The Role of Community College Education in the Employment of Information Technology Workers in Washington State

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October 2010

CCRC Working Paper No. 23

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This study was funded by the National Science Foundation's Advanced Technological Education program and conducted in partnership with the National Workforce Center for Emerging Technologies (NWCET) at Bellevue College, Washington. The authors would like to thank the following individuals: James Jacobs, of Macomb Community College, and Davis Jenkins and Thomas Bailey, of CCRC, for their helpful comments and feedback on prior drafts of this paper; Sandy Mikolaski and Manjari Wijenaike, of NWCET, for their encouragement and feedback regarding this analysis; Matthew Zeidenberg, of CCRC, for his helpful data guidance; David Prince, of the Washington State Board of Community and Technical Colleges, for his support of this work; and Wendy Schwartz for her fine editorial work. Any errors or omissions are strictly the responsibility of the authors.

Abstract

Understanding the role of subbaccalaureate programs in preparing students for the workforce has become increasingly important, particularly in quickly changing fields that require well-trained technical workers, such as information technology (IT). To better understand the role of community colleges in educating IT workers, we examined two key issues: (1) students' employment outcomes by the type of community college IT preparation they complete, and (2) the type of employers that tend to hire community college IT students. Specifically, we analyzed data on students who were enrolled in an IT program at any Washington State community and technical college during the 2000-01 academic year and who completed their program or left college by the spring of the 2004-05 academic year. We examined information on students' course-taking in college and their employment before, during, and after their college enrollment.

Our investigation of employment outcomes by type of community college preparation suggests that employers prefer workers with higher-level credentials. Of the four groups we analyzed, students with both an associate degree and a certificate in IT had the strongest employment outcomes in terms of likelihood of employment, hours worked, and earnings. They were followed by students with an IT associate degree, and then by students with an IT certificate. Students who earned no credential but concentrated their study in IT by completing four or more courses had the weakest employment outcomes, underscoring the importance of completing full programs and earning a credential.

Compared with workers overall, IT students were more likely to work for medium sized employers. They were also more likely to be employed in temporary services and educational services industries. Our findings highlight the importance of community college efforts to engage with the full range of local employers as well as the potential need for different engagement strategies, depending on the employer.

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1. Introduction and Background

The stakes are high for students seeking better employment through a subbaccalaureate education and for the institutions committed to serving them. Success is not only measured by students' academic achievement. Rather, for students, who may endure a variety of hardships while attending college, and for colleges, whose effectiveness is measured by their ability to meet student needs, the ultimate goal is to ensure students' ability to secure high quality and high paying jobs. Employers are also invested in students' mastery of particular skills because of their need for a highly trained technical workforce. It is therefore important to identify educational programs that are effective in preparing students for an increasingly technology-driven workplace.

With its focus on promoting community college technician education, the Advanced Technological Education (ATE) program[1] of the National Science Foundation has had a longstanding interest in ascertaining the efficacy of community college education in preparing technicians for a variety of fields, including information technology (IT) (National Workforce Center for Emerging Technologies [NWCET], 2005, 2006; Boston Area Advanced Technological Education Connections [BATEC], 2007; Germuth, Gullickson, Lawrenz, & Hanssen, 2006). Recently, national initiatives focused on increasing the number of Americans who attain credentials of value in the labor market have sought a better understanding of the impact of earning a subbaccalaureate credential on members of the workforce (Council of Economic Advisers, 2009; Bill & Melinda Gates Foundation, 2009).

As part of a larger investigation of employer perceptions of community college programs and graduates, CCRC examined the employment outcomes of information technology (IT) students in Washington State (WA) community and technical colleges

[1] The Advanced Technological Education (ATE) program focuses on the education of technicians for the high-technology fields. It involves partnerships between academic institutions, frequently community colleges, and employers to promote improvement in the education of science and engineering.

who have completed their programs.[2] The study discussed in this paper addressed two questions related to the employment outcomes of community college IT students:

(1) Which types of community college preparation in IT are associated with better employment outcomes?

(2) Which kinds of employers in which regional labor markets are more likely to employ students with particular types of community college preparation in IT?

Because of their relatively high wages and good employment prospects, IT jobs are of particular interest to colleges and their students. They are an important part of the economy, with projected growth in the coming years for a range of positions, including computer support specialists, network administrators, programmers, and database administrators (see Table 1). While the dominant education credential for some of these positions is more advanced than a community college degree or certificate, some community college programs still have a role in preparing students for them (U.S. Department of Labor, 2010).

Table 1.
Types of Information Technology Jobs

IT Job	Projected Openings 2008-2018 (in thousands)	Dominant Education Credential	Median Wage
Computer Support Specialists	234.6	Associate Degree	$43,450
Network and Computer Systems Administrators	135.5	Bachelor's Degree	$66,310
Computer Programmers	80.3	Bachelor's Degree	$69,620
Database Administrators	44.4	Bachelor's Degree	$69,740

Source: U.S. Department of Labor (2008).

While IT jobs are an important source of employment, the role of community college preparation for them is not clear, despite the fact that IT programs are very common at community colleges. Indeed, IT is among the top five occupational fields among associate and certificate awards at community colleges nationally (U.S.

[2] The larger investigation is part of the Stem-to-Stern project, funded by ATE and conducted by the Community College Research Center (CCRC) in collaboration with the National Workforce Center for Emerging Technology (NWCET) at Bellevue College (WA).

Department of Education, 2008), and a significant number of ATE programs focus on preparing community college students for employment in IT technician jobs (ATE, 2008). Complicating the role of community college preparation for IT jobs are the multiple pathways into many IT jobs—including both subbaccalaureate credentials and bachelor's degrees—as well as work experience (U.S. Department of Labor, 2010). Some research raises questions about the value of subbaccalaureate credentials, such as the associate degree, for IT employment and suggests that the bachelor's degree is necessary (NWCET, 2005. 2006). At the same time, different research indicates while some IT jobs may require a bachelor's degree, others may still be accessible to workers with community college preparation (BATEC, 2007; U.S. Department of Labor, 2010).

The multiple kinds of community college IT programs further complicate an understanding the role of community colleges in preparing workers for IT jobs. They include associate degree programs (typically two years of study) and certificate programs (typically one year of study), but some students do not complete an entire program and just take just a few classes in a concentrated area of study (Jacobs & Grubb, 2006). Since much of the prior research on IT technician employment has focused on the effect of a bachelor's degree compared with an associate degree, little is known about the impact of the different types of IT preparation at community colleges.

