Education Appropriations' Return on Investment of Career and Technical Education Provided by the Utah System of Technical Colleges

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Abstract

A growing need to fill demand for middle skill labor has led many states, including Utah, to invest more heavily in career and technical education (CTE) programs. The purpose of the study is to analyze the marginal benefit to the state from CTE certifications offered through technical colleges. Graduates from 2011 to 2017 cohorts are considered. The objective of the study is to determine the state's positive or negative return on tax as a result of certification. Return on investment, additional taxes, wage growth, payback periods, and conclusions derived from the results are presented. The payback period from state appropriated funds is calculated at 10.18 and 11.26 years from the two models. Graduates from Utah System of Technical College programs showed a large increase in wages as compared to the general Utah workforce. As a result of increased wages, additional taxes were collected from students in each graduating cohort.

Introduction

Career and technical education (CTE) programs fill a labor demand to the economy by equipping students with the skills necessary to succeed in the workforce. Educational training for these programs is concentrated on regionally high demand fields.

CTE programs are offered by three agencies in Utah: Utah State Board of Education, Utah System of Higher Education, and Utah System of Technical Colleges. The Utah State Board of Education (USBE) or Utah's K-12 secondary education system offers CTE membership hours through regular classes and the concurrent enrollment program. There were 32,849 students enrolled in concurrent enrollment courses in the 2016-17 school year (DWS, 2016). Amongst the credits taken, which can go towards college credit or toward a career certificate, 76,001 CTE membership hours were completed (DWS, 2016).

Seven of eight Utah System of Higher Education (USHE) institutions like universities and community colleges also offer CTE courses. The University of Utah does not offer CTE courses as the need is supplemented by a partnership with neighboring Salt Lake Community College. Through USHE, both career certificates and associate degrees are offered.

The Utah System of Technical Colleges (UTech) programs are crafted to fit student demand and the economic needs of a region. The diversity in the state varies from lively urban business to rural farming communities. To fit varying needs of students, technical colleges offer several paths to help meet their goals. One path is certificate seekers, who enter a program to complete a post-secondary certificate and a license when applicable. These programs prepare students directly for the workforce. UTech also provides programs for short-term enrollees which are aimed to advance adults in their current fields or to assist them with skills to maintain current employment. Although certificate seeking students is the group studied in this report, UTech also provides courses to refresh skills for those reentering the workforce or students looking to satisfy their personal interest in certain fields (UTech, 2018).

Goals of CTE programs across agencies also vary. For example, USHE programs are typically used with longer term educational goals in mind, like an associate or bachelor's degree, whereas UTech programs are intended to prepare students immediately for the workforce (Carruth, 2017).

Although career and technical education has been accessible since 1992, the U.S. labor force has gone from 27.89 million workers with a bachelor's degree or higher to 58.7 million; a dramatic increase of approximately 110% (BLS, 2019). As of 2016, over one-third of the U.S. population over the age of 25 holds a bachelor's degree, and is expected to rise (Census, 2017). In 2011, a recent college board goal was to raise the college completion rate of a bachelor's degree to 55% by 2025 (Symonds, 2011).

Higher education generally leads to higher income and, as a result, a higher standard of living. A negative externality created by the demand for educated laborers, however, is new skill gaps in the workforce. A study conducted by the Urban Institute found that almost 70% of 2016 high school graduates attended college. Of those attending their college or university, only 40% graduated, and only 36% of college graduates reported their education prepared them for their job. For some, graduation with a bachelor's degree is never realized. In Utah, 20% of students who complete their first year of college do not return for a second year

(UDRC, 2018). Many starting positions require college education to begin work; students who do not complete a college degree may seek work in low-skill labor to pay for student debt (Urban Institute, 2017).

With the rise in bachelor's degree educational attainment in the workforce, a vacancy for *"middle skill"* careers have created a talent gap in many regions. Middle skill jobs are defined as "those that require more than a high school diploma but less than a four-year degree" (Western Governors Association, 2018). This talent gap has created challenges in regions across the country to fill vacancies requiring middle skill labor, including Utah. Programs to partner state resources to local business needs through CTE programs have been offered as one solution to fill the talent gap in the workforce and to those who chose not to pursue or finish a bachelor's degree (Western Governors Association, 2018).

