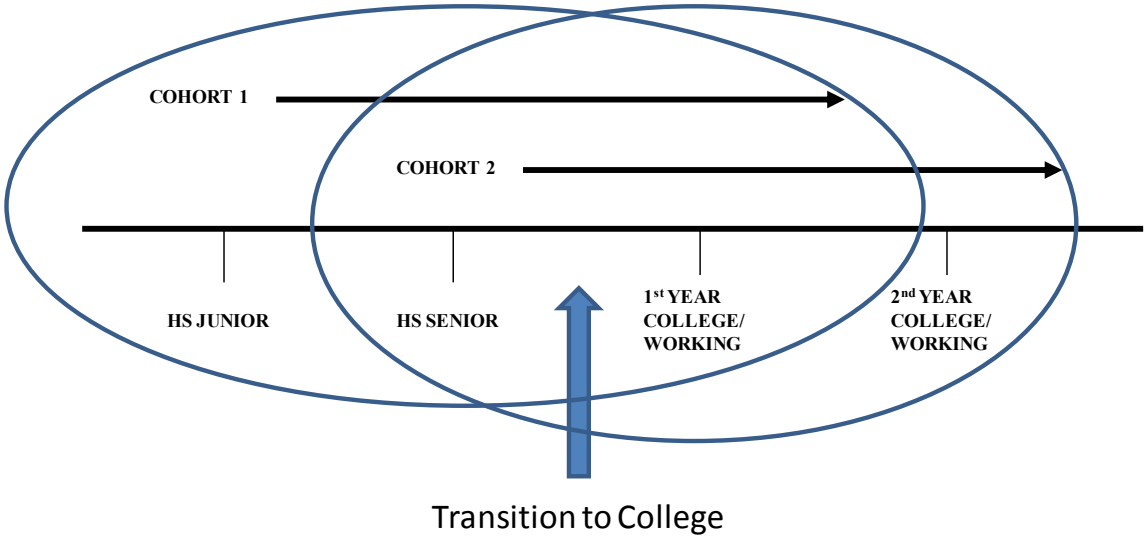


FIGURE 2. Student cohorts.

Data Collection

All of the instruments and procedures were approved by an Institutional Review Board (IRB) prior to beginning data collection. In addition, school districts were provided with information about the study and asked for their approval and cooperation in facilitating the researchers' site visits and data collection efforts. Data collection began with three-day site visits to the high schools and colleges in the selected POS sites in mid-2009; these visits continued through mid-2012.

Qualitative. Interviews were conducted with a variety of individuals at each site, including:

[7] We also used freely accessible online public information about participants to supplement college records and survey data for the 2012 follow-up. See Section B of the results as well as Appendix B for more details.

- Secondary principal and/or vice principal
- Secondary counselor(s)
- Secondary CTE instructors in the POS of interest
- District personnel, including those responsible for student records
- Postsecondary faculty in the POS of interest
- Postsecondary administrators involved in the development of POS
- Postsecondary institutional research staff or those responsible for student records
- Advisory committee member(s) from local business

Interviews included questions about the development of the POS:

- When did the POS begin?
- Who started the process and what was the impetus?
- Who was involved in the planning?
- How long did it take?
- What were the challenges and successes?

Interview questions also asked about the structure of the POS, including:

- course sequencing from the secondary and postsecondary level
- articulation agreements
- dual credit and dual enrollment opportunities
- integration of academics and CTE (both within and across courses)
- availability and structure of career guidance
- credentials (degrees and certifications) available to students

Focus groups were conducted with students to ask about their experiences in their POS, and materials such as course catalogs and other printed materials pertinent to the POS and/or dual enrollment opportunities were collected during site visits. All of this information was used to develop the full case studies (see Appendix H). Emergent themes within and across cases were coded by two researchers for analysis and comparison with the Perkins IV legislation and subsequent OVAE policy guidance.

Quantitative. Two types of data were collected: student surveys and school records (transcripts). The high school survey instrument was developed by NRCCTE POS researchers using selected items from national surveys because they had already been tested for external and construct validity.[8] The survey was piloted on an independent sample and deemed reliable for use in this study.[9] The high school survey asks about students' activities, attitudes about their experiences, and career and educational goals immediately after high school and farther into the future. On the detachable front page of the survey, students were asked to provide contact information so that we would be able to locate them for follow-up.

The initial high school survey was administered on site in the spring of 2009 to all juniors and

[8] These included items from the National Educational Longitudinal Study (NELS), administered by the National Center for Education Statistics (NCES), as well as from High Schools That Work (HSTW), a program of the Southern Regional Education Board (SREB).

[9] The survey was piloted by our colleagues at Clemson University on high school students in their POS sample.

seniors enrolled in POS classes at feeder high schools in each of the three sites. Also in the spring of 2009, passive parental consent letters (with Spanish translation, where needed) were sent to parents describing their child's potential participation in the study and allowing them to opt out; only three did so. In addition, students were asked for their assent prior to taking each round of surveys. The original sample is therefore the population of 11th- and 12th-grade students in seven POS across the three sites who were in school when we administered the surveys and whose parents did not return a signed refusal for their participation (the total *N* in the original sample was 213).

Follow-up surveys were administered to students annually to ask about their progress and changes in plans; these were administered either online or on-site; students were offered an incentive (a gift card) for participation in the follow-up surveys. The final follow-up survey can be found in Appendix A.[10] Multiple recruitment strategies were used during each survey round to maximize response rates, including emailed and mailed invitations, teacher and faculty announcements in class, and phone calls to participants. More detailed information on survey recruitment, method of administration, response rates, and incentive amount can be found in Appendix B.

The 213 students across the three sites who first completed a survey in 2009 are considered our original sample, which we followed through June 2012 using both surveys and school records. Table 2 shows the number of students in each POS by site.[11] About 65% of these students were located in 2012.

Table 2
Number and Percentage of Student POS Enrollment by Site

	Desert	River	Northern
Culinary Arts	48 (37 %)		
Construction Tech	47 (36%)		
Film Tech	35 (27%)		
Mechatronics		22 (47%)	
Industrial Maintenance		22 (47%)	
Auto Tech			27 (77%)
Welding			8 (23%)
Other	1 (1%)	3 (6%)	0 (0%)
Total	131 (100%)	47 (100%)	35 (100%)

Note. POS enrollment was determined by the course the student was enrolled in when surveyed. "Other" responses were those who could not be determined by class enrolled (some high schools offered more than one of the selected POS) or by student survey responses (students who wrote in a POS other than those selected for study).

School transcripts were collected following the end of each academic year from the high schools (Years 1 and 2) and the colleges (Years 2 and 3). Transcripts were masked with student ID numbers by the schools using a key that was kept in a secure location. Table 3 below shows the number of high school and college transcripts available for original sample students.

[10] See Alfeld and Bhattacharya (2011) for the first high school survey and follow-ups before the final survey.
[11] Note that the POS reflect industrial variations in different regions of the country (e.g., River and Northern are located in manufacturing regions).

Table 3
Transcripts Collected by Site

Site	Total Participants	HS Transcripts Available	College Transcripts Available*
Desert	131	107	57
River	47	45	31
Northern	35	35	10

*Only includes students who attended the affiliated college after high school and had a record for at least one post-high school semester (i.e., students who earned dual credit while in high school but did not subsequently enroll in the college are not included; neither are students who did not attend the affiliated college). Includes students who withdrew or failed after enrolling.

See Tables 4A and 4B for the high school and college variables collected for our sample. All academic courses, CTE courses, and electives taken during high school were coded using a system adapted from the Classification of Secondary School Courses (CSSC). See Appendix C for information on course coding. Standardized test scores, graduation status, and cumulative GPA were also recorded from the high school transcripts.

College transcripts were collected and coded for all students in the sample who attended the affiliated college at each site (total N =98).[12] In addition to transcripts, which provide information on courses and grades, other college records provided data on entrance test scores and student status (e.g., currently active, graduated, inactive, never enrolled after high school).

Table 4A
Summary Table of High School Transcript Variables

High School Transcript Variables	High School Transcript Variables
High school attended	Number of science credits
Dual credits earned*	Science GPA
Graduated with HS diploma	Number of upper-level science courses
Certificate earned by HS graduation, type	Number of academic credits
Cumulative GPA	Number of CTE credits
Standardized English test**	CTE GPA
Standardized math test**	Number of English credits
Number of courses taken within POS cluster	English GPA
Number of courses in a different cluster	Number of social studies credits
Number of honors courses	Social studies GPA
Number of math credits	Number of elective credits
Math GPA	Electives GPA
Number of upper-level math courses	

Notes. * All dual credits earned by students in our sample were in CTE areas. ** Different standardized state tests were taken at each of the three sites in English and math. All scores were converted to a standard scale (percentage) for analysis.

[12] Information was not collected from other colleges students may have attended after high school.

Table 4B
Summary Table of College Record Variables

College Variables
Major
Entrance exam score*
Number of dual enrollment credits
Number of non-credit courses
Number of credits earned by end of first year
Total number of college credits to date (2012)
Credits attempted to earned ratio
Enrollment in degree program
College GPA
Courses/grades
Semesters enrolled
Certificates/degrees earned
Birth year
Race and gender
Student status

Note. These data were collected from college transcripts as well as other student records provided by the colleges. Students could earn dual credits while in the high school POS but then not enroll in the college; we do not include these students in the college analyses. * Exams differed by site. Desert: ACT and Accuplacer scores; River: ACT and COMPASS scores; Northern: Accuplacer scores. All scores were converted to a standard scale (percentage) for analysis.

The following is a summary of the multiple types of data collected on our sample. Relevant items from each of these data sources and time points were transferred to a master data file used for longitudinal data analysis in the third section (section C) of the quantitative results.

Table 5
Longitudinal Data Points

Data Type	Number of Students
High school original survey	213
High school transcripts	187
Follow-up	67*
Final follow-up information from other sources	104**
College transcripts from affiliated colleges	92
2012 data of some kind (combination of previous three)	138***

Notes. * This is the number of unique responses to at least one post-high school follow-up survey, not just the final 2012 follow-up survey. Some of the students included in this number responded to more than one follow-up over time. ** This number includes students who did not respond to any survey after the initial high school survey, but for whom college records were obtained and/or status was found by other means (e.g., social media; see Appendix B). *** More explanation of 2012 status data is presented in section B of the quantitative results.

More detail about our survey data collection and data analysis methods can be found in Appendices B and C, which also include a description of challenges and limitations with data collection, coding, and analysis.

Results

The results of this study will be presented in two subsections due to the different research questions and methods used for each. The discussion section will integrate both sections and present implications of both sets of findings for POS policy and practice.

Research Question 1 (Qualitative): What do mature POS sites look like? What are their key elements? How do they align with Perkins IV?

In earlier reports from this project (i.e., Alfeld, 2010; Alfeld & Bhattacharya, 2012), we discussed emergent themes across the three POS sites. We briefly describe them here, then compare them to the Perkins IV legislation and policy guidance around POS. (We use the term POS to describe the mature programs we studied; however, recall that the secondary-postsecondary connections cultivated at these sites had begun prior to Perkins IV.) Full case studies of each of the three sites are available in Appendix H.

Emergent Themes in Mature POS Sites

The following themes emerged as key components of program success across the three sites:

Shared vision of seamless student transitions. Secondary, postsecondary, and local business stakeholders shared a vision of creating seamless transitions for students from high school to college and careers, constantly asking, "What's best for students?" rather than "What's in it for us?" Leaders at each site worked to bring multiple stakeholders on board, motivated primarily by the goal of giving students a more efficient and relevant educational experience in preparation for careers.

Dedicated high school relations staff at the college. Each college funded a staff person dedicated to working with area high schools to facilitate POS development at the beginning of the process. By the time of this study, each site had two to three dedicated staff acting as liaisons with area high schools. These individuals were responsible for coordinating advisory committee meetings, developing articulation agreements, arranging student schedules, advising students on POS course sequences, and working with high school guidance counselors to make students and parents aware of POS opportunities. These responsibilities could not have been shouldered by other staff at the college on top of their regular duties.

Active employer advisory committees. The sites all had active advisory committees for each POS, consisting of secondary and postsecondary instructors and business representatives (some were alumni of the POS) who met at least once a year to discuss curriculum content, sequencing, and equipment according to changing industry standards and employer needs. In addition to these formal meetings, many instructors also had informal relationships with individuals in industry, on whom they could call for advice, equipment, and internship placements for students. In turn, the businesses trusted the teachers to recommend good students for hire.

Good relationships between secondary and postsecondary counterparts. We found that good working relationships between administrator and teacher counterparts at the high school and

college facilitated POS development and maintenance. Willingness to make compromises and see other perspectives was important for maintaining goodwill and making progress. Each of the sites had encountered multiple logistical and policy challenges in creating seamless POS, but each had found ways to overcome these challenges to make the POS work.

Flexibility in arranging dual credit options. Establishing dual credit/dual enrollment options entailed finding solutions for issues like daily and semester scheduling, location of the course (and student transportation if necessary), teacher credentialing (if a high school teacher taught the course), and tuition payment (district funds or tuition waiver). Flexibility in policies and willingness to seek solutions beyond the status quo facilitated the establishment of dual credit agreements.

Automatic transcription by the college of dual credit. Each of the sites had begun enrolling high school students taking dual credit courses in the affiliated college, so that a college transcript would be generated and college credits would be automatically transcripted. This was a solution to the problem of paper certificates being lost or escrowed credits not being claimed by students.

External grant funding to develop POS. The sites would not have had mature POS if the colleges had not committed resources (e.g., funding dedicated staff, renovating high school facilities and equipment to meet college-level standards, and offering tuition waivers) to making them happen. Perkins dollars were not enough; all three colleges had secured external grant funding from a variety of sources to support the POS development effort.

POS in Practice versus POS in Perkins

In this final report, we compare the findings above with Perkins IV and subsequent policy guidance from OVAE regarding POS; these were presented in Figure 1 as a hypothesized model of how POS work to achieve desired policy outcomes. In the following discussion, we repeat some of these emergent themes, in addition to presenting other relevant information gathered at the sites (please refer to the full case studies in Appendix H for more detail).

Perkins IV. We begin by examining the evidence of the four legislated components of POS in Perkins IV in the three mature POS sites:

1. Secondary and postsecondary education elements. The sites in this study were selected based on the fact that they already had strong secondary-postsecondary connections. We discovered through the qualitative research that what made these connections work was a shared vision for seamless transitions for students, good relationships among various stakeholders, and a dedicated staff person(s) at the college whose responsibility it was to create curriculum linkages, including formal articulation agreements, with local high schools. In addition, the colleges reported that their POS development efforts were supplemented with external grant funding and/or flexibility in use of various funding streams.

2. Coherent, non-duplicative alignment of rigorous academic and technical content. Coherent, non-duplicative CTE course sequencing at the sites was the result of an agreement among advisory committee members about what students need to know at each successive level.

Alignment between CTE courses and academic courses (horizontal) was not as evident as the secondary-postsecondary (vertical) alignment within the POS at the sites we visited. Some CTE teachers described efforts to integrate academics into their courses, which was easier than trying to infuse CTE concepts from multiple technical areas into an academic course. However, although many of the POS on paper (i.e., charts showing curriculum offerings required by the state for POS approval) included academic courses as well as CTE courses, it seemed from our visits to classrooms and interviews with administrators and faculty that academic instruction often occurred in a separate, unrelated sequence.