Broadly speaking, a community college education provides valuable returns in the labor market. Prior research indicates that even completing one year of community college coursework is associated with earnings gains (Kane & Rouse, 1999). Furthermore, across all fields of study, individuals who complete an associate degree have higher earnings compared with high school graduates who do not attend college (Grubb, 1999; Kane & Rouse, 1999; Marcotte, Bailey, Borkoski, & Kienzl, 2005). While data on certificates are more limited, existing research suggests that students with an occupational certificate have better employment outcomes than those in academic associate degree programs (Jacobson & Mokher, 2009; Kerckhoff & Bell, 1998). Certificates may be viewed as providing a more specific set of skills than an associate degree, which is designed to provide a more general set of skills and knowledge.

In addition to earning an associate degree or a certificate, students may complete just enough occupational coursework to obtain the skills they need for employment

(Lohman & Dingerson, 2005). Some evidence indicates that enrolling in a very small number of courses is not associated with any wage returns (Belfield & Bailey, 2010; Grubb, 1999; Marcotte et al., 2005). However, more specific examinations of the types of courses taken indicate that coursework in more technical and/or quantitative areas provides greater earnings returns, at least among workers who have lost their jobs (Jacobson, LaLonde, & Sullivan, 2005). Thus, it is quite possible that taking a focused set of courses in IT may be associated with positive employment outcomes.

Importantly, the returns to a community college education are field specific. Prior research has documented that the earnings for community college credentials holders vary significantly by field of study (Grubb, 1999; Jacobson & Mokher, 2009; Kerckhoff & Bell, 1998). For example, health occupations, such as nursing, and other technical fields, such as engineering, are among those with the highest wage returns (Jacobson & Mokher, 2009). This finding underscores the importance of examining outcomes by field of study. By focusing on IT students only, we can understand differences in their employment outcomes by type of community college program without confounding these with differences by field of study.

Through an examination of IT students' employment outcomes, we sought to uncover employer preferences for different kinds of community college preparation, which may help ATE programs and community colleges focus their efforts on offering and promoting the types of IT programs with greater labor market value. For example, some community colleges may decide to concentrate their efforts on their associate degree programs, others on short-term certifications, and still others on just-in-time training through only a few IT courses.

In addition to indicating the relative economic value of different kinds of community college preparation, ascertaining which types of employers hire IT students may further illuminate the role of community college preparation for IT jobs. IT workers in particular are employed by a wide range of employers in nearly all industries, including those in the IT industry and those in other industries that use IT in their work (BATEC, 2007). Given this wide variation, employers' preferences for certain types of community college education may vary depending on the size of their workforce, industry, and the local labor market. Employer size may be associated with hiring

practices. For example, employers of a larger number of workers may be more bureaucratic and thus rely more on a formal screening process and credentials (Bridges & Villemez, 1994). Employers in different industries may also value degrees differently, depending on their technical skill needs and the norms within their particular industry (Bridges, 1996). Furthermore, in science and engineering fields, such as IT, hiring preferences may vary across industry and geography (Lowell & Salzman, 2007). Since IT is an occupation with no public licensure or regulation, the education needed for IT positions is largely determined by employer preferences. Thus, understanding employer preferences through their hiring behavior is particularly important.[3]

Given the wide range of employers of IT workers, a better understanding of how different types of employers favor different types of community college preparation could help guide colleges. With a greater understanding of the employers that hire community college IT students, community college ATE programs may opt to tailor their employer engagement strategies. They may also be able to provide additional information to students when advising them on career options.

In the next section of this paper, we describe the data and methods used in our analysis. We then provide findings on the two key questions addressed: First, we describe IT students' employment outcomes across different types of community college preparation in IT, including earning an associate degree, earning a certificate, and completing concentrated coursework in IT; and, second, we examine IT students' employment outcomes relative to their local labor market and the types of employers that hire them. In the last section, we provide recommendations for community college programs based on the findings.

[3] With its lack of regulation and connection to ongoing changes in technology, IT occupations may provide information on student outcomes that is applicable to other technician occupations, rather than to highly regulated occupations, such as those in the health care industry, or to less technologically-driven occupations, such as those in business administration.

2. Data and Methods

We obtained the data for this analysis through an agreement with the Washington State Board of Community and Technical Colleges (SBCTC).[4] The data were drawn from administrative records data from the SBCTC on students enrolled in the state's community and technical colleges (CTCs) during the 2000-01 academic year. These data, reported to the SBCTC by individual colleges, comprised information about all students in programs supported by state funds. Students' transcript records from the Washington community and technical colleges (WA CTCs) were supplemented with data from the National Student Clearinghouse and Washington State Unemployment Insurance (UI) wage records. We used the information to examine the earnings, hours worked, and employer characteristics of IT students who completed their program or left a CTC by the spring of the 2004-05 academic year.

The data included information on student characteristics and course-taking patterns collected by WA CTCs upon students' enrollment in a CTC and throughout their attendance there. They also included complete records of students' transcripts and credential completions while the students were enrolled at a WA CTC, as well as the students' demographic information. Information on a student's college—used to determine whether the student attended a technical college and whether the student attended a college in the Seattle Metropolitan area—was collected for the last quarter of enrollment. The UI data allowed us to match individual students' educational records with information about their employment in WA and neighboring states before, during, and after their enrollment in a WA CTC through 2006. The National Student Clearinghouse data allowed us to identify students who continued their education at institutions outside of the WA CTC system. These students' educational and employment outcomes were tracked through the spring of the 2005-06 academic year, four to five years after their enrollment at a CTC.[5]

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[4] CCRC has also been working in collaboration with the SBCTC to analyze those data for several research studies and to provide guides on how to conduct analyses using these data (see, e.g., Crosta, Leinbach, Jenkins, Prince, & Whittaker, 2006; Jenkins, 2008; Leinbach & Jenkins, 2008).

[5] The amount of follow-up data varied from four to five years, depending on which quarter of the 2000-01 academic year the student was enrolled.