Talent Ready Utah is a workforce initiative introduced by Governor Gary R. Herbert in 2017. The initiative partners with business leaders and technical colleges across the state to satisfy employment needs. Partnerships in high-demand fields like aerospace, diesel-tech, and information technology are able to use technical colleges to train perspective employees with the specialized skills needed for their industry (Beyer, 2017). A $2.1 million dollar grant was issued for the initiative with a goal of filling 40,000 middle and high-skill jobs over the next four years. Recipients of grant funds included USBE, USHE institutions, and UTech colleges in 2017.

Utah's technical colleges coordinate with secondary education providers, regional universities, and local businesses to ensure that educational pathways exist, providing seamless transition for students of varying education levels between school and the workforce. In conjunction with Governor Herbert's declaration of 2018 as the "Year of Technical Education," USHE institutions leveraged these partnerships into the creation of over 100 new CTE programs (Carruth, 2017). UTech further invites local business and industry leaders to serve on occupational advisory committees that monitor and recommend changes to technical college programs. These advisory committees ensure that educational programs directly meet the needs of local employers.

Funding for these programs comes from business partners, tuition dollars and support from state funding. Appropriation dedicated to UTech programs are unique in comparison with other education organizations in Utah as it is much more reliant on state funding. In 2015, for example, $65.8 million dollars were appropriated by the state while only $7.5 million came from other sources of revenue (DWS, 2016). This funding has significantly increased from prior years to train Utah's workforce in high-demand fields. From 2011 to 2019, tax appropriated funds in UTech (including administrative costs) has risen from $49.32 million to $95.46 million, or a real dollar increase of 40.97% (2011 dollars adjusted to 2019).

To measure the success of these programs, metrics like wage growth, social benefit, and unemployment may be considered. Another tool often used in the private sector to account for the success of a new program is return on investment. A return on investment (ROI) typically takes an accounting approach where benefits and costs are organized on a t-table and evaluated strictly using cost analysis from a financial perspective. CTE programs provide social benefits and can positively influence a community in a variety of ways (Kotamraju, 2016), however, the primary objective of this report will be to evaluate the state's marginal benefit, in taxes, accrued from CTE programs at UTech institutions. This measure is useful when comparing the *monetary* return of the program. A secondary objective of the paper is to calculate wage growth, retention, and a payback period as measures of success of UTech's CTE programs.

Literature Review

Federal and state legislation changed the landscape of technical colleges in 1917 with the passage of the Smith-Hugh Act and established federal aid for technical programs. As the technological landscape of the economy changed, the social landscape of technical colleges changed in 1963; the passage of the Vocational Education Act, which modernized vocational training and put emphasis on preparing students with disabilities, low income and minority students. In 1976 with the addition of the Educational Amendment Act, gender equality was emphasized in technical education (Hayward, 1993). Although technical education has evolved over time, the overarching goal to equip students with the skill necessary for careers has remained its constant.

Harvard University Graduate School of Education conducted a national study, which examined trends and used forecast models that predict the atmosphere of the future economy. Among these results were estimates that 47 million job openings will be created in the next 10 years, and of these jobs, 30% are expected to be filled with workers that hold an associate degree or occupational certificate.(Symonds, 2011) These projections are in agreement with the most recent Bureau of Labor Statitics (BLS) employment projections. BLS projects healthcare and technology to be have the highest employment change in thousands over the next 10 years (BLS, 2016).

The largest sector of occupational growth will be healthcare due to the aging population. Over 50% of the healthcare roles will be filled by those with an occupational certificate. Fields that have experienced decline in the past decade like construction, natural resources, and manufacturing will have openings due to the aging population's retirement with an estimated 8 million jobs needing to be filled. Amongst those careers, an estimated 2.7 million jobs will require a post secondary credential. Within the roles that require a career certification, it was found that 27% of professionals earn more income than their peers who earned a bachelor's degree.

The Harvard study concluded that a widening pay gap and growing need for middle skilled labor should drive policy that encourages CTE programs modeled after Northern European nations. Austria, Denmark, Finland, Germany, the Netherlands, Norway, and Switzerland have young workforces where 40 to 70 percent opt for secondary education that includes vocational training or apprenticeship (Symonds, 2011).