3. Opportunity for dual or concurrent enrollment. All of the sites in our study offered dual enrollment (sometimes called concurrent enrollment), but the path to being able to offer it was described as challenging for several reasons, including working out costs, the location of courses, teacher credentialing, and credit transcription. The colleges waived tuition for high school students as a recruitment investment, received more state funding for their increased enrollments, or were paid by the school districts on a per student basis. If the dual credit course was offered at the college, both semester and daily schedules needed to be aligned between the institutions, and transportation had to be provided for students to get to campus. If the course was offered at the high school, either the college instructor needed to travel to one or more high schools to teach the course, or the high school teacher needed to have (or obtain) the proper credentials to teach at the college level. Finally, the credits high school students earned needed to be automatically transcripted in the college system at the time the course was taken; students often did not claim the credit if paper certificates were issued or if the credit was escrowed.

4. Leads to an industry-recognized credential, certificate, or degree. All of the POS in our study led to a certificate or degree at the postsecondary level. Some also included opportunities for students to receive industry-specific entry-level certifications in high school and more advanced certifications in college as their skills progressed (e.g., in auto tech and culinary arts). However, the strong training and industry ties of the programs could actually prevent students from obtaining a degree. For example, in areas such as construction technology and industrial maintenance, desperate employers often hired students before they completed their programs; thus, on their transcripts at least, these students appear to have dropped out when in fact they were gainfully employed and using highly sought-after skills. In the film POS, what mattered for employment and membership in the union was hours spent working on films, rather than course credits or credentials; these students' transcripts—often leading only through high school—also belie the valuable skills gained in the POS.

OVAE Framework

As mentioned in the introduction, OVAE released a ten-component framework for POS in early 2010 that served as a guide for the CTE field in implementing the POS requirement in Perkins IV. However, because the sites in this study began developing POS-like programs about 10 years earlier (around 2000), we sought to understand whether the framework components are necessary and sufficient, or whether the findings from mature sites suggest additional or alternate components. Table 6 shows the ten components in OVAE's POS Framework, alongside the key components that emerged at the mature POS sites in this study. The lists of components are organized to demonstrate where there might be overlap.

Table 6

Comparing Perkins IV Policy Guidance to POS in Practice

OVAE's 10 Components	Key Components in Mature POS
Partnerships	Relationships
	Shared vision
Course Sequences	Active advisory committees
Legislation and Policies (and Budgets)	External grant funding
	Dedicated staff
Credit Transfer Agreements	Flexibility
	Automatic credit transcription
Professional Development	
Guidance Counseling	*(Note: It is not that these six*
Teaching/Learning Strategies	*remaining components did not exist*
College/Career Ready Standards	*at the mature sites; they just did not*
Technical Skills Assessments	*emerge as key components of POS*
Accountability/Evaluation	*across all three sites.)*

It is not surprising that no one-to-one correspondence exists between the components that emerged from implementation of POS-like programs that preceded the authorization of Perkins IV and the policy guidance that followed Perkins IV. However, despite these differences, there is overlapping correspondence between some of the components (in the review below, OVAE components are ***bolded and italicized***; mature POS components are *italicized*).

- ***Partnerships*** encompass good *relationships* and *shared vision,* discovered in the mature POS sites. Further, partnerships facilitate *active advisory committees* and foster the *flexibility* needed for dual credit arrangements.

- ***Course sequences*** were facilitated by *active advisory committees* that provided input into what students should be learning, when, and how. The advisory committee meetings were often arranged by *dedicated staff* at the colleges who brought secondary, postsecondary, and industry representatives together to discuss course sequences and articulation.

- ***Legislation and policies*** related to POS required *flexibility* in their creation, interpretation, and implementation to make the POS arrangements work according to a *shared vision.* Policies —if budgets can be included under this component—also needed to include line item funding for *dedicated staff* and allow for creative use of *external grants* to supplement funding streams supporting POS.

- ***Credit transfer agreements*** at the mature POS sites needed to be negotiated with *flexibility* (in meetings coordinated by *dedicated staff)* and informed by stakeholders from the *advisory committee.* The goal should be *automatic credit transcription* so that college transcripts are generated as soon as a high school student earns dual credits.

The other six components in OVAE's POS Framework were evident in some of the mature POS sites—as described below—but they did not emerge as critical across all three sites. (It should be

noted that in more recent communications with our contacts at the sites, staff were aware of the OVAE Framework and were working to further develop all of its components). It could be argued that all of the ten components are important, or even critical, to POS; however, this study suggests that the following six components may be "icing on the cake" following the implementation of the four components described above.

Teaching and learning strategies. Many of the POS instructors were experts in their subject matter areas, highly committed to students, and well-versed in traditional CTE teaching and learning strategies such as project-based learning, performance assessments, internships, and career technical student organizations (CTSOs). We heard from students in the focus groups that these strategies were highly successful in engaging and teaching them about the CTE area. However, newer strategies that would better support POS, such as the alignment and integration of academic and technical curricula, were not as frequently observed.

Technical skills assessments. CTE teachers implemented skills assessments (often performance-based) and also facilitated student opportunities to receive industry-recognized credentials while in high school. These credentials could be earned by taking national skills assessments or through off-site, after-school employment to earn "hours" toward certification. Many of the POS areas offered a sequence of certifications that could be earned in subsequent levels of training; however, they were sometimes cost-prohibitive.

Guidance counseling and advisement. High school guidance counselors were often more focused on testing, scheduling, and college applications than on helping students choose a POS. Some high school counselors were unaware of the course sequencing work that had been done between CTE teachers at the high school and the local college. By contrast, the college advisors (including the dedicated "high school relations" staff) were much more well-versed in the POS course sequences, made visits to high schools to promote the programs, and talked with students and parents about the opportunities offered in the POS.

Professional development. Administrators and counselors at one site received professional development (PD) on how to enter POS course sequences into state templates, and teachers in one high school at another site had received PD on academic-CTE curriculum integration. High school teachers at two sites who taught college level classes were trained or mentored by college faculty. However, we did not see any comprehensive, coordinated, or sustained PD around POS at any of the sites, possibly because the sites were already ahead of their states in developing POS-like programs and articulations.

College and career ready standards. All of the sites were concerned with the college and career readiness of their students, which is why they had begun articulating CTE courses and offering dual enrollment. However, other than the fact that high school students in dual credit courses needed to pass college entrance requirements, it was unclear whether there was any particular standard of measurement of college readiness. As will be seen in the quantitative results section, about half of the students who enrolled at the college following high school needed to take remedial/developmental courses (although that number was negatively related to the number of dual credits earned, suggesting that the POS can ameliorate some of the need for such non-credit courses in college). Accepting the need for remediation among entering students, the college in

one site offered a remedial math course for free to high school seniors. In another site, the remedial courses were offered at the college at the same time as the CTE/POS courses so as not to slow momentum toward program completion.

In terms of career readiness, two of the colleges offered employability courses in addition to the POS courses, and the college instructors were focused on preparing their students for work in industry. At the high school level, there was less visible emphasis on career readiness, though students in one site honed customer service skills in the auto shop, and in another site the film students worked alongside adult union workers on movie sets. Although internships were available to high school students in some POS, they appeared to be limited due to the recession.

Accountability/evaluation. Perkins IV does not require reporting on POS student enrollment, therefore the colleges' efforts to collect this information was for program improvement purposes only. Several college representatives were trying to track the enrollment and retention of high school students who had received dual credit, but this proved to be a challenging task, particularly when students enrolled in other colleges and the colleges participating in our study no longer had access to student records. Our sites were in varying stages of progress in creating statewide articulation agreements, but were clearly ahead of many of their peers in developing secondary-postsecondary articulations. One college was part of a statewide POS database, but this seemed to be aimed more at helping students select and take courses in particular areas than for tracking enrollments and outcomes.

Qualitative Considerations

The site visits to the three selected mature POS sites demonstrated that there were key components to POS development that correspond with Perkins IV and subsequent policy guidance, but that there were many areas where components were interrelated and could not be treated as completely separate. In addition, only four of the ten components in the OVAE Framework could be considered key across the three sites we studied, although the other six components existed to various degrees, and the sites are working to improve them because they are now part of the Perkins IV guidance. Implications of the findings from this piece of the research study, as well as considerations for policy and practice, are presented in the discussion section.

Research Question 2 (Quantitative): How do students experience POS? Do they help students' engagement, achievement, and/or transition to college?

In addition to new data, the quantitative results presented in this report include selected findings from earlier reports to facilitate the readers' understanding of the pathways these POS students took. Detailed descriptive statistics from earlier rounds of student survey data can be found in the Year 3 technical report from this study (Alfeld & Bhattacharya, 2011). Additional statistical tables supporting findings presented in the quantitative results can be found in Appendix D.

The results section is organized into four sections: (a) a description of who the students in our sample were in high school; (b) findings regarding these students' transition out of high school; and (c) a description of the effect of high school POS participation on college outcomes using

longitudinal analyses. A final section (d) uses college systems data to compare the students in our sample with matched peers on key variables.

Findings should be interpreted as applying only to the students enrolled in the selected POS at the selected sites who participated in the study. It should be kept in mind that, except for the final section, no comparisons are being made to students *not* enrolled in a POS. In addition, no comparisons are being made between students in different POS or different sites; for the purpose of this study, all student data were pooled for analysis.

A. Selected High School Level-Findings

High School Descriptives.[13] The student survey data initially collected from our sample when they were juniors and seniors (N =213) showed that about half of the students (a) were in the POS that most interested them, (b) said that their school offered enough courses in their POS, and (c) expected to complete at least four courses in their POS by graduation. Two-thirds reported that their POS was related to their career goals, but about a fourth claimed the POS in which they were most interested was not offered at their school. Table 7 shows that, for the most part, students had positive attitudes toward their POS. It should be noted that the survey questions referred to "program of study" rather than "POS" but did not define it; some survey questions used "program of study or career pathway."

Table 7
Students' Attitudes about POS

Being in a POS…	Strongly Disagree	Disagree	Agree	Strongly Agree
Made me more likely to come to school	3%	21%	54%	22%
Made me less likely to drop out	9%	13%	53%	26%
Helped me make connections between school and the career that I want	2%	15%	51%	32%
Made me focus my studies so I know where I am headed	6%	14%	54%	26%
Helped me get better grades	4%	26%	52%	18%
Made me feel like I fit in better at school	9%	27%	52%	13%
Made it more likely that I would take courses I need for the future	4%	12%	54%	30%
Made it more likely that my parents got involved in my selection of courses	10%	37%	42%	10%

Note: N = 208 - 211 (98% - 99%) for these questions. Data source: 2009 High School Survey.

Students who reported that their POS was in their career area of interest had significantly more

[13] All findings in this subsection are from the 2009 high school survey. See Alfeld and Bhattacharya (2011) for full results.

positive attitudes about POS (on a scale constructed from the items in Table 7; see Appendix C), $M = 3.01$, $SD = .53$, compared to students who reported that their POS did not match future career goals: $M = 2.57$, $SD = .50$; $t\ (169) = 4.63$, $p\ .01$.

Confirming the qualitative observations at the participating high schools, the POS students reported on surveys that they were not receiving much guidance from counselors. Students were mostly getting advice on what courses to take from their friends and parents, and found their parents to be most helpful in this regard (about a fifth of students reported that "no one" was helpful). Less than 20% reported talking to a counselor three or more times about course planning since the start of high school, and 68% never took part in a parent-counselor-student conference for course planning purposes. However, between 14% and 47% (depending on the topic) reported talking with a counselor about what courses to take, grades, going to college, applying to two-year colleges or technical schools, possible career paths and the steps necessary to pursue them, and/or finding a job after high school. As guidance and counseling is one of the components of the OVAE Framework, it seems that this is a likely area for improvement.

Although all of the sites in the study offered dual credit, almost half of students reported on their surveys that they did not know if any of their POS courses were offered for dual credit. Interviews at the sites also revealed that sometimes students did not know that they were in a POS or what the available course and pathway options were. This suggests a gap in the information available to students. As these POS continue to evolve, improvements in counseling and guidance could conceivably ameliorate this gap. Improvements might include requiring more meetings with counselors and including parents in these meetings, more focus on guidance from informed teachers in the POS, and accessible, updated school websites. Despite receiving less than ideal guidance on course selection, students reported doing their own research about jobs and college options. Depending on the topic (e.g., activities on the job, training needed, which colleges offered training, salary range, hours required, and how to get the job), 30% to 45% reported "a good deal of knowledge" about their chosen career field.

About one-third of students reported participation in an internship or co-operative education (hereafter referred to as a co-op), however only 23% reported that their experiences in these types of work-based learning (WBL) experiences were "closely related" to their career choice (33% reported that their WBL was "not related at all" to their career choice, and 44% reported WBL as "somewhat related" to career choice). Although not an explicit component of the OVAE Framework, WBL is a teaching and learning strategy that could enhance the POS experience if it were more related to students' career areas of interest. Almost half of the students in this study were working for pay while in high school (a third of whom worked more than 20 hours per week); two-thirds said their job was "not at all related" to their career choice. This seems to be a lost opportunity for career training while students are still in school (Deil-Amen & Deluca, 2010), particularly when compared with the opportunities for youth in other countries (Hoffman, 2011).

As described in the introduction to this report, prior research suggests that dual credit can increase students' chances of entering and completing college. As Table 8 shows, the number of students in our sample who earned any kind of dual credit ranged from very few at Desert College to all of the students at River College (we note that all River College students in our

sample were enrolled in River's "Odyssey" program, a college program offering dual credit to high school students).

Table 8
Sample Students Earning Any Dual Credit by Site

	Number of Students Earning Dual Credit (Percent)		
Site	Yes	No	Unknown
Desert	15 (12%)	102 (78%)	14 (11%)
River	47 (100 %)	0 (0%)	0 (0.0%)
Northern	17 (49%)	16 (46%)	2 (6%)

Table 9 shows the subset of students who earned dual credit in their POS, specifically.

Table 9
Sample Students Earning Dual Credit in Their POS by Site[14]

	Number of Students Earning Dual Credit (Percent)		
Site	In POS	Not in POS	Total Dual Credit
Desert	4 (27%)	11 (73%)	15 (100%)
River	47 (100%)	0 (0%)	47 (100%)
Northern	17 (96%)	0 (0%)	17 (100%)

Note. This table includes only students who were taking dual credit courses (derived from the Yes column in Table 8).

One reason for fewer dual credits earned by students at the Desert site may be that this site was further behind the others in establishing dual credit options, partly because of its large size (Desert serves multiple districts with hundreds of POS) and the additional layers of approvals needed for it to form each articulation agreement. Further, in the film POS at Desert, courses and credentials were less important for employment than hours spent on movie sets that counted toward union memberships, which provided less incentive for students to earn dual credits compared with other POS or sites.

High School Correlations

In addition to the descriptive data presented above, correlational data also contribute to describing our sample while they were in high school. Multiple bivariate hypotheses generated from the literature review were tested regarding the relationship between POS-related activities and a variety of experiences and outcomes (see Appendix D for a full correlation table). Although relationships between variables on the high school survey are fairly modest and cannot be interpreted as causal because our data are cross-sectional, given our small sample size, their significance is worth noting. (Longitudinal relationships will be described in the section entitled *Longitudinal Results: High School to College*.)

Transcript only (N = 187).[15] Some scholars concerned with "tracking" have suggested a

[14] High school transcripts were matched with college transcripts to confirm that dual credit courses showed up in both records.
[15] Sample size varies by analysis.

negative relationship between CTE and academic course-taking and achievement (see Bozick & MacAllum, 2002, and Deluca, Plank, & Estacion, 2006, for reviews). However, POS are theoretically more rigorous than traditional CTE programs, thus the following questions were examined:[16]

- ***Is there a negative relationship between earning POS credits and math or science credits?*** NO. In examining the data from high school transcripts, we found that students in our sample who earned more CTE credits also earned more math (.53**) and science (.52**) credits.