Our analysis focused on students who demonstrated a commitment to studying IT in college. We defined these IT students as those who completed either four or more courses or 12 or more credits[6] in classes identified as IT by their Classification of Instructional Programs (CIP) code. This definition is consistent with the Perkins definition of a concentrator as a student who takes four or more classes in a subject area. The following four-digit CIP code series were used to define IT classes and awards:

- 1102 – Computer Programming
- 1103 – Data Processing
- 1104 – Information Science/Studies
- 1105 – Computer Systems Analysis
- 1108 – Computer Software and Media Applications
- 1109 – Computer Systems Networking and Telecommunications
- 1110 – Computer/Information Technology Administration and Management
- 1199 – Computer and Information Sciences and Support Services, Other

However, after reviewing the list of IT courses identified by these CIP codes, certain classes that were more related to general computer and office skills, not necessarily part of a focused program of study for IT, were excluded from consideration as IT courses.[7]

We categorized IT students in one of the following four groups based on their educational attainment while enrolled at a CTC:

(1) IT associate degree completers: students who completed an associate degree in IT by the spring of the 2004-05 academic year;

(2) IT certificate completers: students who completed a certificate in IT offered by the colleges by the spring of the 2004-05 academic year;

(3) IT associate degree and IT certificate completers: students who completed both an associate degree in IT and a certificate in IT; and

[6] WA CTCs operate on a quarter system: 12 quarter credits are equivalent to 8 traditional semester credits.

[7] Specifically, we excluded the course if the course title included letter combinations, such as: WORD, EXCEL, POWERP, KEYBOARD, SPREADSHEET, LOTUS, TYPEWRITING, SPRDSHT, WORKS, ACROBAT, WRD, WDPROC, OFFICE, and OUTLOOK.

(4) IT concentrators: students who earned neither an IT certificate nor an IT associate degree, but took at least four courses in IT or earned at least 12 credits in IT.

Students were classified into these four categories without regard to prior education or non-IT credentials earned. That is, the students in this sample may have had some previous postsecondary experience before enrolling in a CTC.

Some students were excluded from both the descriptive analysis and the multivariate analysis because they did not meet the criteria for them or because of significant data problems. First, students must have stopped attending a CTC for one year in order to have gained some experience in the labor market. Thus, we restricted our sample to students who last attended a CTC by the spring of the 2004-05 academic year. Students who transferred to another school after their period of enrollment in Washington CTCs were excluded because they had not yet completed their schooling. Students who were still enrolled in a CTC during the 2005-06 academic year (and thus did not have employment outcomes available for one year after their leaving the WA CTC system) were excluded because they, too, had not yet completed their schooling. Students who did not complete credentials may have, at least temporarily, completed their studies and entered the workforce having completed enough study to obtain the necessary IT skills for employment, though some may eventually plan to complete a degree or certificate.

Second, students were excluded because of problems with their data. One student who represented an extreme outlier on prior earnings was removed from the analysis. Students who were missing plausible data on either date of birth or gender or one of the key outcomes (hours worked or total earnings in the fourth quarter after leaving school) were excluded. In our analyses, for the other categorical variables with high levels of missing data in our sample (race/ethnicity, prior education, and SES quintile), we included a separate dummy variable for "missing," but did not drop these cases because of their high numbers in the data. Ultimately, after all these exclusions, the final set of students for analysis included 3,053 IT students out of an original 4,894 IT students.

Despite their richness, these data do have some limitations. The assumption was made that students who did not have UI records in a given quarter were unemployed during that quarter. However, the validity of this assumption may be compromised by individuals who were working for the federal government or serving in the military, who

were self-employed or working "off the books," or who were employed in locations outside Washington and beyond its neighboring states. Data may also have been compromised by human error in reporting employment records.

We first conducted descriptive analyses on student characteristics and their outcomes by various types of preparation. We then used multivariate techniques to control for differences among students with different types of educational preparation to better assess the difference in their employment outcomes. In this analysis we sought to identify which educational outcomes in IT (as well as what other factors) were associated with greater labor market success. Finally, we examined student outcomes by local labor market and employer type, comparing these outcomes to publicly available data on the overall distribution of workers in the local labor market and among types of employers.

It is important to look at outcomes over a long enough period of time to allow the individuals to settle into the labor market and find employment (Grubb, 1999; Jacobson, 2009); thus, we examined student outcomes one year after the end of their enrollment in a CTC, regardless of whether or not students completed a credential. The one-year period allows students enough time to transition into the workforce after completing their studies. While additional quarters of data were available for some students who completed their studies earlier and thus had more follow-up data in the labor market, we did not examine these quarters, because doing so would mean that students who took longer to complete their studies would be dropped from the sample due to lack of follow-up data. Thus, the students included in the sample had at least a three year window to complete their studies.

3. Findings

To provide background on the IT student population and to place them in context, we first present data on the personal characteristics of the IT students—those who enrolled for the first time in a WA CTC during the 2000-01 academic year and left it by spring 2005—and compare them with the wider population of workforce students enrolled in WA CTCs during the 2000-01 academic year. We then focus our analysis exclusively on IT students, examining their employment outcomes across different types of community college preparation and labor markets, and by employer type.

3.1 Characteristics of Information Technology Students

To place IT students in a wider context, we first compared their characteristics with those of career and technical education (CTE) students generally, that is, with all students who indicated a non-transfer, workforce, or vocational intent; enrolled in a WA CTC during the 2000-01 academic year; and left a WA CTC without transferring to another institution by spring 2005. We then compared IT students who had four distinct educational outcomes: (1) IT associate degree completers, (2) IT certificate completers, (3) IT associate degree and IT certificate completers, and (4) IT concentrators (Table 2).

Compared with the overall group of CTE students, IT students were a more select group because they had reached certain educational milestones. CTE students included those who reached these educational milestones as well as those who completed very few courses. On average, compared with CTE students, IT students were more likely to be male (72.3% versus 47.4%), more likely to be in the top two socioeconomic status (SES) quintiles (47.2% versus 35.8%), and slightly more likely to be White (75.1% versus 72.8%).[8] In addition, they were more likely than CTE students to have had some postsecondary education experience before enrolling in a WA CTC than the average CTE student (59.6% versus 46.9%). In terms of previous employment, IT students had higher rates of previous work experience (64.5% versus 57.1% worked full time at some point in

[8] The SES variable is based on the average socioeconomic indicators for the Census block group of a student's listed residence, calculated using a methodology developed by CCRC researchers (Crosta et al., 2006).

the five years before enrolling at a CTC), had worked more hours worked (231 versus 185 average quarterly hours in the second year before enrolling at a CTC), and higher previous earnings ($4,319 versus $3,089 in average quarterly earnings in the second year before enrolling at a CTC).[9]

IT students who completed different types of preparation had differences in their personal characteristics and pre-CTC experiences as well. On average, those who obtained an IT certificate, either alone or along with an IT associate degree, had higher previous quarterly earnings ($4,874 and $4,963) than those who completed only an IT associate degree or those who concentrated in IT coursework ($3,988 and $4,260). They were also more likely to attend a technical college (30.9% and 29.8%, versus 16% and 16.5%, among these four outcome types). IT students who completed only certificates were slightly more advantaged than IT students overall. They were more likely to hold a bachelor's degree (23.9% versus 16.1%) and to have a higher SES (52.0% versus 47.2% in the top two SES quintiles). They were also more likely to be older (71.2% versus 62.8% were over 27 years of age upon enrollment at a CTC) and to have had higher previous quarterly earnings ($4,874 versus $4,319 in average quarterly earnings in the second year prior to enrollment in a CTC).