Emsi, a labor market and education data science company, also conducted a national study on the return on investment for CTE programs across the U.S. system of technical colleges. The programs in the United States are then compared to other developed nations including Canada, England, and Germany. In all cases, programs in the United States showed a lag in employment and wages behind comparison groups with Germany, and England leading in career based education. Many of these countries often have vocational training that is sponsored by both private industry and the government. This study suggested that the underdevelopment of apprenticeships and career services was tied to a lack of a universally acceptable accreditation of technical colleges across the United States. In addition, a lack of availability of data within technical colleges showing potential increases in wages exists as compared to university programs. Many states, seeking to fill jobs

that require middle skill employment, have begun making changes to make CTE programs more accessible and attractive to potential students.

Emsi's study also looked at the lifetime return of individual technical colleges which varied from state to state. In Connecticut every public dollar invested in a state community college earns the state 16 times as much in the life of the certificate holder. In Washington, that figure is nine to one and in Tennessee the figure is five to one. Although the return varies, the common thread is a positive return in income tax collected over the lifetime of a certificate holder.

Social benefits were also discussed, finding that an estimated 10% increase in vocational training led to a 1.5 percentage point reduction in the youth unemployment rate. Results from both Massachusetts and California show much lower high school dropout rates when vocational education is included as part of secondary schooling. Emsi concluded that although CTE education participation was low when compared to similar economies, the revenue and social benefits of investment in CTE education had positive returns (Emsi, 2016).

A summary of CTE education in Utah, as directed by House Bill 337, was produced by the Utah Department of Workforce Services (DWS) in 2015. The study compared CTE programs with K-12 education and university or college education. Fields of interest, changes in programs, and demand from employers was presented. Highlights from the report showed CTE programs led to a higher employment rate and retention than USHE counterparts. Graduates from a university or college showed a higher dollar increase of quarterly wages. UCAT or UTech students saw an increase of wage from $3,205 a quarter to $4,410. Although the amount was smaller the growth rate was higher showing a 38% increase in wages compared to the 27% increase in wages from USHE graduates. The largest increase in wages for Utah was in transportation and material moving, a program that requires CTE certification. The report ended with projections of industry growth for the state of Utah (DWS, 2016).

Along with the report from Workforce Services (DWS), the Utah System of Higher Education reported the return on investment of their CTE programs, which included both certifications and associate degrees. The focus of the report was on programs offered by the seven CTE participating USHE institutions. The findings of the report showed an increase of annual income from $28,532 to $39,807 for certificate holders from the first year of completion to the fifth year in the workforce (Carruth, 2017). Overall job placement of 84% was reported from recent USHE CTE graduates the first year after certification. Over the lifetime of CTE graduates, an additional $131 million in tax revenue will be collected over a 30 year working career compared to those who have not completed a program. The results of the study, however, are exclusive to CTE programs offered at USHE institutions. CTE programs in both Utah studies showed an increase in wages and a decrease in unemployment. However, very little overlap exists in programs offered by UTech institutions (Carruth, 2017).To test for this overlap, a study using the Integrated Post-secondary Education Data System found that only 16 out of 535 regions in Utah, or 2%, had overlapping programs (DWS, 2016).

In addition to national and Utah reports, a California study followed students across 112 CTE institutions who serve a total of 2.6 million students statewide. The study filtered students to those receiving a certificate and looked at the change in wage by the industry of certificate. Controlling for wage trends in California, the wage growth across all certificate types showed a statistically significant increase after receiving a certificate. The increase varied from programs like business management, which saw a 10 percent wage increase, to healthcare, which saw close to a

36 percent increase after completion. This study concluded that all programs were not equal, but accounting for pre-enrollment earnings and economy wide earnings growth, CTE programs had a substantial positive effect on earnings (Stevens, 2015).

Although both state and national reports showed a positive return in career and technical education, a standardized methodology was not used to put returns in perspective. Hollenbeck, Senior Economist Emeritus for Upjohn Institute, examined several different methods to show the return on investment of CTE education. A return on investment for a financial asset, like an equity or bond, is a fairly easy concept to understand. ROI is typically calculated as a ratio of the initial investment and the future value of an investment with interest and capital gains considered. To put mathematically, ROI as a percentage is:

$$ROI = [(FV + i - IC)/IC] * 100$$

Figure 1

Where 'FV' is the future value of the investment, 'i' is interest payments, and 'IC' is the initial cost of the investment.