- ***Is taking a greater number of POS courses negatively related to grades in math and science?*** NO. The number of POS credits earned by students in our sample was positively related to grades in both math (.14*) and science (.22**).

- ***Is there a negative relationship between taking a greater number of POS courses and standardized test scores?*** NO. The number of POS credits earned was not significantly related to math standardized test scores among students in our sample, and there was a positive relationship between POS credits and English standardized test scores (.19*).[17]

Surveys and transcripts (N = 187). Combining high school survey data and transcript data using students' study ID numbers, we were able to examine relationships between students' self-reports and their school records. A greater number of POS credits was related to having a positive attitude toward POS (.16*) and to the belief that what is learned in school will be useful later in life (.15*).[18] Satisfaction with the help students received when choosing courses was also related to the number of POS courses taken (.16*). Students' GPA in high school CTE courses was related to consulting with a counselor (.24**),[19] the number of POS credits earned (.16*), and having a positive attitude toward POS (.16*). Additionally, consulting with a counselor was linked with a positive attitude toward POS (.30**). This suggests that either counselors are playing a key role in "selling" POS to students and promoting student engagement through POS participation, or that the higher achieving, more engaged students are more likely to meet with their counselors.

To ensure that it is not only the "good" students reaping the benefits of POS-related experiences, all of the following relationships were examined after controlling for GPA (although we caution that causation still cannot be determined from these cross-sectional data):

- Students taking more POS courses were more likely to believe that what they learned in school would be useful later in life ($\beta = .147$, $p < .05$) and were likely to earn more college credits while in high school ($\beta = .664$, $p < .01$).
- Students who talked with their counselors more often about what courses to take, grades, going to college, applying to two-year colleges or technical schools, possible career paths and the steps necessary to pursue them, and/or finding a job after high school were more

[16] For all statistics that follow, * $p < .05$, ** $p < .01$, *** $p < .001$.
[17] The ratio of CTE credits to academic credits was also positively related to English standardized test scores (.16*).
[18] The latter two attitudes were also related to each other (.40**). Both of these items are scales constructed from survey items. See Appendix C for more details.
[19] Consulting with a counselor was also a constructed scale (see Appendix C).

likely to report having researched careers ($\beta = .22$, $p < .01$), college options ($\beta = .22$, $p < .01$), and industries with the most job growth/opportunity ($\beta = .20$, $p < .01$).

- Consulting with a counselor was related to positive attitudes toward POS ($\beta = .29$, $p < .01$), and positive attitudes toward POS were related to students' belief that what they learned in school would be useful later in life ($\beta = .41$, $p < .01$).
- Students who participated in internships or co-ops that were closely related to the job they wanted to have in the future were more likely to have positive attitudes about their POS ($\beta = .24$, $p < .01$) and were more likely to think that the information they learned in school will be useful later in life ($\beta = .24$, $p < .01$).

These cross-sectional results from the high school survey suggest that POS participation has a positive relationship with many desirable student behaviors, attitudes, and outcomes that are associated with educational success, even when controlling for GPA—simply put, students at all achievement levels seem to benefit from POS. The next section describes data on students' graduation from high school, enrollment in college, and (for some) finding work.

B. Transitioning From High School to College and Work

If they were on schedule, all of our sample students ($N = 213$) should have graduated high school by the spring of 2010.[20] As shown in Table 10, over 90% of the original high school sample graduated from high school (the other 10% are unknown). This compares favorably to state graduation rates, which ranged from 67% to 88%.[21] Although we cannot determine with cross-sectional data whether the likelihood of graduating from high school is affected by POS participation, we do know from the surveys that students in POS report that being in a POS makes them less likely to drop out (refer back to Table 7).

Table 10
Sample Student High School Graduation Rate by Spring 2010 by Site

Site	POS Sample Graduation Rate – Number (Percent)	State Graduation Rate
Desert	118 (90%)	67%
River	43 (92%)	80%
Northern	31(89%)	88%

In the summer of 2012, college records were obtained for as many of our sample students as possible from the affiliated college at each site in order to report the most up-to-date information by the end of the longitudinal study. If the student did not have a college record, we obtained college and/or work status information either from their final survey or from online searches (e.g., Facebook) conducted in the spring of 2012. We were able to find current information on 138 students (65% of our original sample).[22]

[20] A student was considered as having graduated only if a graduation date was clearly noted on his or her high school transcript. Because we ceased collecting high school transcripts after Spring 2010, it is possible that more students eventually graduated than for whom we have records.
[21] Source: http://nces.ed.gov/programs/coe/pdf/coe_scr.pdf
[22] Fifty students completed a final follow-up survey, 51 students had existing records at the three affiliated colleges that were used to determine student outcomes, and the college/work statuses of 69 students were found using Facebook and online search engines such as People Finder. Some students had records in multiple places, but each student was only counted once, so the non-duplicated $N = 138$.

Figure 3 shows the July 2012 status of the 138 students for whom we were able to collect information via surveys, college records, or internet searches in the spring/summer of 2012.[23] Over two-thirds of those for whom we found information are still attending college (and may also be working), whereas the remaining one-third are working but are no longer in school.[24]

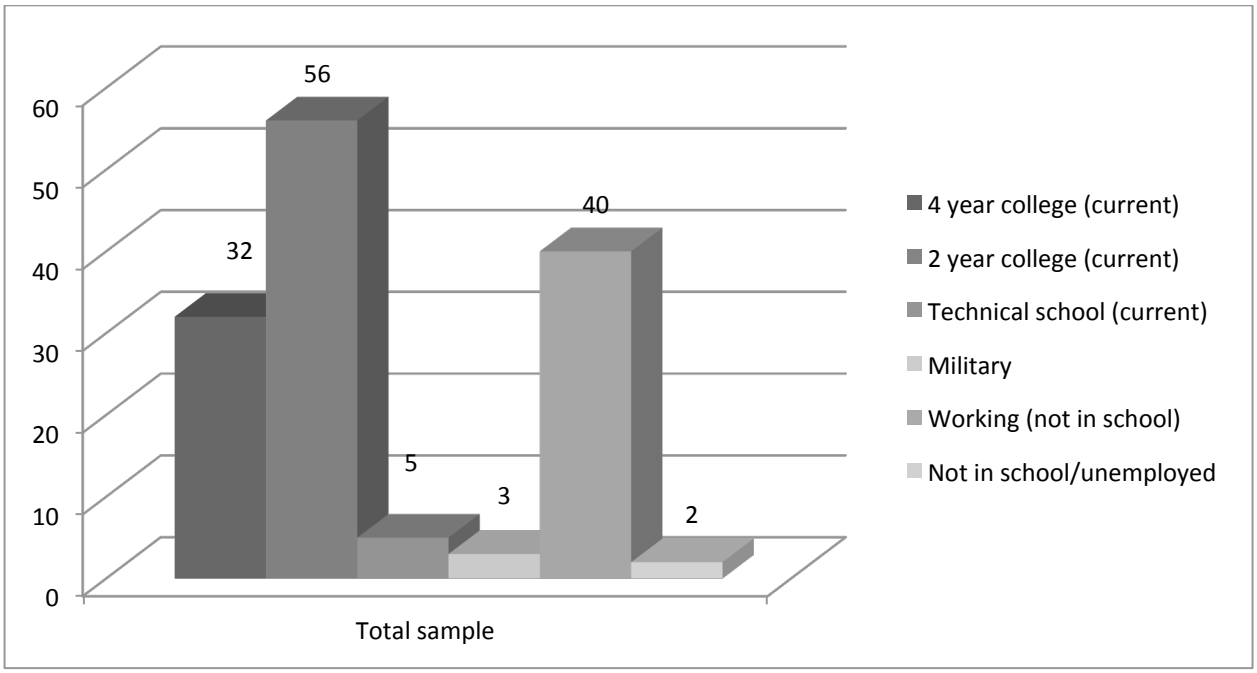


FIGURE 3. Primary status for students with 2012 data.

Notes. Only known statuses as of the spring/summer of 2012 are depicted here: $N = 138$. We do not include the 75 students for whom we do not have current information. Students were categorized according to their primary status; if a student was enrolled in any form of education, this was coded first.[25] Note that 53 students who are accounted for in one of the postsecondary categories were also working while in school. Data source: Final survey, college records, and online searches.

Using all available information, including information we had from earlier rounds of data collection, we were able to determine the proportions of students in the sample who continued in their high school POS, stayed within the same career cluster as the POS (a less conservative

[23] Online and college records could sometimes provide information on what a student did after high school, but current activities as of the summer of 2012 were not always apparent from these sources (e.g., a student may have attended the affiliated college after high school and have an existing record, but she or he may have been inactive for the last year).

[24] The numbers in Figure 3 are for a subset of students for whom we have 2012 information and therefore may not correspond with Figure 5, which shows the numbers out of the entire original sample, for whom we have data at some time points but not others.

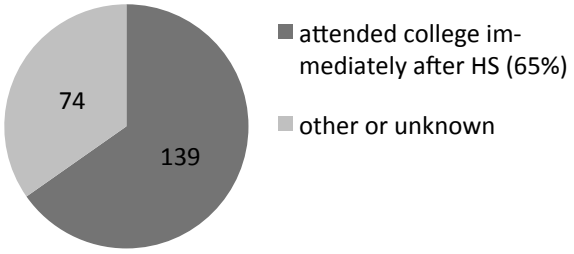
[25] In other words, students listed as enrolled in school could also have been working but those who are listed as working are currently *not* enrolled in school (although they may have attended a postsecondary institution after HS prior to the most recent data collection). Students in the "graduated two-year college" category are those for whom we have this information but do not know their current status; if we know that a student went to a four-year college, or started working after graduation, that student would be accounted for in one of these categories. For those in the "attended two-year college" category, although they attended the college at some point after high school, their current status (e.g., enrolled, graduated, transferred) is not known.

measure), or enrolled in a different cluster entirely.[26]

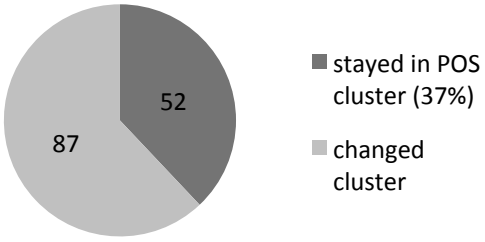
Figure 4A shows that almost two-thirds of our sample students (139 of the 213 students, or 65%) transitioned to a postsecondary institution immediately after high school.[27] Although 37 students continued in the same POS in college, 52 stayed in the same cluster. Thus, as Figure 4B shows, of the students in our sample who continued on to college, a little over one-third (37%) continued in the same cluster as their high school POS.

Examining both college *and* work status information (Figure 4C), 63 students continued in the same POS cluster as high school in either a postsecondary institution and/or a job.[28] It is possible that more students pursued their POS cluster after high school, but we do not have this information. Thus, a conservative estimate is that about 30% of the original sample of students continued in their POS in either college *or* work.

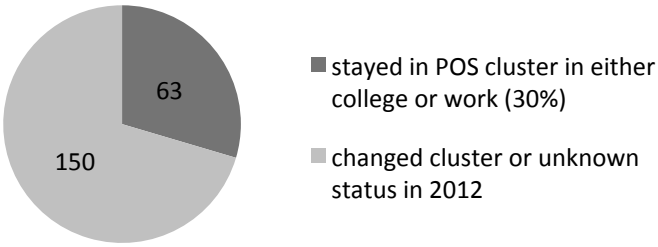
a. Of Entire Sample...



b. Of Students in College...



c. Of Entire Sample...

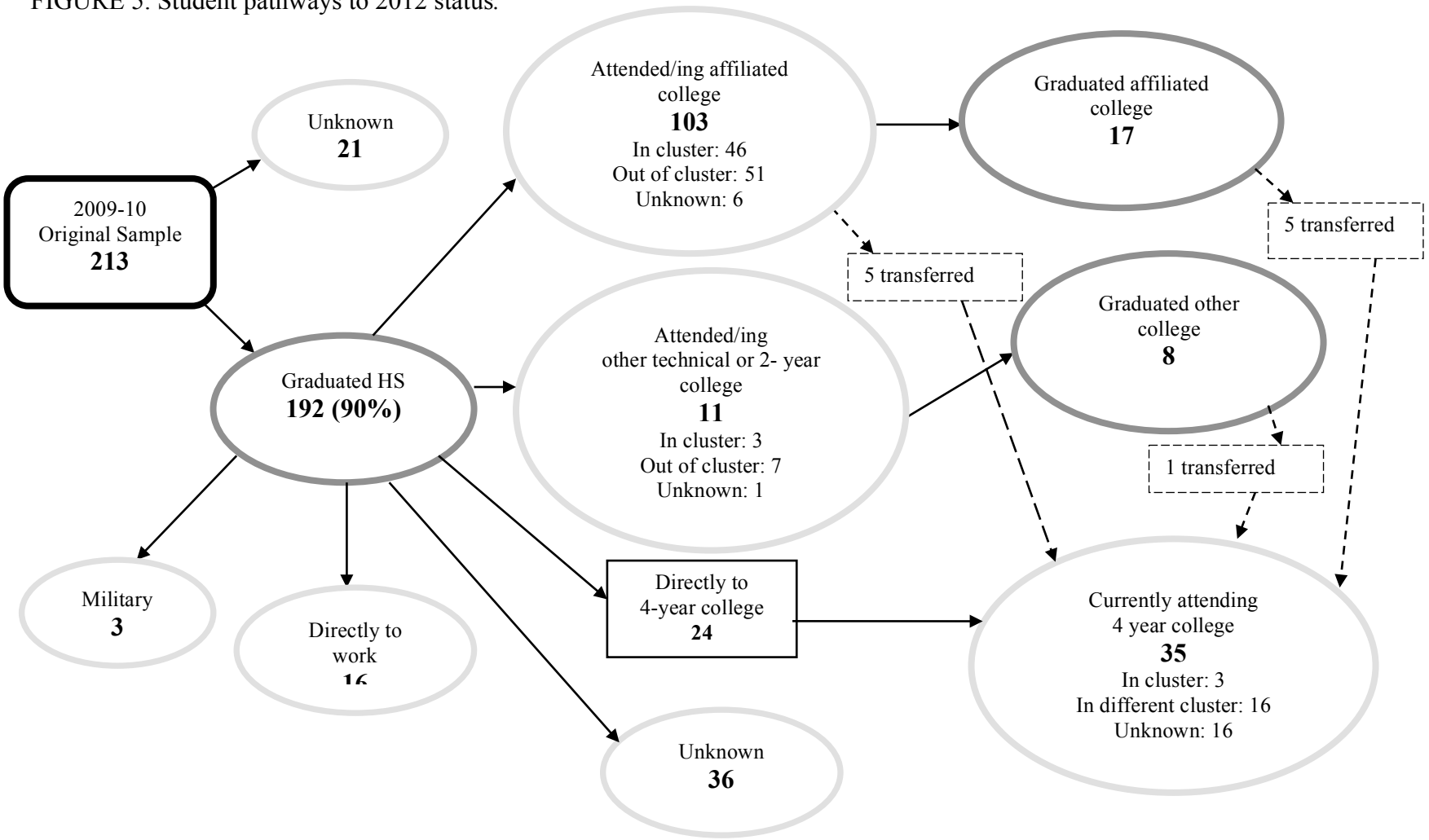


FIGURES 4A, 4B, and 4C. Proportions of students going to college and staying in their high school POS cluster.