These findings may suggest that IT certificate completers were seeking targeted skills offered by a certificate program rather than the more general skills offered by an associate degree. IT students who obtained only an IT associate degree may have included more relatively new entrants into the labor market, as they had the lowest rates of prior employment compared with IT students in general (58.9% versus 64.5%). IT concentrators were more likely to be employed while enrolled at a CTC than IT students in general (they worked an average of 49.1% of quarters while enrolled, versus 44.9% for IT students in general) and to have had higher average quarterly earnings while at a CTC ($2,714 versus $2,320), supporting the notion that they were pursuing specific skills related to advancement at work.

[9] We examined their prior earnings in the second year before enrollment in a CTC to better measure students' earnings before the potential decline in earnings leading up to their enrollment in the CTCs; prior research has shown that immediately before and after education and training individuals often experience a dip in their earnings (see Heckman, 1999).

Table 2.
Student Demographics

Characteristic	All CTE Students	All IT Students	IT Associate Degree and IT Certificate Holders	IT Associate Degree Holders	IT Certificate Holders	IT Concentrator
N	47,241	3,053	208	499	278	2,068
Sex						
Male	47.4%	72.3%	84.6%	69.9%	70.5%	71.8%
Female	52.6%	27.7%	15.4%	30.1%	29.5%	28.2%
Race/Ethnicity						
Asian/Pacific Islander	8.6%	11.8%	8.0%	8.4%	17.9%	12.9%
African-American	6.2%	4.6%	4.7%	3.4%	6.0%	4.7%
Native American	2.1%	1.6%	1.3%	0.9%	0.7%	2.1%
Latino	8.0%	4.1%	5.3%	5.0%	2.2%	3.9%
Other	2.3%	2.8%	3.3%	3.7%	3.7%	2.1%
White only	72.8%	75.1%	77.3%	78.5%	69.4%	74.3%
Missing	74.3%	53.9%	27.9%	35.7%	51.8%	61.3%
SES Quintile (1 highest, 5 lowest)						
Quintile 1	15.6%	22.0%	11.2%	17.5%	22.7%	24.0%
Quintile 2	20.3%	25.2%	31.8%	22.9%	29.3%	24.4%
Quintile 3	22.1%	21.1%	16.8%	23.2%	22.7%	20.9%
Quintile 4	22.0%	18.6%	27.4%	18.7%	16.0%	18.0%
Quintile 5	20.0%	13.1%	12.8%	17.7%	9.4%	12.7%
Missing	12.0%	12.2%	13.9%	18.6%	7.9%	11.0%
Prior Education Category						
HS grad or less	53.1%	40.4%	43.2%	44.5%	31.9%	40.1%
Some post HS	21.1%	28.2%	27.4%	30.0%	26.1%	28.1%
Certificate (< 2 yrs)	6.1%	7.2%	7.9%	7.2%	8.4%	7.0%
Associate degree	6.1%	8.4%	13.2%	8.3%	10.1%	7.7%
Bachelor's degree	13.6%	15.8%	8.4%	9.9%	23.5%	17.0%
Missing	19.4%	12.2%	8.7%	8.6%	14.4%	13.2%
Age Category as of First Quarter						
Age 18 or younger	9.7%	11.2%	9.1%	11.0%	6.8%	12.0%
Age 19 to 22	17.6%	15.4%	15.4%	15.8%	10.4%	16.0%
Age 23 to 26	11.7%	10.6%	7.2%	11.2%	11.5%	10.7%
Age 27 to 39	31.4%	34.6%	36.1%	34.1%	39.2%	33.9%
Age 40 or older	29.5%	28.2%	32.2%	27.9%	32.0%	27.3%
Average age	32.7	32.3	33.1	31.9	34.0	32.0

Characteristic	All CTE Students	All IT Students	IT Associate Degree and IT Certificate Holders	IT Associate Degree Holders	IT Certificate Holders	IT Concentrator
Prior Work Experience						
Worked FT any quarter in 5 years before enrolled	57.1%	64.5%	69.7%	58.9%	68.7%	64.8%
Average weekly hours worked the 2nd year before enrolled	14.2	17.8	20.7	17.1	19.8	17.3
Average quarterly earnings the 2nd year before enrolled	$3,089	$4,319	$4,963	$3,988	$4,874	$4,260
Received Need-Based Financial Aid in Last Quarter	18.4%	28.3%	38.8%	37.9%	29.3%	24.8%
College Characteristics						
Attended a technical college	25.8%	18.7%	29.8%	16.0%	30.9%	16.5%
Attended CTC in Seattle metro area	57.9%	69.7%	72.6%	66.7%	89.9%	67.4%
Enrollment Status as of Last Quarter						
Full Time	41.8%	63.3%	60.3%	69.6%	66.1%	61.8%
Part Time	58.2%	36.7%	39.7%	30.4%	33.9%	38.2%
Experiences While in School						
Quarters in school	4.8	7.3	9.5	9.0	7.6	6.6
% of quarters worked	52.3%	44.9%	35.9%	36.3%	36.4%	49.1%
Average weekly hours worked while in school	12.9	10.5	7.4	7.5	8.2	11.9
Average quarterly earnings while in school	$2,679	$2,320	$1,352	$1,409	$1,745	$2,714
Average total credits earned	37.0	92.1	134.6	123.1	104.0	78.7
Completed a certification class	1.7%	26.4%	50.5%	43.7%	38.8%	18.1%

3.2 Employment Outcomes by Type of Preparation

To better understand the role of community college preparation in IT, we investigated in more detail the employment experiences of IT students who completed the four different types of preparation. We first descriptively examined their general employment outcomes (Table 3). The proportion of IT students who were employed one year after completing their studies ranged from 59.5% (for IT associate degree completers and for IT concentrators) to 68.3% (for holders of both an IT associate degree and an IT certificate). Mean hours worked per week ranged from 19.4 and 19.8 (for IT concentrators and IT associate degree holders) to 24.2 (for holders of both an IT associate

degree and an IT certificate). Mean quarterly earnings ranged from $3,786 (for IT associate degree holders) to $4,419 (for holders of both an IT associate degree and an IT certificate). Students who held only an IT associate degree had low average quarterly earnings, perhaps because they were younger on average and less likely to have had prior postsecondary education or work experience.