Hollenbeck discussed the obstacle this seemingly easy calculation presents when looking at a non-traditional investment like a state's investment in a workforce development program. Capital investments' timing becomes difficult with a work-based program as it may take years to see benefits. The benefits of work-based programs go beyond financial yields, providing social benefit as well. Human capital investment becomes difficult as the net new taxes calculation becomes more complex, as training may have resulted in lower unemployment, decrease in public assistance programs like SNAP, or a calculation of foregone earnings because of the training period. Finally, fringe benefits like insurance and 401K plans could also be considered in a calculation for the return on a state's investment in work-based programs (Hollenbeck, 2012).

Whatever calculation is used to study return on investment, consideration of future projects should be used throughout the development of the model. Consistency in methodology must exist for lawmakers to properly compare returns from one program to another. To ensure this consistency in this research's return on investment models, which will be explained more in depth in later sections, methodology was kept functionally simple.

UTech State Appropriated Budget

Funding is used to pay for the operation of campuses, salaries, new buildings, "employer-driven program expansion, equipment, student support, performance-based funding, strategic workforce investments, and scholarship programs" (UTech, 2018). Allocated, tax appropriated and other funding for 2019 totaled $103,145,700 (Utah State Legislature, 2019). Funding outside of tax appropriations come from sources like federal grants, tuition costs, fees and donations to technical colleges. Figure two shows the change in tax appropriated funding for fiscal year 2010 through 2019.

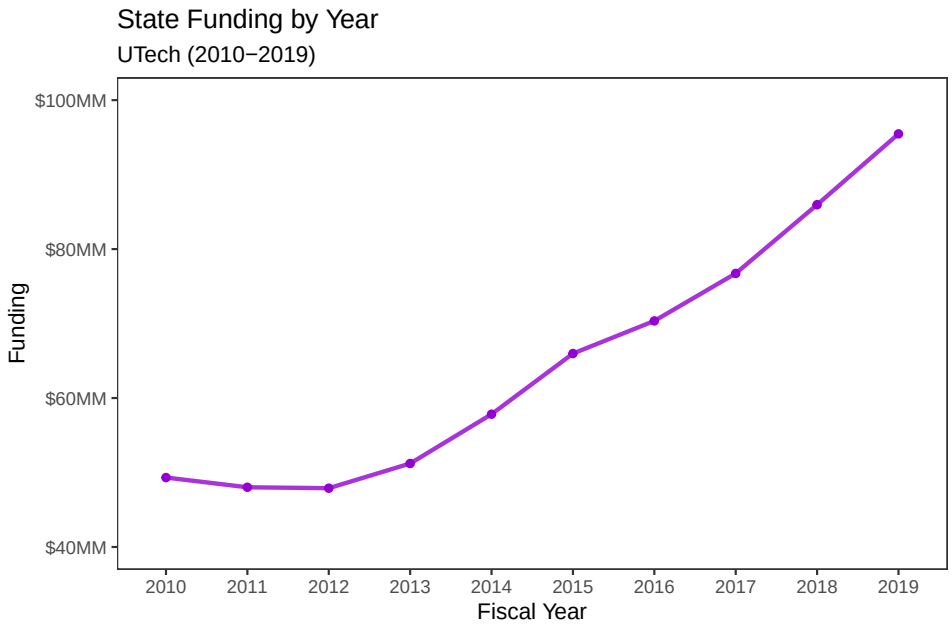

Figure 2

A portion of funding from the state budget, which is approved by the state legislature, is allocated based on UCA 53B-7-707, which dictates that funding should be allocated by the technical colleges' overall performance. This performance is determined by the UTech board of trustees and weighted on performance of certificate programs (30%), short term occupational training (10%), secondary student completion (15%), placement (25%), and college efficiencies (20%). Each category is assigned several point values which are summed to a total category score (UTech, 2017).

State funding for technical colleges has increased from $76.7 million to $84.3 million in 2017, and $93 million in 2018, or a 9.3% and 9.8% increase respectively. The budget figures used throughout this study are the tax appropriated budget. This figure is not the total budget for individual colleges. Dedicated credits have been removed for evaluation. The main source of these funds comes from tuition but may also include collections from "assessments, contributions, donations, fees, fines, licenses, penalties, rental, sales, non-federal grants, or other collections" (Utah State Legislature, 63J-1-102). Tax appropriated funding is used as it is representative of the state's investment in CTE education rather than a collection of revenues from the student body.