Examining the data in a slightly different way, Figure 5 shows students' transitions from secondary to postsecondary pursuits for all 213 students in the original sample.

[26] The 16 career clusters are defined at http://www.careertech.org/career-clusters/clusters-occupations.html
[27] This includes students who were of unknown status as of 2012, but whom we know either (a) graduated from postsecondary prior to 2102, or (b) attended postsecondary after high school but left/were inactive.
[28] Work status was only available for some students—if they completed the final survey, or if they were identified on Facebook and work information was shared on their page. For those with available work status, jobs were coded for both POS and cluster correspondence similar to the coding of postsecondary programs.

FIGURE 5. Student pathways to 2012 status.[29]



[29] Numbers enrolled at the affiliated colleges are accurate; however, if a student did *not* attend one of these three colleges, it does not necessarily mean that they did not attend college after high school. High school graduation is conservative, as it does not include students who may have taken more than four years to graduate. Three students with majors in different clusters at the affiliated college had jobs within their POS clusters.
Data sources: High school and college records, final follow-up survey, and online records (i.e., Facebook, Zaba Search, People Finder).

As Figure 5 shows, most students (103 of the 139) who enrolled in college after high school went to one of the three colleges participating in our study. The breakdown was as follows: Desert: 61 students (47% of the Desert sample); River: 31 students (66% of the River sample); Northern: 11 students (31% of the Northern sample).[30] In addition, the largest percentage of students continuing within the same cluster as their high school POS is among the subgroup that enrolled at one of the affiliated colleges, which suggests a seamless connection between the high schools and colleges for the POS at these sites (and/or that this is the closest college or the only one with the desired program). As noted, because most of our students are still in college as of the time of the writing of this report, it is too early to tell what their ultimate educational and career outcomes will be.

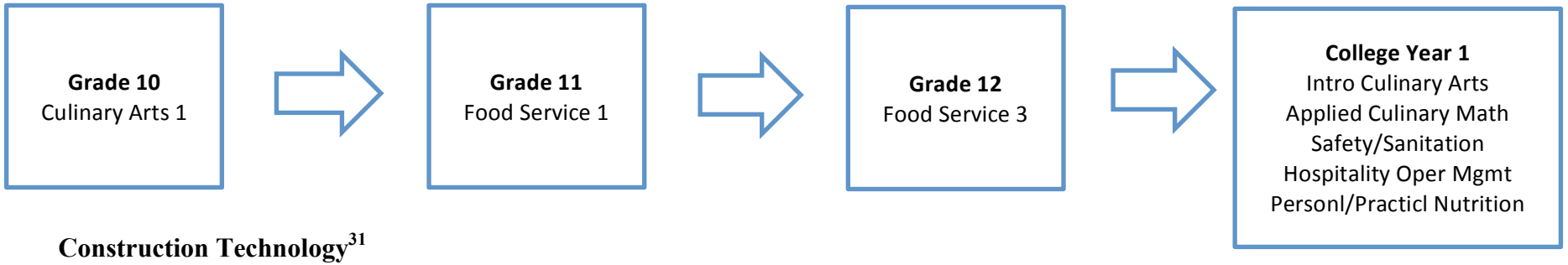
To illustrate possible POS pathways at the sites in this study, Figure 6 depicts the progression of students in our sample who transitioned from high school to the affiliated college (which provided transcripts) or straight to a career (as indicated on surveys) within their POS. More examples of courses offered within each POS are included in Appendix C.

The following visuals depict the progression of courses a student might take within a particular POS, as they transition from high school to college. All examples shown here are pathways of actual students in the sample, derived from their high school and college transcripts, and self-report (survey) if the student did not attend an affiliated college.

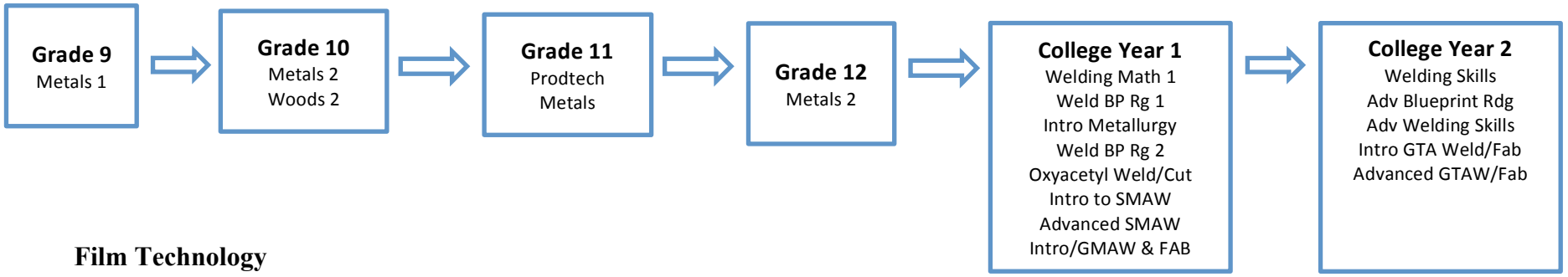
[30] It is possible that relatively more students from the River site than from the other sites enrolled in the affiliated college because River College was the only two-year college option in its region and reached out to all of its feeder high schools to offer dual credit through the "Odyssey College" option (please refer to our extended case studies, in Appendix H, for further information about the sites).

FIGURE 6. POS student pathways.

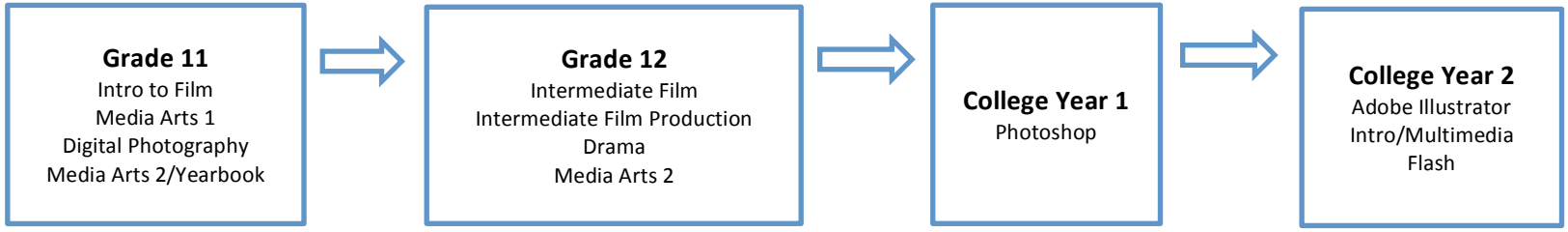
Culinary Arts



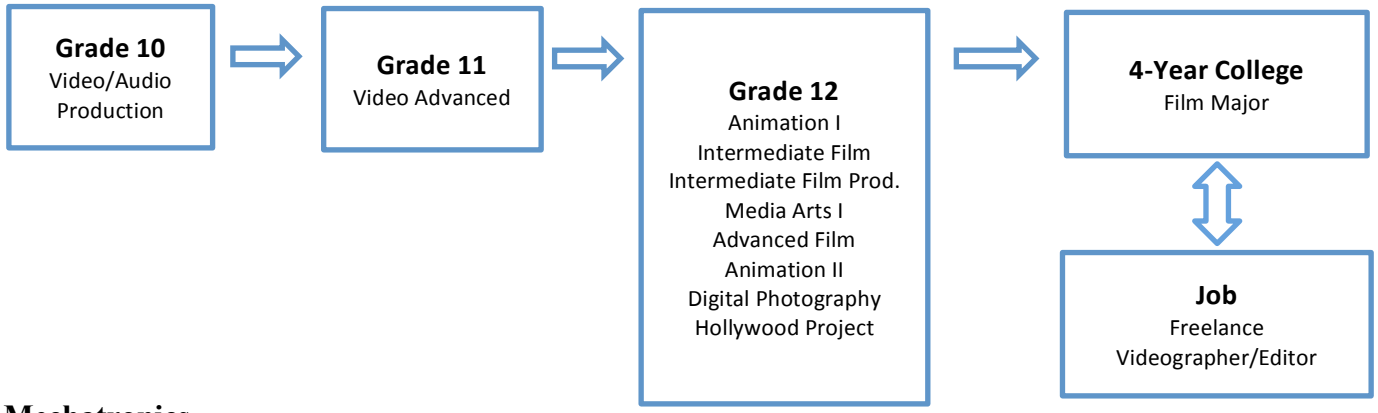
Construction Technology[31]



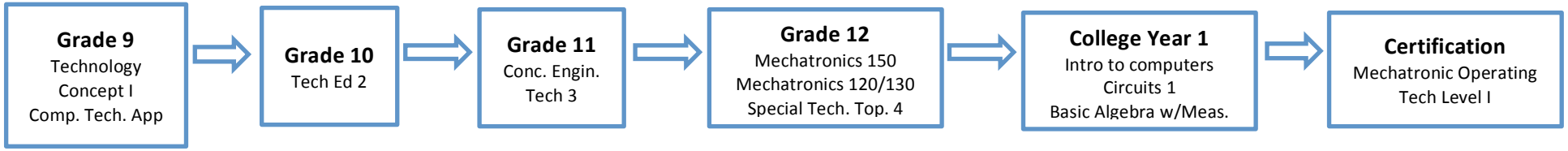
Film Technology

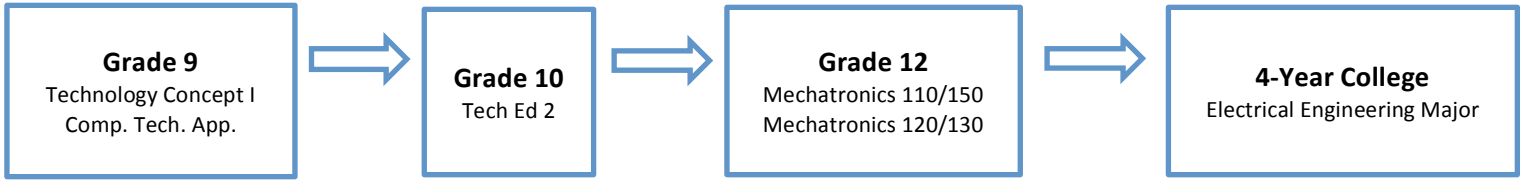


[31] Course abbreviations are specific to the occupational area (e.g., SMAW = shielded metal arc welding; GTAW = gas tungsten arc welding).

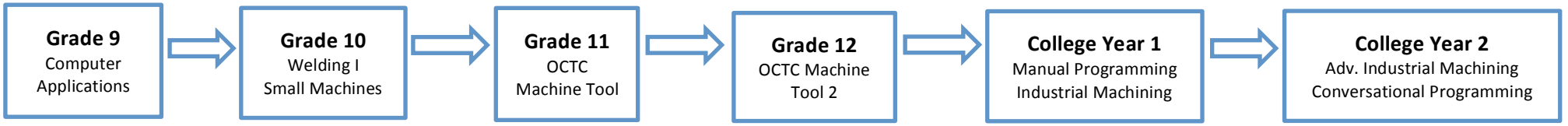


Mechatronics

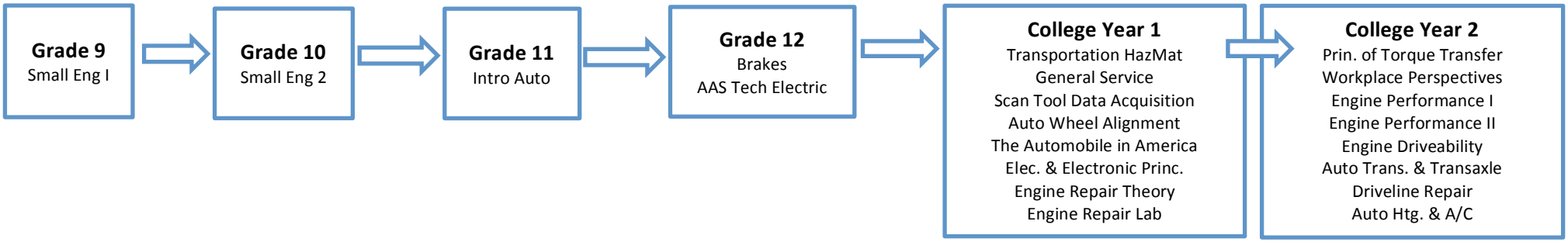


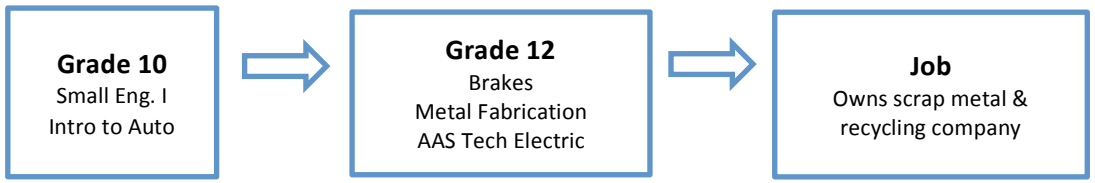


Industrial Maintenance

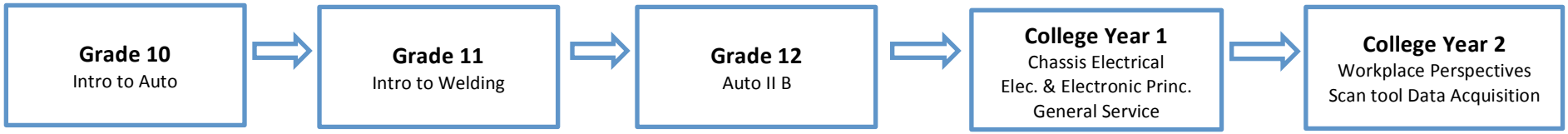


Automotive Technology





Welding



Final survey results. A short final survey was answered by students in 2012; this survey solicited information about their current status[32] and included retrospective questions about high school. Although 34 of 50 students agreed in a closed-ended survey question that their high school provided adequate preparation for college, 37 had suggestions for improvement in response to the open-ended question, "How could high school have better prepared you for college or work?" These suggestions fell into four larger categories, examples of which are shown in the text box below. As noted, the 50 students who answered the 2012 final survey may not be representative of all 213 of the students in the study. Their responses suggest some areas for POS improvement.

Selected Student Suggestions in Response to the 2012 Final Survey Question: "How Could High School Have Better Prepared You for College or Work?"

Provide more rigor/accountability:

- *Teachers could have been more demanding and pushed me more. College was somewhat of a shock as far as workload/time management.*
- *Held students more accountable for homework, more challenging coursework.*
- *High school is nothing like college, the homework is so much more intense. As much as I hated homework, it would have been easier to transition to a new lifestyle if high school had become similar senior year.*

Provide different or improved instruction method:

- *Structured courses more, taught in more sequence*
- *High school could have been more encouraging and engaging*
- *More one on one time*

Provide a clearer connection with college:

- *Four years of math, math that was relevant to a transition to college, sciences that were transitional [sic] to college.*
- *Have more college credit opportunities, we're far away from closest community college.*

Provide instruction that is better aligned with career preparation:

- *Teach more about everyday working and mathematics instead of lower-paced math and education—more practical skills*
- *Try to give more real-world experiences, would have learned more and been more prepared if they went over more real world situations*
- *More direct communication, practical skills, real-world examples*

Students post-high school plans, as reported on the initial high school survey administered in 2009, were compared to students' actual status both immediately post-high school and three

[32] Please note that of the 50 students (23% of the original sample) responding to the final survey, 76% are still enrolled in college. About 24% have earned either a certificate or an Associate's degree (their numbers are evenly split between the two). A missing data analysis revealed that those who took this final survey (three years after the first survey) reported a higher father's level of education, higher aspirations, and a higher high school GPA than non-respondents. Other demographic differences were not significant.

years later (see Table 11). Interestingly, the percentages for planning to attend and actually attending two- and four-year colleges "flipped": More students actually attended a two-year college than planned to, whereas fewer actually attended a four-year college than planned to (although most students are still in school as of this writing and some may still transfer to a four-year college). Possible explanations are that students may now be more realistic about credentials needed for the job market, or more realistic about their own abilities. The proportions of students in two-year colleges and working in 2010-2011 and 2012 reflect students' leaving college and moving into the workforce.