Table 3.
Employment Outcomes One Year After Leaving School, By Educational Outcome

Employment Outcome	All IT Students	IT Associate Degree and IT Certificate Holders	IT Associate Degree Holders	IT Certificate Holders	IT Concentrators
N	3,053	208	499	278	2,068
Percent Employed	60.6%	68.3%	59.5%	64.7%	59.5%
Percent Employed Full Time	42.1%	51.9%	41.3%	43.9%	41.1%
Median Hours Worked	19.5	32.2	20.5	22.3	17.2
Mean Hours Worked	19.9	24.2	19.8	20.7	19.4
Median Quarterly Earnings	$2,603	$4,665	$2,570	$3,414	$2,272
Mean Quarterly Earnings	$4,113	$4,419	$3,786	$4,310	$4,135

Other student factors were also related to differences in employment outcomes (see Table 4). Students without prior full-time work experience had worse employment outcomes than those with it: they were less likely to be employed full time and earned less per quarter one year after leaving a CTC. Given these differences, it is important to note that students entering community college may have vastly different purposes for attending, depending on their age, prior work experience, and prior education.

Table 4.
Employment Outcomes One Year After Leaving School,
By Previous Education, Previous Work Experience, and Age

Employment Status	IT Students without Prior Certificates or Degrees	IT Students with Prior Certificates or Degrees	IT Students Who Never Worked Full Time in the 5 Years before Enrollment	IT Students Who Worked Full Time in the 5 Years before Enrollment	IT Students Age 22 or Younger at Time of Enrollment	IT Students Older than 22 at Time of Enrollment
N	1,792	842	1,083	1,970	812	2,241
Percent Employed	62%	60%	37%	74%	62%	60%
Percent Employed Full Time	42%	45%	21%	54%	39%	43%
Median Hours Worked	21.0	19.3	0.0	32.2	17.3	20.3
Mean Hours Worked	20.3	20.0	10.9	24.9	19.7	20.0
Median Quarterly Earnings	$2,644	$2,974	$0	$4,984	$2,226	$2,928
Mean Quarterly Earnings	$3,733	$4,977	$1,755	$5,409	$3,075	$4,489

To fully account for the differences among the types of students who completed each type of IT education outcome, we conducted additional multivariate statistical analyses to consider factors potentially related to the hours worked and average earnings observed among the different groups of IT students. Controlling for these relevant factors that may explain differences in employment outcomes allowed us to make more complete inferences about the employment outcomes associated with different educational outcomes for community college IT students. Specifically, we controlled for factors related to employment, including students' characteristics, such as race/ethnicity, gender, age, and prior education; students' employment experiences prior to and during their enrollment at the community colleges; labor market conditions upon their entrance into the labor market after leaving the college; and their educational experiences while at community college, including credits earned and quarters enrolled. We further examined the relationship between students' community college IT educational outcomes and their employment status, hours worked, and quarterly earnings, holding these other factors constant using multiple regression analysis (Tables 5 and 6).

Work experience before and during community college attendance was an important factor related to IT students' employment outcomes, including employment status, hours worked, and earnings. In terms of prior employment status, IT students who worked full time in any quarter during the five years before enrolling in a CTC were more likely to be employed, work more hours, and have higher earnings one year after

completing their CTC studies. Likewise, in terms of work intensity and earnings, students who worked more hours and had higher earnings in prior quarters were more likely to work more hours and have higher earnings one year after completing their CTC studies. IT students' employment experiences while enrolled at a community college also constituted an important factor related to their employment outcomes. Rather than detracting from their studies and, ultimately, their employment outcomes, working while attending a CTC was associated with a greater likelihood of employment, more hours worked, and higher earnings among IT students one year after leaving a CTC.

Prior education was also an important correlate of employment and earnings. IT students who already had a bachelor's degree, associate degree, or some postsecondary education were more likely to be employed full time one year after completing their CTC studies. Likewise, the same categories of prior education were important predictors of earnings one year after completing CTC studies.

Students' age was negatively related to their employment outcomes. Perhaps once we controlled for prior work experience and education, older workers had a more difficult time entering the IT field relative to younger workers because younger workers either had or were perceived to have had more experience with recent technology.

Table 5.
Coefficients from Logistic Regressions for
Employment Status One Year After Leaving School

Coefficient	Employed
IT Educational Outcomes Attained at CTC	
Certificate	0.337*
Associate Degree	0.22
Associate Degree and Certificate	0.503*
Student Characteristic	
Female	0.171
Asian	0.106
African-American	0.079
Native American	0
Latino	0.164
Other Race/Ethnicity	0.133
Missing Race/Ethnicity	-0.006
SES Quintile 1	-0.099
SES Quintile 2	-0.051
SES Quintile 3	0.015
SES Quintile 4	-0.076
Missing SES Quintile	-1.511***
Some Postsecondary Education	0.128
Certification	-0.269
Associate Degree	0.05
Bachelor's Degree	0.164
Missing Prior Education	-0.11
Age	-0.022***
Employment Experiences	
Any Full-time Employment in the 5 Years Before Enrollment	0.159***
Percent of Quarters Employed While Enrolled	0.021***
Labor Market Conditions	
Unemployment Rate Upon Entrance to Labor Market	-0.211*
Summer Upon Entrance to Labor Market	0.075
Fall Upon Entrance to Labor Market	0.124
Spring Upon Entrance to Labor Market	0.230+
Experiences at CTC	
Attended Seattle Area CTC	0.023
Attended Technical College	0.007
Received Financial Aid	-0.022
Took Industry Certification Class	0.155
Total Credits Earned	0.002*
Constant	0.665
N	3053
R2	0.262