By using state appropriated funds only, a more accurate picture of the return on the state's investment can be observed. Included in the budget calculation is funding for administrative expenses, equipment, one-time expenses and workforce development programs like custom fit training. Not included in the budget is capital development such as construction of new facilities. A full appropriated budget table, including dedicated credits, can be referenced in the Appendix Table 1A for comparison of figures. In the 2019 budget, dedicated credits make up 7.62% of the

total appropriated budget for technical colleges. The difference between dedicated credits and total budget illustrates the need for state funds to operate and maintain the state's technical colleges. Budgets for individual technical college are referenced in the Appendix Table 1B.

UTech Certification

The increase in funding is framed to meet UTech's overarching 10-year goals. Goals include an increase in graduates, meeting economic needs, and internal inefficiencies (an increase in the number of graduates per full-time equivalent students) (UTech, 2018). These goals are in agreement with the state's executive branch's goal of 40,000 high skilled jobs in four years through Talent Ready Utah. Certification programs can vary significantly in program length. Using those that have obtained any UTech certification, a total of 6,218 unique recipients obtained at least one certification in 2017. Progress of certification has followed an upward trend, peaking in 2016 when 6,335 certifications were awarded. However, after 2016, the number of certificates awarded dropped slightly as seen in Figure 3.

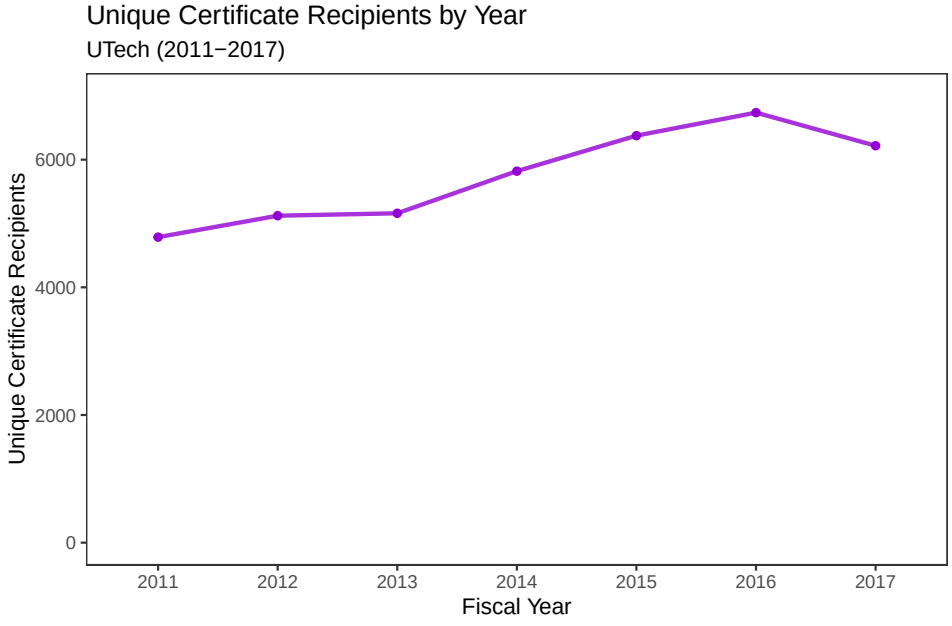

Figure 3

The recent decrease in graduates is explained by UTech as a policy change where "under old policy, students were classified as completers upon receipt of a post secondary certificate, regardless of some students' statuses as being still enrolled. Now, students are classified as graduates or non-graduates only upon

exiting their programs. This change results in a decline in graduates from FY 2016-17. The further decline from FY 2017-18 is believed to be consequent to the colleges discontinuing short-term programs in favor of longer programs" (UTech, 2018).

To accommodate increased student demand, UTech aims to place institutions that are geographically accessible to the most students possible in Utah. Institution location and expansion is mandated by state law. Primary locations are found in: Logan, Kaysville, Lehi, Ogden, Cedar City, Tooele, Vernal, and St. George. In addition to primary locations, extensions to main campuses called satellite locations are used throughout the state to expand the reach of UTech institutions.