Table 11
Comparison of 2009 Student Aspirations and 2012 Actual Status

Student Aspiration/Actual Status	2009 Plans*	2010-2011 Post High School Activity	2012 Status
Technical/trade school	13%	4%	3%
Two-year college	32%	61%	35%
Four-year college	36%	21%	21%
Work	7%	10%	24%
Military	4%	2%	2%
Unemployed & not in school	N/A	1%	1%
Unknown	N/A	N/A	15%

Note. Data sources: High school 2009 survey (for 2009 plans), final follow-up survey, college records, and online records (for post-high school activity and 2012 status). $N = 156$. *An additional 7% were unsure of their plans after high school, and 1% planned to start a family.

Although the response rate to the final survey was low and the numbers are small, several other interesting findings emerged. Nearly half ($N = 17$) of those currently in college who responded to the final survey agreed that their college major choice was influenced by a CTE class taken in high school; 11 of these 17 students chose a college major in the same career cluster as their high school POS, suggesting that the POS was influential for these students in some way.

Of the 36 survey responders who were working at the time of the final survey (29 of whom were attending school at the same time), the majority had positive feelings about their job. Nearly three-quarters of these students (26) perceived their job as providing opportunities for advancement, and 29 reported that their job allowed use of existing skills and abilities. About two-thirds (24) agreed that their current job helped with access to more education or training; however, 10 students reported that their current job had actually hindered them from getting desired education or training. Half (18) said their current job is "not related at all" to the job they would like to have five years from now. Ideally, work and school experiences would be more connected in order to help young people prepare for future careers (Deil-Amen & Deluca, 2010).

C. Longitudinal Results: High School to College

The college-level results reported in this section are limited to the students in our sample for whom we have college records from the three participating colleges in our study. Before presenting the longitudinal prediction models using students' high school and college data, we first examine the milestones considered to be important for college student success, according to

the Community College Research Center (Bailey, 2011). Each indicator of student success is listed below, along with the results from our data:

- *Took and passed college-level courses (for students starting in remedial programs).* Of the students in our sample who took at least one remedial/developmental course, 74% were either still enrolled in college as of 2012 or had graduated or transferred, indicating persistence with postsecondary education.
- *Earned 12 college credits and still enrolled.* For the 87 students in our sample for whom we were able to collect college transcript data, 55% had earned at least 12 college credits by the end of their first year (this figure does not include dual credits earned prior to enrollment). Of the 12+ credit group, 77% persisted with postsecondary education as of 2012 (i.e., these students are currently enrolled or have graduated or transferred).
- *Persisted term to term and year to year.* We report whether students are still enrolled, graduated, withdrew, or transferred. Those in the first two categories persisted term to term.
- *Earned 30 credits and still enrolled.* Thus far, only four students have earned at least 30 credits, but almost half of the sample is still enrolled; thus it is too early to determine.
- *Earned occupational certificate.* 15% of our sample had done so.[33]
- *Earned associate degree.* 8% of our sample had done so.
- *Transferred to a baccalaureate program*. 10% of students in our sample who enrolled in a community college after high school had transferred to a four-year institution by 2012.

The students in our sample who went to college appear to have been successful thus far, according to the above criteria, but it is still too early to reach conclusions about their postsecondary outcomes because most of them are still enrolled as of the time of this writing. Because the ratio of credits attempted to credits earned has been found elsewhere in the literature as a predictor of college retention (Seidman, 2005), we also examined this in our sample and found that the ratio of college credits attempted to credits earned was significantly related to high school GPA (.40**), high school standardized math test scores (.34**), college entrance exam scores (.25*), and college GPA (.63**).[34] Although these results confirm that high-achieving students are successful in college, none of the high school POS variables were significantly related to the ratio of credits attempted versus credits earned.

Using multiple regression techniques on a combined longitudinal dataset of survey and transcript data from high school and college levels,[35] we examined the effect of high school-level variables

[33] Includes those who earned a certificate at the end of high school with dual credits.

[34] When creating the ratio variable, credits earned included all of the attempted courses that a student passed. Credits attempted included all courses that appeared on college transcripts after the student enrolled, including non-credit and withdrawals but excluding dual credits. There are conflicting reports in the literature as to whether or not to include in the "credits attempted" ratio the courses from which a student withdrew. Katherine Hughes of the Community College Research Center (CCRC) suggested (personal communication, August 14, 2012) that "W" courses should be included because if a student withdraws from a course during the initial drop/add grace period at the start of a semester, these courses would not appear on the transcript. Courses from which a student withdrew that appeared on the student's transcript are truly "credits attempted" and are therefore included in our count.

[35] Outcomes were determined from high school transcripts and/or college transcripts, depending on the data available for each student. Records could not be identified for several students for multiple reasons, including moving, schools not having permission to release records for particular students, or not being able to identify students by names provided on surveys.

that were hypothesized, based on our literature review, to predict a number of post-high school outcomes of interest. WBL and guidance counseling (see Figure 1) were included in preliminary analyses as potential predictors, but were not included in the final models because of the small numbers and the fact that these variables did not make significant additional contributions; further, too few students participated in CTSOs to consider adding this variable to the models.

Table 12 below shows the statistical models for each postsecondary outcome of interest using high school variables as predictors. Each column represents a separate regression model. Sample sizes differed across the models depending on the number of students for whom we were able to obtain outcome data (see the last row of the table). All of the models were significant overall ($p < .05$). High school GPA was entered into all of the models to control for student achievement when examining the effects of number of POS courses taken, attitudes toward POS (a scale created from the high school survey, $\alpha = .85$), and number of dual credit courses taken (these were virtually all in CTE courses in this sample, as explained earlier) on college outcomes. Effect sizes ranged from small to medium. Prior to finalizing these regression models, correlations between other available high school variables and college outcomes were also tested (refer to Tables 4A and 4B for variables available). See Appendix D for the full table of correlations of all of the variables included in the regression models. Our sample size was not large enough to test structural models or mediating variables.

Table 12
Effects of High School POS-Related Behaviors and Attitudes on Post-High School Outcomes

	Entrance exam score	Number of remedial courses	Number of credits earned by the end of Year 1	College GPA	Stayed in same cluster	Earned credential	Attended four-year
Variable	Coefficient (*SE*)	Coefficient (*SE*)	Coefficient (*SE*)	Coefficient (*SE*)	Coefficient (*SE*)	Coefficient (*SE*)	Coefficient (*SE*)
Intercept	0.26	0.98	-8.38	0.17	0.73	-0.02	-0.27
	(0.09)	(1.35)	(6.63)	(0.67)	(0.29)	(0.25)	(0.20)
HS GPA	0.09**	-0.17	5.22**	0.52**	-0.01	0.06	0.31**
	(0.03)	(0.37)	(1.84)	(0.18)	(0.07)	(0.06)	(0.05)
Number of POS courses	0.00	0.01	-0.07	0.03	0.57**	0.04*	-0.02
	(0.01)	(0.08)	(0.38)	(0.04)	(0.02)	(0.02)	(0.01)
POS Attitude	0.01	0.45	3.14 [t]	0.20	0.15 [t]	-0.02	-0.10 [t]
	(0.03)	(0.34)	(1.69)	(0.17)	(0.08)	(0.07)	(0.05)
Number of dual credits (HS)	-0.01	-0.22**	-0.04	0.09*	0.03*	0.02 [t]	0.01
	(0.01)	(0.07)	(0.31)	(0.03)	(0.01)	(0.01)	(0.01)
F	4.54*	3.16*	3.24*	4.84*	5.86*	2.88*	12.83*
R^2	0.21	0.14	0.14	0.17	0.15	0.08	0.27
Effect size	0.27	0.16	0.16	0.20	0.18	0.09	0.37
N	74	82	82	98	135	143	142
M	53%	1.4	14.5	2.47	N/A	N/A	N/A

Notes. Intercept = value when all predictors are zero. * = $p < .05$, ** $p < .01$, *** $p < .001$, [t] = $p < .10$ (trend). Variable explanations appear in Appendix C.

- As they reflect student achievement, college entrance exam scores were, not surprisingly, most strongly predicted by high school GPA; other high school variables were not significant predictors of college entrance exam scores.
- The number of remedial/developmental courses required in college was negatively predicted by the number of dual credits students earned in high school. Because high school GPA is also in the model, this result suggests that dual credits are helpful, regardless of achievement level, in helping students bypass remedial courses and move into credit-bearing courses in college.
- The number of credits students earned in college by the end of their first year was predicted by high school GPA; attitudes toward POS in high school also tended toward significance, suggesting that positive POS experiences have a beneficial effect on students in college above and beyond GPA, POS courses taken, and dual credits earned.
- College GPA was, not surprisingly, most strongly predicted by high school GPA. Number of dual credits earned was also a significant predictor of college GPA, again indicating an additional boost to students' college success offered by taking college-level courses while in high school.
- Staying in the same career cluster as one's high school POS was related to the number of POS courses taken in high school; clearly, these are the students most interested in the POS.[36] Indeed, positive attitude toward one's POS in high school also tended to predict staying in the same cluster in college. Finally, staying in the same cluster was also predicted by number of dual credits earned by students in high school, which were primarily in POS.[37]
- Earning a credential (certificate or degree) in college—at least by 2012—was predicted by the number of POS courses students took in high school, and also somewhat by the number of dual credits earned. Both POS courses and dual credits (which are correlated, because many of the dual credit courses were taken in the POS) may serve to get students into a program earlier, which has been shown elsewhere to increase the likelihood of completion (Jenkins & Cho, 2012).
- Finally, attending a four-year college was predicted by high school GPA—not surprisingly, as higher achieving students tend to apply to and be accepted by, baccalaureate-granting institutions—but slightly *negatively* predicted by attitude toward POS in high school. The latter finding may be explained by the fact that the POS were in CTE fields that are primarily pursued at two-year institutions.

Overall, although most of the college-level outcomes of interest were most strongly predicted by high school GPA, it is noteworthy that other high school variables, such as positive attitude toward POS and number of dual credits earned, had a significant effect on the college outcomes. This is particularly interesting given that the sample size for four of the seven models was less than 100; in larger samples, perhaps the relationships would be stronger. These analyses have shown a clear pattern that provides preliminary evidence in favor of POS participation.

[36] Students reporting in high school that their POS was not related to their career goals were less likely to stay in the same cluster after high school ($X^2 = 4.24$, $p < .05$).

[37] Interestingly, the number of remedial courses was negatively correlated with staying in the same cluster (-.28**) (see Appendix D). Although the causal order is unclear because these are both measured at the college level, this suggests that if students are required to take remedial courses, they are more likely to stray away from the POS.

D. Comparisons: College Systems Data

The longitudinal results reported in the previous section are the focus of the quantitative part of this study. However, to examine how students in our sample who enrolled at the affiliated colleges after high school compared to other students attending the college in the same programs, we undertook an additional set of analyses that involved obtaining systems data from each college for all students in the POS, whether or not they attended the high schools with mature POS. We then compared the students in our sample to similar students who entered the college programs from other high schools (which may or may not have also had POS).

Instructions and data templates were provided to each college when the systems data were requested in order to facilitate data cleaning and transfer. See Appendix E for a list of variables available from colleges on the sample and comparison groups. Across the three sites, each comparison group consisted of students who were enrolled in the college POS of interest[38] during the 2009-2010, 2010-2011, and/or 2011-2012 academic years (the same years as our sample). After this initial filter was applied, students who graduated from high school prior to 2009 were removed in order to limit the comparison group to students who were of similar age and high school experience as our sample.

Tables 13 shows that at Desert College, students in our sample had a significantly higher GPA and were taking significantly fewer remedial courses than those in the comparison group. (Further, although not statistically significant, the means reveal some differences that may nonetheless be practically significant: The students in our sample earned more dual credits, more college credits, and more certificates than students in the comparison group.)

Table 13
Differences on Key Indicators Between the Sample and Comparison Group: Desert

	Original Sample		Comparison Group				
Variable	*M*	*SD*	*M*	*SD*	*df*	*F*	*P*
Entrance exam score	0.55	0.15	0.53	0.16	323	0.76	0.39
Dual enrollment credits	1.13	2.48	0.52	2.26	616	3.23	0.73
Number remedial courses	2.12	2.17	8.28	6.20	389	47.78	0.00**
College GPA	2.22	1.42	1.67	1.31	614	7.27	0.01**
Number college credits	25.94	22.71	21.15	21.38	416	2.03	0.16
Number certificates	0.20	0.79	0.15	0.61	616	0.37	0.54

Note. N = 50-54 for the original sample; N = 186-308 for the comparison group.

The sample sizes for the comparison groups at Northern and River Colleges were too small for meaningful analysis, perhaps due to the fact that virtually all of the enrolled students attended one of the mature POS high schools. However, although not presented in a table, we did find that at Northern College, students in our sample had earned a significantly higher number of dual enrollment credits (10.67 vs. 0.48, $F = 137.67$, $p < .001$) and, although not statistically significant, a greater number of college credits overall (42 vs. 33).[39]

[38] Desert: Culinary Arts, Construction Tech, Film Tech; Northern: Auto, Welding.
[39] Please note that our sample sizes are small (100 of our sample students but less than 10 in the comparison group); these results should be interpreted with caution.

We undertook these systems data analyses comparing students in our sample to their peers at the same colleges because we did not have a comparison group in the study design. That is, whereas the results within our sample (presented in previous sections of this report) suggested positive effects on students of POS participation, the systems data analyses were an attempt to put the findings in some context (albeit limited by the data that were available to us from the colleges).

Considerations from Quantitative Results

Both the within-group and between-group quantitative analyses show that students benefit in several ways from POS participation, but the most consistent effect seems to be from the opportunity for dual enrollment. Our findings were similar to those of Allen and Dadgar (2012), who also found that dual enrollment increased students' credit attainment and college GPA, as well as Karp and her colleagues (2007), who found that students who take CTE-focused dual enrollment courses earn higher grades in college. Further, using regression discontinuity design and propensity score matching to examine the effects of dual enrollment for students participating in the Concurrent Courses Initiative (CCI) in California, Hughes et al. (2012) found that graduating dual enrollment students entered the CCI partner college at a higher rate than their district peers (43% vs. 29%). These researchers also found that in most sites, dual enrollment participants who enrolled in college during 2009–2010 made significant gains in college credit accumulation compared to other college freshmen (Hughes et al., 2012).

Some researchers have posited that the beneficial effects of dual enrollment arise from the fact that participating students learn habits related to college success, such as study stills, as well as how to "play the part" of a college student (Foster & Nakkula, 2005; Karp, 2012). "The dual enrollment experience may allow students to begin to view themselves as capable of engaging successfully in college-level work" (Edwards et al., 2011, p. 7). Further, it may be that "dual enrollment fosters more positive attitudes towards earning postsecondary degrees in students who did not previously hold these attitudes" (Swanson, 2008, p. 7). For the students in our sample who took dual credit courses on the college campus, this may be the case. It is also possible that students who took dual credit courses taught by a college instructor at their high school felt that they were treated like college students. One question raised by this study of mature POS sites is whether it is the POS per se that is helping students, or whether it is the connection of the high school to the college programs, particularly the opportunity for dual enrollment, that helps students succeed in college.