Note: + p<.1, * p<.05, ** p<.01, *** p<.001

Table 6.
Ordinary Least Squares (OLS) Regressions
for Hours Worked and Earnings One Year After Leaving School

Factor	Hours Worked	Earnings
IT Educational Outcomes Attained at CTC		
Certificate	1.573	429.624+
Associate Degree	1.680+	415.418*
Associate Degree & Certificate	4.490***	742.319**
Student Characteristic		
Female	0.545	171.395
Asian	0.674	-60.379
African-American	-1.813	-279.535
Native American	3.048	128.261
Latino	-0.878	71.352
Other Race/Ethnicity	0.419	-281.839
Missing Race/Ethnicity	-1.066	-206.997
SES Quintile 1	-2.320*	-323.469
SES Quintile 2	-1.646	-55.973
SES Quintile 3	-0.273	161.667
SES Quintile 4	-1.797	-264.111
Missing SES Quintile	-8.848***	-1618.511***
Some Postsecondary Education	0.952	260.772
Certification	-1.845	-224.405
Associate Degree	1.825	731.026**
Bachelor's Degree	0.198	453.595+
Missing Prior Education	-0.677	-14.826
Age	-0.122***	-23.750**
Employment Experiences		
Any Full-time Employment in the 5 Years Before Enrollment	0.633***	77.659***
Average Quarterly Earnings 2nd Year Before Enrollment	--	0.157***
Average Weekly Hours Worked 2nd Year Before Enrollment	0.121***	--
Percent of Quarters Employed While Enrolled	0.074***	4.626*
Average Quarterly Earnings While Enrolled	--	0.652***
Average Weekly Hours Worked While Enrolled	0.359***	--
Same Employer in Before and After Enrollment	-2.276*	-529.690*
Labor Market Conditions		
Unemployment Rate Upon Entrance to Labor Market	-0.782	-189.695
Summer Upon Entrance to Labor Market	-0.068	-46.815
Fall Upon Entrance to Labor Market	0.035	-54.827
Spring Upon Entrance to Labor Market	0.189	131.122

Factor	Hours Worked	Earnings
Experiences at CTC		
Attended Seattle Area CTC	0.494	317.927*
Attended Technical College	-0.322	-143.418
Received Financial Aid	-0.116	-142.792
Took Industry Certification Class	1.742*	267.465+
Total Credits Earned	0.018**	3.075*
Constant	16.634***	3003.404**
N	3053	3053
R2	0.314	0.468

Note: + p<.1, * p<.05, ** p<.01, *** p<.001

Controlling for differences in student characteristics, employment experience, labor market conditions upon entrance to the labor market, and community college experience (credits earned and quarters enrolled), we used the regression results to calculate adjusted or estimated values for employment outcomes for each group of students completing a different type of IT preparation (Table 7).[10] IT students who left a CTC with more credentials had better employment outcomes. Those who earned an IT associate degree and a certificate worked more hours and earned more one year after leaving a CTC than those who concentrated in IT. These IT students had higher quarterly earnings ($4,698) and more hours worked weekly (23.7) on average than IT concentrators ($3,955 and 19.2 hours). Those students who earned only an IT associate degree ($4,371 and 20.9 hours) or an IT certificate ($4,385 and 20.8 hours) also worked more hours and earned more than IT concentrators. Notably, once controlling for these differences, associate degree holders had outcomes that were more similar to IT certificate holders than IT concentrators.

[10] In calculating these adjusted values for employment outcomes we assumed all other factors were at the mean.

Table 7.
Employment Outcomes One Year after Leaving School,
By Type of IT Preparation, Adjusted for Student Differences

Employment Status	IT Certificate and IT Associate Degree	IT Associate Degree Only	IT Certificate Only	IT Concentrator
Percent Worked	72.50%	66.50%	69.10%	61.40%
Hours Worked Weekly	23.7	20.9	20.8	19.2
Quarterly Earnings	$4,698	$4,371	$4,385	$3,955

IT credentials had positive value in the labor market, even when we controlled for the intensity and duration of the educational experience by including credits earned and quarters enrolled. This finding implies that these credentials may have independent value in the labor market aside from students' educational experience. This value may reflect social traits that employers associate with completing a credential, such as motivation or discipline, which are not necessarily associated with qualities that students would gain only through earning credits at a college. Alternatively, the value of a credential may reflect the completion of a particular program of study designed to impart a particular set of skills to completers; students who completed such a program may have acquired unique skills and abilities that would not be gained by taking an alternative set of courses (Grubb, 1999).

Our findings support the notion that IT credentials attained at a community college are associated with valuable employment outcomes for students entering the labor market. Given the non-experimental nature of this analysis, however, we cannot assume causality between completion of particular kinds of preparation in IT and subsequent employment outcomes. While we controlled for as many factors related to employment as we were able to in the regression analyses, it is still possible that other unmeasured factors may have affected the employment outcomes. Thus, these findings are associations that we observed based on the data available at the time.

3.3 Employment Outcomes by Local Labor Market and Employer Type

IT students' employment outcomes one year after they left the community colleges (or the fourth quarter after leaving) provide an indication of how they fared in the labor market.[11] To put these outcomes in context, we examined IT students' employment outcomes across local labor markets and employer types and compared them with the overall Washington State patterns of employment. While using this full range of employment opportunities might not be particularly appropriate for this group of IT students, the comparison is intended to illuminate how IT students' employment matched with the opportunities available and how it differed depending on the labor market in their local area. Ultimately, we sought to identify particular labor market conditions where employment opportunities for community college IT students might be more likely to exist.

We first examined the role of the local labor market in IT students' employment outcomes, given the unique focus on the IT industry in the Seattle metro area compared with the state of Washington outside the Seattle metro area (U.S. Census Bureau, 2007). We defined the students' local labor market according to the CTC they last attended, since it would provide an indication of their commuting patterns as well as the set of networks that they were likely to access in finding employment. Despite the differences in industry across these local labor markets, the employment outcomes of CTC IT students one year after leaving CTCs in the Seattle metro area were somewhat different from those outside the Seattle metro area (Table 8). They were slightly less likely to be employed (59.8% versus 62.4%) and to be employed full time (41.6% versus 43.2%). They worked a fewer number of hours per week (18.3 hours versus 21.9 hours) but had higher average quarterly earnings ($4,243 versus $3,814). These differences illustrate the potential importance of the relationship between local labor markets and the value of education (Kolesnikova, 2009).