Although our findings support other findings in the literature regarding initial college success for students participating in CTE dual enrollment, to date, no study has followed dual enrollment students through college completion (Abdul-Alim, 2012). However, Jenkins and Cho (2012) analyzed data over a five-year period for over 20,000 college students in the National Student Clearinghouse (NSC) database and found that, among CTE concentrators, over one-third earned a certificate or associate degree in community college and 5% transferred to a four-year without a two-year credential (Jenkins & Cho, 2012). It is too early to tell what the ultimate college and career outcomes will be for our sample, as most of our students are still enrolled in college as of this writing. In addition, students in this age group are still exploring options and may yet change directions (Arnett, 2000; Bailey, Jenkins, & Leinbach, 2006).

As mentioned in the introduction to this report, dual enrollment has the most extant research support of the four Perkins IV POS components, but it should be emphasized that dual enrollment by definition encompasses the secondary-postsecondary connection component. The other two components in the POS legislation, curriculum alignment/integration and credential/degree focus, have not been studied to the same extent but certainly warrant further research as promising strategies for supporting students in their college and career preparation, particularly as part of POS. One study found that program coherence can lead to increased student achievement (Newmann, Smith, Allensworth, & Bryk, 2001); another found that the sooner students enter a program of study in college, the more likely they are to graduate (Jenkins & Cho, 2012).

Compared to other countries, American young people experience a less structured transition from school to work (Arnett, 2000; Hoffman, 2011; Symonds et al., 2011). This study provides preliminary evidence to suggest that students beginning their POS in high school and continuing in college have an advantage over those who do not. POS appear to help CTE students by providing a road map to college with the offering of a sequence of courses that leads to a postsecondary degree or credential; in particular, the opportunity to participate in dual enrollment provides critical momentum.

Limitations

Prior to discussing the overall findings and limitations of this study, some important limitations should be acknowledged. The most obvious limitation is that we examined mature POS-like programs that were developed prior to Perkins IV using a framework (OVAE's ten components of POS) that was developed well after Perkins IV was authorized. Despite this disconnect, however, it is encouraging that the sites in this study possessed some of the same key components of the legislation and the later framework. Educators and policymakers appear to be attuned to what seem to be the necessary ingredients for successful college and career transition programs.

Another limitation is that this study only focused on selected programs at three sites, thus our findings may not be generalizable to other programs or sites. Low response rates to follow-up student surveys minimize the extent to which we can draw conclusions about POS students' post-high school experiences, and the public information we were able to find online regarding students' 2012 status (for those who did not complete a survey or have a record at the affiliated college) may not be accurate. Appendix F presents a missing data analysis. However, it should be noted that this limitation is not unique to this study. Rampell (2012) noted that high school graduates who are not enrolled in college full time are a notoriously transient population that social scientists and other experts have trouble tracking, and Lipka (2011) chronicled the difficulties in getting college students to respond to surveys, suggesting that a 20% response rate is now considered adequate. However, the small number of sites and low response rate meant that our sample size was not large enough to test structural models or mediating variables to determine causal relationships between students' behaviors, attitudes, and outcomes.

Dual enrollment emerged as a strong predictor of postsecondary success in this study, as in

others, but this finding should be viewed with some caution. Because there has not been a random assignment study of dual enrollment, it is difficult to disentangle the effects of the dual enrollment experience from student characteristics (Allen, 2010). For example, students with higher ability and motivation may be more likely to enroll in college-level courses as high school students. At the sites in our study, however, many of the dual credit opportunities were built into the POS as part of the course sequence, and even expected of POS students, so external factors may not have played as large a role as in schools in which students have to seek out these kinds of opportunities themselves. Furthermore, we heeded Allen's (2010) caution about dual enrollment opportunities being available only for the most able students and controlled for prior achievement (high school GPA) when examining the college outcomes of the POS students in our study.

We also did not examine *where* students were taking their dual enrollment courses, and there was a mix within and across the sites. Speroni (2010) found that dual enrollment predicts college enrollment but only if the dual enrollment course was taken at the community college rather than at the high school. In addition, we did not examine outcomes for students in programs of different levels of rigor or quality (Karp, 2012) because we only had seven POS and no two were in the same CTE area (which would have provided a comparison).

Finally, this study coincided with the economic recession beginning in 2008, and it is unclear whether or how this affects the results. In the interviews, college administrators told us that their enrollments were larger than ever in 2009 and 2010, and high school representatives mentioned reduced budgets for teachers and equipment and fewer opportunities for student internships in local companies. However, we also heard from multiple sources that regional employers were still eager to hire the POS graduates, particularly from the programs related to manufacturing.

Additional limitations regarding data collection, coding, and analysis are noted in Appendix G.

Discussion

The purpose of this mixed methods study was to learn about the key components of POS that support students' transition to college and careers, including whether and how participation affects students. Specifically, in order to explore the implementation of CTE POS, a new requirement in the 2006 Perkins IV legislation, this study sought to backward map the process of POS development and operation at three mature, POS-like sites. We started from the desired end point of POS—colleges awarding industry-recognized credentials or degrees to students who began the POS while in high school—and identified (a) the key components of the programs and (b) the progression of students through the programs to get to this desired end point. We found that POS development is a complex and lengthy process, and that the key components in practice do not neatly align with the key components contained in the Perkins policy guidance. We also found that, although the majority of students do not continue with the same high school POS in college or work, POS participation does have a positive effect on a variety of high school and college outcomes.

The backwards mapping model that guided our study was an effective way to unpack the mechanisms of mature POS. Selecting sites with evidence of intended policy outcomes, studying

them, and comparing their inputs with Perkins IV policy guidance from OVAE allowed us to better understand the necessary components of POS, even though OVAE's guidance was released a year after this study began. The most striking commonality across the mature sites was a shared vision by multiple stakeholders of a seamless transition from high school to college, which guided subsequent practices. At the mature POS sites in this study, each of the ten components of OVAE's framework were evident, but some emerged as more critical than others. Partnerships were clearly the key component—that is, multiple stakeholders with good relationships working together to achieve a shared vision of helping students better prepare for college and careers. Also important were secondary-postsecondary course sequencing (with input from advisory committees) and credit transfer agreements allowing students to earn dual credit, which may require some flexibility from both secondary and postsecondary partners. Finally, legislation and policies need to allow for dedicated staffing and the use of external funds to support high-quality POS development and implementation (assuming no additional Perkins funding). Seen in terms of their correspondence with the qualitative findings from this study, these four components of OVAE's POS Framework seemed to be the common denominators in the three mature, POS-like sites that began prior to Perkins IV.

Our findings regarding the need for dedicated staffing to create secondary-postsecondary links and external funding sought by the colleges to support POS development were unexpected, as they were neither part of Perkins IV or the subsequent OVAE Framework, nor were they included in the hypotheses we developed for this study based on prior literature. Most striking was the importance of the dedicated "high school relations" staff at each of the colleges, who served multiple functions, including coordinating multi-stakeholder meetings about curriculum alignment to advising high school and college students on course selection. The importance of the individuals in this role to the success of the POS cannot be underestimated. In addition to considering what supports state and local educators need to continue to improve all of the components in the OVAE Framework, future policy and guidance around POS should help Perkins recipients fund POS coordinators and find ways to creatively blend funding streams to support POS in other ways.

The quantitative findings regarding students' progression through the POS add another dimension to the research findings. In early reports from this study (e.g., Alfeld & Bhattacharya, 2011), when we had indications that fewer than half of the students were continuing in their POS at the college level, we noted that even when a POS is well-established and mature, it does not guarantee that students will continue to progress through that POS. Career interests and college and work decisions are still in flux at this point in students' lives, therefore the high school to college transition is not linear, particularly when the number of options for possible career fields increases greatly when students get to college. However, as we have now found in our final analyses, this does not indicate that the POS we studied are not successful in preparing students for postsecondary education or facilitating decision-making regarding career paths.

Notably, most of the POS students in our sample continued on to postsecondary education and were still enrolled in 2012. About one-third of our students were pursuing the same field as their high school POS. Considering the myriad paths these students could have taken, this percentage suggests that POS steered them in a particular direction. Combining students' survey data and school transcripts demonstrated that students' experience in POS is positive, and that many

aspects of POS—particularly the opportunity to earn college credit while in high school—actually boost students' chances of college success, in terms of fewer remedial courses and higher college GPA (regardless of high school GPA). Students taking more POS courses were also more likely to have earned a credential within the timeframe of this study.

Future Perkins legislation and policy guidance should acknowledge that continuing in the same POS (or career cluster) after high school, although certainly one desirable outcome, is not an adequate measure of POS success. A more realistic outcome is the capacity that POS have for providing students with the ability to make future educational and career decisions, using the skills they gained through participation in POS; this is especially crucial given the flux both in the economy and in this developmental stage of life. The students in mature POS sites that began prior to Perkins IV, although not necessarily representative, appeared to benefit from the POS experience, suggesting that POS developed after 2006 with additional policy guidance may have even better outcomes.

This study used a backward mapping approach to examine how POS-like sites in practice align with POS policy components. We found evidence that students benefit from POS but that additional components may need to be added to the OVAE Framework. We recommend that continuity of students in the same POS from high school to college and career should not be the only measurement of success of the policy, and we also urge patience, as even mature POS sites continue to evolve and improve over time. The qualitative findings from this study suggest that the development of POS is easier said (or legislated) than done (or implemented), but our quantitative results suggest that the effort will be worthwhile in terms of students' postsecondary success. Future research should track a larger sample of students for a longer period of time—through postsecondary education and into the workforce—to examine long-term outcomes of POS participation.

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Appendix A: Final Follow-up Survey
(administered online or via telephone)

Welcome to the Programs of Study follow-up survey! You are eligible for this survey because you took a similar survey at your high school in Spring of 2009 or 2010. We are interested in learning about how your education experiences and opinions have changed over time. You may have taken additional surveys for this study at your college in the last year or two. Now, we would like to do a final follow-up to see how you are doing before the study ends. This is your last chance to let us know how you feel! This survey should only take about 5 minutes. If you complete this last follow-up survey, you will receive a $25 gift card to Amazon.com (where you can buy CDs, DVDs, and books)!

1. **Please select any credentials or degrees you have already completed below. Check as many as apply.**

   - ○ GED
   - ○ Training or skill certificate from trade or technical school
   - ○ Associate's degree from community college
   - ○ None of the above
   - ○ Other (please specify) _____

2. **If you have completed a postsecondary degree or credential, what subject or career cluster is your credential in?**

- ○ Agriculture, Food, & Natural Resources
- ○ Architecture & Construction
- ○ Arts, Audio-video technology, & Communications
- ○ Business Management & Administration
- ○ Education & Training
- ○ Finance
- ○ Government & Public Administration
- ○ Health Science
- ○ Hospitality & Tourism
- ○ Human Services
- ○ Information Technology
- ○ Law, Public safety, Corrections, & Security
- ○ Hospitality & Tourism
- ○ Manufacturing
- ○ Marketing, Sales, & Service
- ○ Science, Technology, Engineering, & Mathematics
- ○ Transportation, Distribution, & Logistics
- ○ Other (please specify) _____

3. **What is the highest level of education you ever hope to complete?**

- ○ High school diploma or GED
- ○ 1 year degree or certificate from community or technical college
- ○ 2 year degree or certificate from community college
- ○ Bachelor's degree (4 year college)
- ○ Master's degree (M.S., M.A., MBA)
- ○ Medical (M.D.), Law (J.D.), Doctorate (Ph.D.), or other advanced degree

4. **Please select the career field that most closely matches the one you see yourself working in <u>10 years from now</u>.**

- ○ Agriculture, Food, & Natural Resources
- ○ Architecture & Construction
- ○ Arts, Audio-video technology, & Communications
- ○ Business Management & Administration
- ○ Education & Training
- ○ Finance
- ○ Government & Public Administration
- ○ Health Science
- ○ Hospitality & Tourism
- ○ Human Services
- ○ Information Technology
- ○ Law, Public safety, Corrections, & Security
- ○ Hospitality & Tourism
- ○ Manufacturing
- ○ Marketing, Sales, & Service
- ○ Science, Technology, Engineering, & Mathematics
- ○ Transportation, Distribution, & Logistics
- ○ Other (please specify) _____

5. **Are you currently in some form of postsecondary education (e.g., trade/technical school, 2 year college, 4 year college or university), either full-time or part-time?**

   - ○ Yes (go to next page)
   - ○ No (skip to page after next)
   - ○ Other (please specify) _____

6. **What is the name of the postsecondary institution you are enrolled in?**
   _____

7. **What kind of certificate, license, diploma, or degree do you expect to earn in your current program? SELECT ALL THAT APPLY.**

   - ○ High school diploma
   - ○ Adult Basic Education Certificate
   - ○ GED certificate
   - ○ Training or Skill certificate
   - ○ AA or Associate's diploma or degree (2 year)
   - ○ BA or BS college degree (4 year)
   - ○ Other (please specify) _____

8. **If you are currently enrolled in a 2 or 4 year college, what is your program or major? Choose the option that is the closest match.**

- ○ Agriculture, Food, & Natural Resources
- ○ Architecture & Construction
- ○ Arts, Audio-video technology, & Communications
- ○ Business Management & Administration
- ○ Education & Training
- ○ Finance
- ○ Government & Public Administration
- ○ Health Science
- ○ Hospitality & Tourism
- ○ Human Services
- ○ Information Technology
- ○ Law, Public safety, Corrections, & Security
- ○ Hospitality & Tourism
- ○ Manufacturing
- ○ Marketing, Sales, & Service
- ○ Science, Technology, Engineering, & Mathematics
- ○ Transportation, Distribution, & Logistics

9. If you are currently enrolled in a 2-year or 4-year college, did you take any career technical education (CTE) classes during high school that helped you decide on your college major?

○ Yes
○ No

Write in the name of this class or classes

_____

Answer questions on this page if not currently in school

10. Do you plan to enroll in postsecondary education (e.g., trade/technical school, 2-year or 4-year college) in the future?

○ Yes
○ No

11. If yes, what type of school do you plan to enroll in?

○ Adult Basic Education or GED courses
○ 1 year degree or certificate program at a community or technical college
○ 2 year degree or certificate program at a community college
○ 4 year college or university
○ I do not plan to return to school

12. If yes, what do you plan to major in?

_____

13. Are you currently working for pay, either full-time or part-time?

○ Yes (continue to next question)
○ No (skip to next page)

14. Currently, in what area is your MAIN occupation or job? Select the area that is the closest match.

- ○ Agriculture, Food, & Natural Resources
- ○ Architecture & Construction
- ○ Arts, Audio-video technology, & Communications
- ○ Business Management & Administration
- ○ Education & Training
- ○ Finance
- ○ Government & Public Administration
- ○ Health Science
- ○ Hospitality & Tourism
- ○ Human Services
- ○ Information Technology
- ○ Law, Public safety, Corrections, & Security
- ○ Hospitality & Tourism
- ○ Manufacturing
- ○ Marketing, Sales, & Service
- ○ Science, Technology, Engineering, & Mathematics
- ○ Transportation, Distribution, & Logistics
- ○ Other (please specify)

_____

15. Thinking about your current job, how much do you agree or disagree with the following statements? (Mark ONE answer per statement).

	Strongly Agree	Agree	Disagree	Strongly disagree
My job allows me to use my skills and abilities	○	○	○	○
I am overqualified for the work that I do in this job	○	○	○	○
My job has influenced my career choice	○	○	○	○
This job gives me opportunities for advancement	○	○	○	○
My job has helped me to get more education/training	○	○	○	○
My job has gotten in the way of the education/training that I would like to get	○	○	○	○

16. Is your current job related to the job you want to have 5 years from now?

- ○ Closely related
- ○ Somewhat related
- ○ Not related at all

17. If you are not employed AND not in school, please tell us why. SELECT ALL THAT APPLY.

- ○ Does not apply: I'm either in school, working, or both
- ○ Family obligations
- ○ Personal or family member health or disability issues
- ○ Did not like job or school
- ○ Got fired or laid off
- ○ Failed out of school or expelled from school
- ○ Lack the necessary schooling, training, or skills for the kind of job I want
- ○ No job openings for the skills I have
- ○ Commute distance/cost or lack of transportation to work
- ○ Can't decide what I want to do
- ○ Completed post-high school education program and looking for a job
- ○ In transition between school and/or jobs
- ○ Other (please list)

_____

18. Thinking about your high school education, choose whether you strongly disagree, disagree, agree, or strongly agree with the following statements.

	Strongly disagree	Disagree	Agree	Strongly agree
My high school adequately prepared me for work	○	○	○	○
My high school adequately prepared me for college	○	○	○	○

How could your high school education have better prepared you for college and work?

_____

_____

_____

Appendix B: Survey Administration

After selecting the three sites for study participation, we sent high school principals at the colleges' feeder high schools letters describing the study and requesting student participation. The number of high schools or districts feeding into each college was described in Table 1 of this report. See Table B-1 for the high schools per site that agreed to participate in this longitudinal study.

Table B-1
High Schools Participating in the Study by Site

Site	Number of participating high schools	Number of POS
Desert	6	3
Northern	3	2
River	7	2

Tables B-2 and B-3 below show the demographics of the sample at each of the sites. The students at Northern and River sites were mostly White and male, whereas the majority of students from Desert were Hispanic, and the proportion of males to females was more evenly distributed.

Table B-2
Percent of Sample Students of each Gender by Site

Site	Male (%)	Female (%)
Desert	57	43
Northern	97	3
River	94	6
Total %	72	28

Table B-3
Percent of Sample Students of Each Race/Ethnicity by Site

Site	Native American/ Alaskan	Asian	Black	Hispanic	More than one race	Native Hawaiian	White
Desert	5	2	0	66	8	1	19
Northern	3	3	3	3	3	0	85
River	4	2	0	0	0	0	94
Total %	5	2	1	41	5	1	46

Note: N = 129 (98.5%) for Desert; Total N = 211 (99.1%)

The participating high schools granted the researchers access to students (whose parents did not opt out and who themselves assented) for survey purposes, and they provided one to two years of high school record data, depending on the student's grade (junior or senior) at the time of participation, for each participating student.

The first high school survey was administered in the spring of 2009 to students enrolled in classes that were required for the POS of interest at each site. Specifically, students in high school classes that were pre-requisites for Culinary Arts, Construction Tech, and Film Tech were surveyed at Desert; students in Mechatronics and Industrial Maintenance classes were surveyed at River; and students in Welding and Auto Tech courses were surveyed at Northern. Students' POS were determined by which course a student was in when the survey was taken. After the initial survey administration, attempts were made to survey as many students from the original sample as possible as they transitioned out of high school. Survey time points are depicted in Table B-4 below.

Table B-4
Timeline of Survey Administration and Methods Used

Year	Survey	Recruitment	Administration	Incentive
Spring 2009	HS Survey 1 Juniors & seniors	In-person	In-person	N/A
Fall 2009	College Survey 1 Graduated seniors enrolled in POS at college	Email Instructor announcements in class	Online	Lottery for several $50 or $100 gift cards
Winter 2009-2010	Alternate Survey 1 Seniors who had graduated but not enrolled in POS at college	Email Mail	Online	$35 gift cards to all participants
Spring 2010	HS Survey 2 HS seniors (juniors during HS Survey 1)	Email Mail Distribution of survey link by letters in class	Online	$25 gift cards to all participants
Fall/Winter 2010-2011	College Survey 2 Original sample students enrolled in POS at college	In-person Email	Online and in-person	$25 gift cards to all participants
Summer 2011	Alternate Survey 2 All original sample students who were not recruited at college (not enrolled in POS at college)	Email Mail	Online	$25 gift cards to all participants
Spring/ Summer 2012	Final Follow-up All original sample students	Email Mail Phone calls	Online and over the phone	$25 gift cards to all participants

Notes. Gift cards given as incentives were for Amazon.com. For all online administrations of the survey, except for College Survey 1, students were given the option in recruitment communications of receiving the survey by mail.

Recruitment. As this longitudinal study progressed, it became apparent that multiple recruitment methods needed to be employed because students were not necessarily progressing in their POS in a linear fashion. For example, to obtain the first college survey sample, enrollment lists for the programs of interest were obtained from the colleges, with the expectation that many of the high school seniors graduating the previous spring would be transitioning to the postsecondary portion

of their POS. In fact, only 16 of the 94 graduating seniors in the spring of 2009 were enrolled in the POS of interest in the affiliated college the following fall (see Table B-5).[40] Because college enrollment lists for the POS of interest were not yielding a large number of students from the original sample, the alternate surveys were introduced as a way to track education and career-related activities of students who were not accounted for in the affiliated college POS.

Recruitment efforts relied on contact information self-reported by the student during the first survey, unless a student participated in one of the follow-up surveys and provided updated information, or was enrolled at one of the affiliated colleges. At the time of the second college survey, sample students were recruited from the POS of interest, but colleges were also asked to provide updated contact information on sample students who may be attending the college in a different program. For the final follow-up survey, records used for sample recruitment were a combination of original contact information reported, updates from the affiliated colleges, and information that was publicly available through online search engines and social media.

Recruitment strategies and communications took into consideration accepted guidelines for better response rates. Specifically, emailed and mailed messages were personalized, addressing students by name; multiple communications were sent to non-responders with varied approaches (i.e., a more detailed initial invitation, followed by brief reminders referring to the original communication with a deadline for responding); and the value of receiving participants' perspectives through surveys was conveyed (Dillman, Smyth, & Christian, 2008). Recruitment messages were also timed strategically, taking into consideration the type of contact information available and the timeframe of recruitment (e.g., students may not be frequently checking a college email address during summer or semester breaks).

When more than one form of contact information was on record for a student, email was typically the first strategy used. Given the age range of our sample (i.e., late teens to early twenties), it seemed that email would be the preferred method of communication, if this type of contact information had been provided to the researchers. Mailing addresses were used as a second strategy if a participant did not respond to email, or if an email address was not on record.

For the final follow-up in 2012, two new strategies were implemented: social media (i.e., Facebook) and phone calls. These strategies had not been used during previous survey administrations due to the challenges involved outweighing their potential return. However, it was decided that all strategies possible would be attempted for the final follow-up to determine the status of as many students as could be found. Ultimately, Facebook did not garner additional survey responses but proved to be a useful tool for tracking education and career activities for sample students who did not respond to the final survey. Phone calls were more successful—some students who had not responded to any surveys since the initial high school survey were recruited via phone calls to take the final survey online, and it was administered over the phone to others.[41]

Survey administration. In addition to various recruitment methods, multiple methods of survey

[40] To make it onto a program enrollment list, the student would need to declare a major. Students could be taking classes relevant for their POS at the college without taking this step.
[41] Some students recruited by phone requested that a link to the online survey be sent to them through email.

administration were employed. Nearly 100% of students in the POS of interest participated during the first high school survey administered in their classrooms. Although in-person surveying was not always feasible for future survey administrations (e.g., there was no common physical location or time where targeted students were located for alternate surveys and the final follow-up), attempts were made to make recruitment more personal and important by enlisting the help of teachers for the second high school survey and faculty at the colleges for college-level surveys. Specifically, teachers and faculty provided verbal reminders and made brief announcements in class about the survey. Response rates are provided in Table B-5 below.

Table B-5
Survey Responses by Site

Survey	Desert	River	Northern	Total
HS 1	131	47	35	213
HS 2	24/82	7/17	3/16	34/115 (30%)
College 1	N/A	2/13	0/3	3/16 (19%)
College 2	2/9	2/3	3/5	7/17 (41%)
Alternate 1	8/49	2/17	3/15	13/81 (16%)
Alternate 2	10/125	4/43	0/30	14/198 (7%)
Final Follow-up	38/131	5/47	7/35	50/213 (23%)

Note. No graduating seniors at Desert who participated in the original high school survey were enrolled in the POS of interest at the college the following Fall.

Survey limitations. At the time of the initial survey, students were asked to write their names and contact information on a detachable cover sheet at the beginning of the survey document. The research team did not have access to class lists, which made student self-reported contact information our only source of information for follow-up activities. Illegible handwriting and inaccurate contact information posed a challenge during the first few rounds of follow-up.

The college survey samples were smaller than expected because recruitment was limited to students who were enrolled in the POS of interest. Original sample students could be attending the affiliated college (and a number of them were) in a different program or without declaring a major, unbeknownst to the research team. In later phases of this project when college records were obtained, this became clear. Updated contact information was obtained for all original sample participants who had attended one of the affiliated colleges, and they were recruited for the final follow-up survey.

Many of the follow-up activities relied on students having internet access. Those students who have regular access to a computer and a frequently checked e-mail address may be those who are less mobile and more likely to be in school or have a professional job. Students who are willing to report on their education and career activities, or to post these activities in a public space like Facebook, may have more positive experiences to report.

Appendix C: Using the CSSC for Transcript Coding and Details on Variable Construction from Transcripts and Surveys

Transcript coding & variable construction. The Classification of Secondary School Courses (CSSC), developed from the High School Transcript Studies (HST) in 2000 was used as a basis for coding high school transcripts. The CSSC is structured as follows: Courses within a program area are uniquely identified by a 6-digit code. The first 2 digits represent the main program area (e.g., Physical Sciences). The next 2 digits represent a subcategory within the program area (e.g., courses that fall under Pure Chemistry), and the last 2 digits define the specific course within the program area and subcategory (e.g., Organic Chemistry). The CTE portion of the CSSC was revised in 2007, thus the updated version was used for our coding of courses in this area. At the high school level, each course that a student took for credit was coded. Courses on student transcripts were matched with CSSC codes using the criteria described in Table C-1.

Table C-1
Process for Determining Transcript Course Codes

Decision Level	Criteria	Outcome
1	Course name on transcript matches CSSC course name	Transcript course coded with CSSC code
2	(If #1 not met) Course name on transcript fits course description in CSSC	Transcript course coded with CSSC code
3	(If #1 and #2 not met) Other related content areas of CSSC checked for potential match	(If match found) Transcript course coded with found CSSC code
4	(If #1—#3 not met) Course does not match existing courses in CSSC	New code assigned, following pattern of CSSC coding

Efforts were made to match as many courses as possible to existing CSSC codes. New course codes were added only if a course seemed dissimilar enough from courses categorized under an existing code. Because the CSSC was about 10 years old at the time transcript coding for this study commenced, some specific CTE areas (e.g., digital media) were under-developed in terms of variety of courses and codes available. The most recent version of the CSSC addresses some of these shortcomings; however, it was not available at the time of our coding. Therefore, the final transcript coding scheme used is loosely based on the CSSC categorization, but new classifications and categories were added to accommodate courses that did not fit in the existing template. A number of additions had to be made for computer technology-related and digital media-related courses.

Because course names on transcripts were not identical across sites or even across schools within sites, multiple courses were sometimes identified as one course code (e.g., General Communication Skills, Essentials of Communication, and Communications all were categorized under one course code).

If the general content of a course could not be determined by the course name and a matching CSSC code could not be readily identified, course descriptions were searched on school

websites. Brief course descriptions were sought from guidance counselors or other administrators at relevant high schools for any courses that remained unidentifiable after checking school websites online.

In addition to course titles, course grades and credits earned per course were directly coded from transcripts. Not all high schools reported grades identically—some provided letter grades, others provided percentages, and some provided both. Grades were standardized and coded as described below.

Table C-2
Standardizing Grades

Letter grade (if provided)	Percent (if provided)	Code assigned
A	90 - 100	4
B	80 - 89	3
C	70 - 79	2
D	60 - 69	1
F/Incomplete	0 - 59	0

In addition to individual courses and grades, available standardized test scores and cumulative high school GPA were entered directly from high school transcripts. From this information, several additional variables were created for each student (refer to Table 4A in this report). These new variables are explained below.

- *Dual credits earned:* Dual credits were recorded on both high school and college transcripts, however, the credit counting process was not identical across levels (e.g., a dual credit course might count for two credits in high school and six in college). All dual credit courses taken by high school students were determined (or confirmed) by matching high school transcripts with transcripts obtained from affiliated colleges. A sum of the total number of credits earned at the college level was created.
- *Number of courses within the POS cluster:* The POS cluster was based on the student's POS in high school. High school courses that were considered relevant to each POS of interest were included in this count. See Table C-3 below for examples.
- *Number of courses in a different cluster:* Any CTE courses a student took that were outside of his or her POS cluster were included in this count.
- *Number of Honors courses:* Any academic or CTE courses identified as Honors, Accelerated, Advanced, or Advanced Placement (AP) were included in this count. Electives courses (e.g., Advanced Art) were not included.
- *Number of Math/Science/Social Studies/English credits:* The total number of credits taken in each academic subject area during high school was created as four different variables.
- *Math/Science/Social Studies/English/CTE/Electives GPA:* Calculated from grades earned in each subject area, yielding six different GPAs for each subject area/course category.
- *Number of upper-level Math courses*: Included Honors Algebra I and II, Pre-AP or Pre-International Baccalaureate (IB) Algebra II, Algebra III and Accelerated Algebra III, Honors Geometry and Pre-AP or Pre-IB Geometry, Pre-calculus, Honors Pre-calculus,

Calculus, and AP Calculus.

- *Number of upper-level Science courses:* Included Honors Intro to Physical Science, Honors Integrated Science, Honors Earth Science, Honors Biology and Biology II, Pre-AP or Pre-IB Biology, AP Biology, Biotechnology, Honors Chemistry, Honors Intro to Chemistry and Physics, Honors Forensic Chemistry, AP Chemistry, Honors Anatomy, Physics and AP Physics, Honors Space Science and Aerospace Science, and Aerospace Science II.
- *Number of academic credits:* Included all credits earned in academic subject areas (e.g., Math, Science, Social Studies, English, Foreign Languages).
- *Number of CTE credits:* Includes all credits in CTE areas (i.e., does not include academic credits or Electives).