[11] We looked at outcomes one year after leaving college to allow enough time for students to obtain employment; prior research has shown that immediately before and after education and training individuals often experience a dip in their earnings (see Heckman, 1999).

Table 8.
Employment Outcomes One Year after Leaving School, By Labor Market

Employment Status	All IT Students	IT Students, Seattle Metro Area	IT Students, Outside the Seattle Metro Area
Percent Employed	60.6%	59.8%	62.4%
Percent Employed Full Time	42.1%	41.6%	43.2%
Median Hours Worked Per Week	19.5	18.3	21.9
Mean Hours Worked Per Week	19.9	19.6	20.6
Median Quarterly Earnings	$2,603	$2,563	$2,678
Mean Quarterly Earnings	$4,113	$4,243	$3,814

The size of IT students' employers, in terms of their number of employees, provides insight into employment opportunities that students encountered in the labor market upon completing their community college studies (Table 9). IT students in WA and in the Seattle metro area worked for employers that differed in size: about 40% worked in small firms (fewer than 100 employees), 24% in medium size firms (100 to 500 employees), and a little over 35% in large firms (more than 500 employees). While similar percentages of IT students worked for small employers compared with the average workers both in Seattle and outside Seattle, more IT students worked for medium size employers and fewer worked for large employers. This difference may suggest some differences in how middle size firms utilized IT workers relative to small and large size firms or a preference for IT workers with other types of credentials, like a bachelor's degree and/or an industry certification.

Table 9.
Employer Size Among Those Employed One Year after Leaving School, By Labor Market

Number of Employees	Percent of All Workers in Washington State Workforce*	Percent of All IT Students	Percent of Workers in Seattle Metro Area*	Percent of IT Students, Seattle Metro Area	Percent of Workers in Outside Seattle Metro Area*	Percent of IT Students, Outside Seattle Metro Area
Fewer than 100	40.9%	40.9%	36.6%	39.6%	47.9%	43.9%
100-499	14.8%	23.9%	14.5%	23.9%	15.4%	24.0%
500+	44.3%	35.2%	48.9%	36.5%	36.7%	32.1%

*Source: U.S. Census Bureau, (2007), *County Business Patterns*, Washington and Seattle-Tacoma-Bellevue Metropolitan Statistical Area.

In addition to size, the industry of IT students' employers provides insight into the students' labor market experiences. Table 10 summarizes the industries where IT students were employed just one year after leaving a CTC. Both in Seattle and outside Seattle, IT students were employed in a wide range of industries after leaving a CTC, the majority of which were industries whose main focus was not IT. In fact, only 16.8% of IT students in Seattle and 9.6% of IT students outside Seattle were employed in IT-related industries. It is important to note that our employment data were industry-based rather than occupation-based; IT students might have been performing IT-related roles for non-IT-related industries.

Compared with workers overall in the labor market, CTC IT students were more likely to be employed in IT-related industries, as would be expected. They were also more likely to be employed in temporary services and educational services industries. The relatively high employment in temporary services may reflect students' intentions to use these firms to gain entry into more permanent IT employment (Jenkins, 2001). The relatively high employment in educational services may reflect IT students' employment at their own educational institutions. They were less likely to be employed in the health care and construction industries, perhaps reflecting the higher proportion of workers trained specifically in these industries.

Table 10.
Industries Employing IT Students One Year after Leaving School, By Labor Market

Industry	Percent of All Workers in Washington State*	Percent of IT Students	Percent of Workers in Seattle Metro Area*	Percent of IT Students, Seattle Metro Area	Percent of Workers in Outside Seattle Metro Area*	Percent of IT Students, Outside Seattle Metro Area
Total with Industry Code Available	2,316,296	1,808	1,432,531	1,266	883,765	542
Construction	7.1%	4.3%	6.8%	4.5%	7.6%	3.9%
Manufacturing	11.1%	9.0%	11.1%	9.1%	11.1%	8.7%
Wholesale Trade	5.5%	4.5%	5.8%	4.9%	5.1%	3.5%
Retail Trade	13.9%	13.9%	12.2%	13.4%	16.5%	15.1%
Transportation & Warehousing	3.6%	3.8%	4.2%	4.0%	2.8%	3.1%
Information	4.5%	7.3%	6.1%	8.8%	2.0%	3.7%
Finance & Insurance	4.7%	4.6%	5.1%	4.9%	4.1%	3.9%
Real Estate & Rental & Leasing	2.2%	1.8%	2.3%	1.7%	1.9%	1.8%
Professional, Scientific, & Technical Services	6.4%	8.9%	7.0%	9.5%	5.4%	7.6%
Administrative & Support & Waste Management & Remediation Services	4.0%	5.6%	3.9%	5.2%	4.2%	6.5%
Temporary Services	1.6%	7.5%	2.0%	9.0%	1.1%	4.1%
Educational Services	1.9%	6.4%	2.1%	5.9%	1.7%	7.6%
Health Care & Social Assistance	13.7%	6.0%	12.2%	4.5%	16.3%	9.6%
Arts, Entertainment, & Recreation	2.5%	1.8%	2.5%	1.5%	2.5%	2.4%
Accommodation & Food Services	9.3%	6.3%	8.6%	6.0%	10.4%	6.8%
Other	4.6%	3.7%	8.3%	3.6%	7.2%	3.9%
Public Administration	Not available	4.7%	Not available	3.3%	Not available	7.9%
Total IT-related Industry**	6.4%	14.7%	8.4%	16.8%	3.1%	9.8%

* Source: U.S. Census Bureau, (2007), County Business Patterns, Washington and Seattle-Tacoma-Bellevue Metropolitan Statistical Area.
**Includes NAICS codes for Computer and Software Wholesalers; Computer, Software, and Electronics Stores; Information; Computer Systems Design & Related Services; Computer & Office Machine Repair & Maintenance; Computer & Peripheral Equipment Manufacturing; and Computer Training.
*** For some of the NAICS codes included this category, specific employment numbers were withheld, and a range of employee numbers was offered instead. The averages of these ranges were used in calculating the total category percentage.

Beyond the differences between IT students and the overall WA workforce, IT students with different educational outcomes from the CTC varied with respect to the kinds of employers that hired them. In terms of employer size, similar percentages of IT students completing the fours types of preparation were employed across small, medium, and large employers (Table 11). Thus, employers of different sizes did not have differential hiring behaviors that favored workers with certain educational outcomes from a CTC; however, because our data only included subbaccalaureate credentials, it was not

possible to assess these credentials relative to other credentials that employers might prefer, such as a bachelor's degree or an industry certification.