Table C-3
Examples of Courses Within POS clusters

Cluster	POS	Courses Included in Cluster
	DESERT COLLEGE	
Hospitality & Tourism	Culinary Arts	Culinary Arts I Culinary Arts II Nutrition Hospitality/Tourism Food Service I Food Service II
Architecture & Construction	Construction Technology	CAD/ENG 1 CAD/ENG II CAD/Arch Draft I CAD/Arch Draft II Woods I Metals I Metals II Prodtech Woods Small Engine Mech
Arts, Audio-video Technology, & Communications	Film Technology	Comm Skills through TV Prod Animation I Animation II, Animation II Lab Animation III, Animation III Lab Computer Graphics (I, II) Digital Photography Digital Photography II Media Arts I Media Arts II, Media Arts II/Yearbook Media Arts III Hollywood Project Intro to Film Production

		Intermediate Film, Intermediate Film Production Advanced Film Television I Video/Audio Production Video Advertising Drama Drama II 3D Computer Art Inventor 3D Modeling Autodesk Inventor Illustration I, Illustration II Mass Media Communication Mass Media/Society Communication Skills Desktop Publishing Digital Editing Photoshop I Basic Application Design
RIVER COLLEGE		
Science, Technology, Engineering & Mathematics	Mechatronics	Adv Three Dimensional Design Architectural Drafting Computer Applications (Regular or Accelerated) Computer Tech Conc. Engin. Tech 3 Drafting I (Regular or Accelerated) Engineering Design Engineering Technology Industrial & Engineering Machine Tool Technol Mechatronics Mechanical Comp Mech. Pneu/Hydro Comp Manufact (Indus. Tech) MIT Engineering Tech Small Engines Sm Pwr Eq Strength/Speed Accel Technology Concepts Special Problems Tech E 2 Two Dimensional Three Dimensional AC
Manufacturing	Industrial Maintenance	Adv. Three Dimensional Design

		Comp Maint/Syst Tech Drafting (Regular or Accelerated) Manufact. Indus. Tech Machine Tool Technol OCTC Machine Tool OCTC Machine Tool 2 Small Engines Sm. Power Structures Strength/Speed/Accel Three Dimensional AC Technology Concepts Welding
NORTHERN COLLEGE		
Manufacturing	Welding	Ag Mechanics IND-Metal Fabrication Design Implementation Advanced Manufacturing Welding I Manufacturing Tech Small Engines
Transportation, Distribution, & Logistics	Auto Tech	AAS Engine Performance AAS Tech Electric Auto Wheel Alignment Brakes Disc Academy Auto (A, B) Disc Academy Engr (A, B) Intro to Auto Intro Electricity Intro to Engineering Design (A, B) Metal Fabrication Intro to Metals Power & Energy Small Engines Gen Auto Serv

College transcripts were obtained for students in the sample who enrolled at the affiliated college for dual credit courses and/or enrolled as a college student after high school. College transcripts for students who only took dual credits at the high school were used to confirm the number of dual credits taken while in high school, and to determine whether or not a student had earned a certificate by the time of high school graduation. For students who had records at the affiliated colleges after high school, the following variables were created (see Table 4B in the report):

- *Number of non-credit courses*: The number of remedial/developmental/noncredit courses taken.
- *Number of credits earned by end of first year*: The total number of credits earned during the first year of college enrollment, post-high school (i.e., not including dual credit).

- *Total number of college credits to date (2012):* The sum of all credits earned at the college as of the end of spring semester in 2012.
- *Ratio of credits attempted to earned:* A ratio of total attempted credits at the college level to credits earned. Credits attempted was the credit sum of all courses reported on the college transcript, included classes students withdrew from or failed (because they would not have appeared on the transcript if the student had withdrawn during add/drop period). Credits earned included only the courses that students passed.

Variable construction from surveys. For data analysis purposes, some survey items that grouped together in factor analyses were converted into scales. In section A of the quantitative results (see Footnotes 15 and 16), attitude toward POS, beliefs about information learned in school, and consulting with a counselor are mentioned as constructed scales. See Table C-4 for the survey items that made up each of these scales.

Table C-4
Construction of Scale Variables from Survey Items

Scale	Survey Items	Alpha and Scoring
Attitude toward POS	Having a POS has… • Made me more likely to want to come to school • Made me less likely to want to drop out of school • Helped me get better grades • Made me feel like I fit in better at school • Helped me make connections • Made it more likely that I would take courses that I need for the future • Made it more likely that my parents got involved in my selection of courses • Made me focus my studies so I know where I am headed	α = .85 1 = Strongly disagree 2 = Disagree 3 = Agree 4 = Strongly agree
Beliefs about information learned in school	Most of the information learned in school is/will be… • Useful for everyday life • Useful for college or further training • Useful for my career	α = .81 1 = Strongly disagree 2 = Disagree 3 = Agree 4 = Strongly agree
Consulting with a counselor	How often have you consulted with a counselor on… • Course plan • What courses to take this school year • Going to college • Possible jobs or careers when you are an adult • Your grades	α = .82 0 = Never 1 = One or more times

- Finding a job after high school
- Steps necessary to pursue your career
- Applying for college or vocational/technical school

Note, Data source: High school 2009 survey. The item “things studied in class” was not including in the consulting with counselor scale because it did not group with the other items.

Appendix D: Additional Statistical Tables

The following tables present the results of additional statistical analyses referred to in the quantitative section of the report.

Table D-1

Cross-Sectional Summary Table of Relationships Among Key High School Variables

Variable	Consult with counselor	# of POS credits	# of CTE credits	# of Math Credits	# of Science Credits	# of Dual Credits	Overall GPA	CTE GPA	Math GPA	Science GPA	Intern/ co-op	English STS	Math STS	Attitude toward POS
Consult with counselor		.085	.059	.061	.123	.104	**.194****	**.238****	.138	**.166***	**.142***	**.303****	.155	**.304****
Number of POS credits			**.753****	**.529****	**.519****	**.663****	.095	**.155***	**.143***	**.219****	.005	**.190***	.078	**.188****
Number of CTE credits				**.624****	**.587****	**.633****	.033	.099	.103	**.203****	.033	**.206***	.106	**.181***
Number of Math Credits					**.774****	**.509****	**.154***	.118	**.228****	**.263****	-.049	.117	.094	.098
Number of Science Credits						**.471****	.086	.094	.117	**.213****	**-.151***	.135	.057	.120
Number of Dual Credits							.041	.108	.054	**.163***	.030	.124	-.016	.111
Overall GPA								**.814****	**.785****	**.830****	**.180***	**.347****	**.431****	.051
CTE GPA									**.585****	**.629****	.061	**.377****	**.333****	**.157***
Math GPA										**.692****	**.158***	**.299****	**.414****	-.002
Science GPA											**.165***	**.375****	**.407****	-.013
Intern/co-op												.132	.045	.078
English STS														.037
Math STS														.019

Notes. * = $p < .05$, ** $p < .01$, *** $p < .001$. Significant relationships appear in bold font. GPA = grade point average; STS = standardized test score. *N* for correlations ranged from 140-210. Data source: High school transcripts and student surveys (latter used only for parent-teacher-counselor conference and internship/co-op variables).

Highlights:

- Number of Math credits was positively related to staying in the same POS cluster (.21**)
- Number of Science credits was positively related to staying in the same POS cluster (.23**)
- Number of CTE credits was negatively related to the number of remedial courses taken (-.26*), positively related to college GPA (.24*), staying in the same cluster (.37**), and earning a credential (.17*).

Table D-2

Cross-Sectional Summary Table of Relationships Among Key College Variables

Variable	Entrance exam score	Remedial classes	Year 1 credits	College GPA	Stayed in cluster	Earned credential	Attended four-year
Entrance exam score		**-.447****	.208	**.342****	.108	.094	.178
Remedial classes			.166	-.176	**-.281****	-.085	-.165
Year 1 credits				**.392****	.166	**.358****	.207
College GPA					.180	**.279****	**.194***
Stayed in cluster						.159	-.153
Earned credential							-.002

Note. * = $p < .05$, ** $p < .01$, *** $p < .001$. Bolded coefficients are statistically significant at least $p < .05$. *N* for correlations ranged from 68-81.
Data source: College transcripts.

Table D-3

Correlations Between Selected High School Transcript Data with College Outcomes

Variable	Entrance exam score	Remedial classes	Year 1 credits	College GPA	Stayed in cluster	Earned credential	Attended four-year
Consult with counselor	.191	-.143	.155	**.194***	.069	.117	.134
# POS credits	.101	**-.260***	.071	**.235***	**.421****	**.235****	.053
# CTE credits	.029	**-.261***	-.044	**.239***	**.365****	**.173***	-.009
# Math credits	.079	**-.295****	.030	.154	**.214****	.097	**.161***
#Science credits	.085	**-.269***	-.047	**.207***	**.227****	.105	**.180***
# of Dual credits	-.199	**-.347****	.014	**.245***	**.241****	**.176***	**.185***
Overall GPA	**.429****	-.043	**.330****	**.298****	.024	.100	**.463****
CTE GPA	**.403****	-.154	.176	**.281****	.061	.112	**.417****
Math GPA	**.389****	-.136	**.387****	**.349****	.115	.072	**.376****
Science GPA	**.319****	-.135	**.255***	**.318****	.154	.088	**.427****
Internship/Co-op	.084	.046	.083	.146	.073	.020	.001
English STS	**.443****	**-.246***	.171	.202	.039	.079	**.262****
Math STS	**.613****	**-.328****	.207	**.420****	**.210***	-.026	**.263****
Attitude toward POS	.082	.091	**.220***	.135	**.214****	.018	-.123

Note, * = $p < .05$, ** $p < .01$, *** $p < .001$. Bolded coefficients are statistically significant at least $p < .05$. *N* for correlations ranged from 68-167.
Data source: High school transcripts, college transcripts, and student surveys (latter used only for internship/co-op, POS attitude, and consult with counselor variables)

Appendix E: Comparison Analysis

Table E-1

Data Received from Colleges on Sample and Comparison Group Students[42]

Variable	Original Sample	Comparison Group
High school attended	<Already known from HS data>	To determine whether comparison group students attended a POS high school (i.e., high school with existing partnership with college)
High school graduation year	<Already known from HS data>	The comparison group was restricted to those who entered college as beginning freshmen since the 2009-2010 academic year, in order to be as comparable as possible to our sample (i.e., excluding returning adult students)
Major	To determine if students stayed in same pathway as HS POS	Only students not in our sample and enrolled in the POS of interest from the 2009-2010 academic year to 2011-2012 academic year were included
Entrance Exam	✓	✓
Number of dual enrollment credits	✓	✓
Number of non-credit courses to date	✓	✓
Total number of college credits to date	✓	✓
Enrollment in degree program	✓	✓
College GPA	✓	✓
Semesters enrolled	✓	✓
Certificates/degrees earned	✓	✓
Birth Year	✓	✓
Race and gender	✓	✓
Student status	✓	✓

[42] To create the most equivalent comparison group for our Northern and Desert samples, additional filters were applied: Any students born before 1990; graduated high school after 2011; or transferred into the college from another college were removed from the comparison group. Any student who had attended one of the POS high schools in our sample were removed (they would have been exposed to the same POS as the target group and thus contaminated). At Northern, any student who changed their major to something other than the POS of interest was removed from the comparison group to increase match. The comparison group at River College was too small to add additional filters or make any comparisons.

Appendix F: Missing Data Analysis

A non-response bias analysis was conducted to determine if study participants responding to follow-up surveys have different characteristics from participants who have not responded. The original sample of 213 high school students, surveyed on site in the spring of 2009, was divided into two groups, as follows:

- Responders ($N = 82$): Students who completed the first high school survey and responded to at least one follow-up survey.
- Non-responders ($N = 131$): Students who did not participate in any surveys after the initial high school survey in 2009.

Chi-squared analyses indicated no significant differences between follow-up response statuses based on gender, X^2 (1, 210) = .13, $p = .72$; study site, X^2 (2, 213) = 2.24, $p = .33$; grade level, X^2 (1, 210) = 1.11, $p = .29$; or immediate plans after completing high school, X^2 (4, 193) = 7.16, $p = .13$.[43] However, there was a significant difference between follow-up responders and non-responders on student reported level of education obtained by fathers: X^2 (5, $n = 173$) = 18.26, $p = .00$. Forty-seven percent of non-responders, compared to 21% of responders, reported that their father's highest level of education as completing a high school diploma or GED, whereas 22% of responders, compared to 7% of non-responders, indicated graduating from a four-year college or obtaining a master's as their father's education level. There were no significant differences on mother's education between the two groups.

Additionally, a significant difference existed between responders ($M = 2.79$, $SD = .67$) and non-responders ($M = 2.46$, $SD = .63$) on high school GPA: $t(188) = -3.50$, $p = .001$.

Finally, responders and non-responders differed significantly on their expectations (as high school students in 2009) of how far they would go in school, X^2 (4, $n = 207$) = 10.54, $p = .03$.[44]

Overall, responders had higher educational aspirations than non-responders. Specifically, 34% of responders, compared to 23% of non-responders, aspired to an advanced degree; 30% responders, compared to 20% of non-responders, aspired to a Bachelor's degree; and 18% of responders, compared to 35% of non-responders, aspired to a certificate or Associate's degree. Overall, then, students who responded to the surveys tended to have higher achievement, higher aspirations, and higher levels of father's education than non-responders. However, because we were able to supplement the final survey data with information on college and work status obtained via online searches and college transcripts, some of the non-response bias may be mitigated.

[43] "Plans after high school" included the following categories: (a) enroll in a four-year college/university; (b) enroll in a two-year college or enroll in a two-year college then transfer to a four-year college; (c) enroll in technical or trade school; (d) join the military, get a job, or paid community service; and (e) start a family, travel, unpaid community service, or unsure.

[44] "How far you will go in school" included the following categories: (a) not complete high school or earn a GED or high school diploma; (b) earn a certificate or associate's degree from a community college; (c) earn a bachelor's degree; (d) earn a Master's, Doctorate, or other advanced degree; and (e) don't know.

Appendix G: Limitations

In addition to those limitations presented in the discussion section, this study has several other limitations.

Several sites that were highly recommended for inclusion in this study and met all of our initial criteria declined our visit on the basis of limited time and resources for hosting researchers. For this reason and because of our own limited time and resources, we do not claim to have conducted an exhaustive search of potential sites. However, we do offer a range of approaches to POS implementation that contributes to our understanding of how POS were developed and are being implemented at the local level.

The original sample was defined as students enrolled in classes required for selected POS. In the River and Northern sites, students may have been more likely to intentionally take a class because they were pursuing a particular POS pathway. At the Desert site, the POS were more recently developed. Students were not always aware that they were on a pathway, or that they may have been taking a class as an elective. Students at the Desert site were more likely to list other, unrelated career paths as responses to the survey question, "What is your program of study?" In the overall sample, 20% of students (the majority of whom—93%—were from the Desert site) listed an unrelated career path, responded "I don't know" or left this question blank. We coded these students as being in the POS for the class in which they took the survey (culinary, construction, or film), but it may be that students at this large site had many more POS options and were therefore more likely to change, or that students had not yet grasped the POS concept and interpreted the survey question as asking about their desired career path.

On surveys, participants were asked to indicate the cluster of which their POS or job was a part, depending on the question. The rationale for making this a close-ended question was to minimize the amount of data that would need to be re-coded by the researchers. However, the clusters are not always as straightforward to students, who may classify their major inaccurately. For example, students enrolled in Culinary Arts sometimes classified their major as within the Agriculture cluster instead of Hospitality and Tourism, because "Food" is included in the Agriculture cluster label. Other students did not classify Auto Tech under the Transportation, Distribution, and Logistics cluster, instead marking "other" because the association was not clear. On a related note, whether or not a student stayed in the same POS or cluster was based on whether their college major or employment field was clearly linked to their high school POS (e.g., Auto Tech student currently working as an auto mechanic). However, a student may have selected a different cluster as their major, even though their career aspiration was still linked to the original POS (e.g., an Auto Tech student who aspired to own his own auto shop and selected Business as his major).

Some students were unidentifiable by the school or district, depending on the site, when records were requested after the school year. Although schools and colleges were able to provide corrected information for some students, a few remained unidentifiable—in some cases, perhaps due to an incorrect name on file.

Appendix H: Case Studies

Please see http://bit.ly/TUignU.

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