Table 11.
Employer Size Among Those Employed One Year after Leaving School, By Educational Outcome

Employer Size	All IT Students Employed	IT Associate Degree and IT Certificate Holders Employed	IT Associate Degree Holders Employed	IT Certificate Holders Employed	IT Concentrators Employed
Fewer than 100 Employees	39.8%	38.4%	43.0%	45.5%	38.5%
100 – 499 Employees	23.4%	24.5%	21.2%	23.8%	23.7%
500+ Employees	37.2%	37.1%	35.3%	32.6%	38.3%
Mean	2,267	2,685	2,964	2,756	1,983
Median	201	216	173	146	216

In terms of industry, the four groups of IT students were employed in a similar range of industries (Table 12). One notable exception was that IT associate degree and certificate holders and IT certificate holders worked for temporary services firms at higher rates than IT associate degree holders and IT concentrators (13.6% and 12.2% versus 6.3% and 6.4%). These groups of IT students were also more likely to attend a technical college, so it is possible these colleges had stronger relationships with temporary placement firms, leading to their students' greater likelihood of working in this industry. Alternatively, temporary placement agencies may value students with a certificate because they viewed the credential as a proxy for the acquisition of specific skills. The implications of a higher rate of employment in the temporary placement firms are unclear. The finding may indicate a less stable employment experience as workers moved from placement to placement or it may have been a mechanism for helping connect workers to permanent employment opportunities at the sites of their temporary placement, as these employers "tried them out" on a temporary basis (Andersson, Holzer, & Lane, 2007; Kalleberg, 2003).

Table 12.
Industry Among Those Employed One Year after CTC, By Educational Outcome

Industry	All IT Students	IT Associate Degree and IT Certificate Holders	IT Associate Degree Holders	IT Certificate Holders	IT Concentrators
Total with Industry Code Available	1,808	140	286	180	1,202
Construction	4.3%	5.0%	6.3%	3.9%	3.8%
Manufacturing	9.0%	7.9%	12.2%	10.6%	8.1%
Wholesale Trade	4.5%	3.6%	5.9%	1.7%	4.7%
Retail Trade	13.9%	16.4%	12.6%	13.3%	14.1%
Transportation & Warehousing	3.8%	1.4%	3.5%	3.9%	4.1%
Information	7.3%	7.9%	7.0%	5.6%	7.6%
Finance & Insurance	4.6%	2.9%	3.8%	4.4%	5.0%
Real Estate & Rental & Leasing	1.8%	1.4%	2.8%	1.1%	1.7%
Professional, Scientific, & Technical Services	8.9%	12.1%	9.8%	10.6%	8.1%
Administrative & Support & Waste Management & Remediation Services	5.6%	5.0%	4.9%	7.8%	5.5%
Temporary Services	7.5%	13.6%	6.3%	12.2%	6.4%
Educational Services	6.4%	7.1%	8.0%	6.7%	5.9%
Health Care & Social Assistance	6.0%	5.0%	4.2%	5.6%	6.7%
Arts, Entertainment, & Recreation	1.8%	0.7%	1.0%	1.1%	2.2%
Accommodation & Food Services	6.3%	5.0%	5.2%	4.4%	6.9%
Other	3.7%	3.6%	1.4%	4.4%	4.2%
Public Administration	4.7%	1.4%	4.9%	2.8%	5.3%
Total IT-related Industry*	14.7%	17.9%	15.4%	13.3%	14.4%

*Includes NAICS codes for Computer and Software Wholesalers; Computer, Software, and Electronics Stores; Information; Computer Systems Design & Related Services; Computer & Office Machine Repair & Maintenance; Computer & Peripheral Equipment Manufacturing; and Computer Training. Some of these categories are counted under other categories.

4. Conclusion

The employment experiences of information technology students (IT) one year after completing their community college studies provide insights about the role of community college preparation for IT workers. The analysis presented in this paper highlights the different IT educational outcomes available to IT students and how they relate to students' employment outcomes.

When controlling for a range of factors related to employment, students who earned credentials were more likely to be employed and to earn higher wages than those who did not get as far in their IT training. This finding reinforces the notion that community college credentials are associated with positive employment outcomes and suggest that employers appear to prefer students with more of these credentials. Students with both an associate degree and a certificate realized greater returns compared with students who only completed concentrated IT coursework. Having two credentials may indicate that a student has both broad skills (via the associate degree) and more specific skills (via the certificate). Completing only an associate degree or a certificate produced moderate returns, similar to completion of concentrated IT coursework. Earning a degree or a certificate, but not both, may have the partial value of indicating that a student acquired either general or specific skills.

Nevertheless, the finding that all types of subbaccalaureate credentials awarded to IT students by community colleges were associated with better employment outcomes than was only the completion of concentrated IT coursework underscores the importance of promoting credential completion for community college students, at least those in IT programs. This finding provides evidence to support current efforts in community colleges to promote completion of these credentials to increase students' probability of labor market success.

With respect to how IT students from the CTCs fit into the Washington State labor market as a whole, they worked for employers varying widely in their number of employees. However, the students were employed by medium size employers more frequently than the overall workforce. While they worked in a range of industries, IT students were more likely than other workers to be employed in IT-related industries, as

well as in temporary placement services and educational services. These findings raise questions about the implications of working in industries that employ high numbers of IT students, particularly the longer term career implications of working in the temporary services industry.

Further research should examine the career progression of community college students who begin their post-college employment with specific types of employers, such as temporary agencies. Moreover, because the findings of this analysis underscore the fact that certain employers are more likely to hire community college IT students than other employers, community college IT program staff may want to use data on student employment to help target their placement efforts with the types of employers that have hired their students in the past. They may also want to conduct outreach with employers that have not previously hired many of their students in order to better understand these employers' needs and to demonstrate to them the value of their college's programs.

Ultimately, this analysis demonstrates the need for a nuanced examination of community college students' employment outcomes and the type of employers that hire students holding different but related subbaccalaureate credentials. While our study focused on IT, it provides important evidence on student outcomes that may be applied more broadly to other technical areas. Programs supporting technician education, such as the ATE program, may be able to harness similar state longitudinal data on students' educational and employment experiences to gain knowledge about students' pathways after leaving their own programs. This information could inform program improvement and the strengthening of connections with the labor market, thereby enhancing students' career outcomes.

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