Demograpics of UTech Certificate Holders

The racial and ethnic make-up of UTech graduates who declared race on their application is representative of the state population with 82% of graduates identifying as White. Using a two-tailed student's t-test, assuming unequal variance, the two populations (UTech graduates and general Utah population) resulted in a p-value of *.9679* indicating that the two populations do not vary. State Census Estimates for 2017 were used as the comparison group (Census, 2019).

Table 1: Racial Makeup of UTech Graduates

Cohort	Race	Graduates	% of Population	State Pop.	% of State
2017	Hispanic	818	13.57%	418,747	13.50%
2017	Asian	70	1.16%	75,691	2.44%
2017	Black	94	1.56%	37,669	1.21%
2017	American Indian	76	1.26%	32,694	1.05%
2017	Pacific Islander	34	0.56%	26,547	0.86%
2017	White	4935	81.88%	2,657,013	85.66%

Percentage of female certificate holders has historically been higher than their male counterparts with the exception of 2015. Among the graduates, 70% of males and 26% of females were employed in high-demand fields (UDRC, 2018). For certificate seeking males, the most popular area of study in 2017 was the welding technology/welder program, while the most popular area of study for females was the Medical/Clinical Assistant program.

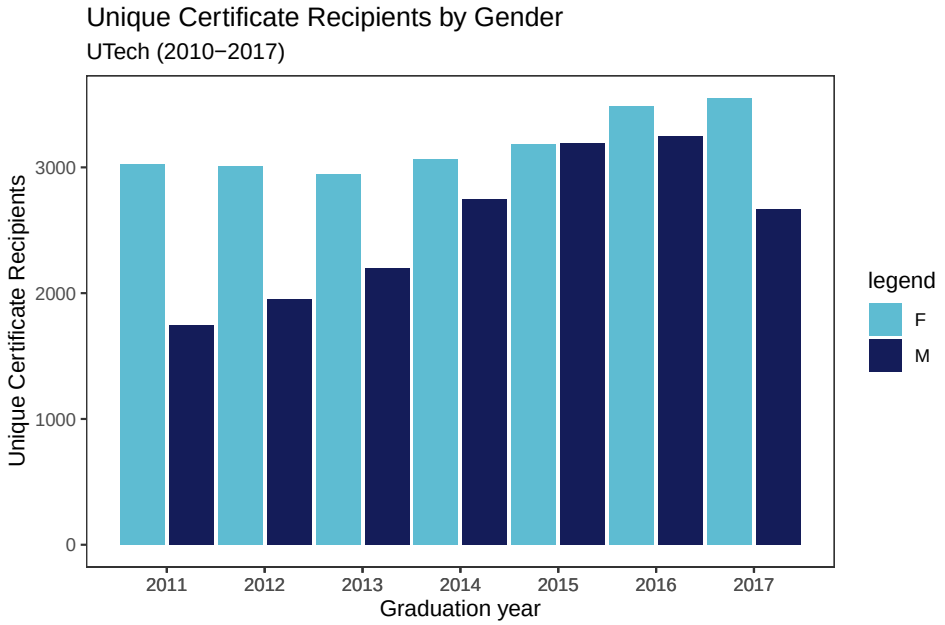

Figure 4

Age was broken into eight bins and evaluated using data from 2011 - 2017, beginning with a group younger than 21 and ending with a group over 41 years of age. From the total observations, 37.9% of graduates were under the age of 21 while 12.5% are over the age of 41. A more detailed summary of UTech graduates' ages is shown in Table 2. This contrasted to a median working age of 36.5 for Utah (Census, 2017). The national workforce median age is 42 and is expected to continue to rise over the next 10 years (BLS, 2017).

Table 2: UTech Graduates by Age

Age Bin	Graduates	Percent
Null	149	0%
> 41	5,086	12%
37-40	1,917	5%
33-36	2,433	6%
29-32	3,132	8%
25-28	4,697	12%
21-24	7,928	19%
< 21	15,462	38%

Data

Data for this study was supplied from three sources. The student data was collected by UTech and includes: student enrollment, program, demographic, and institution information. UTech certificate records is student information from 2011 - 2017 for students who have completed a UTech certificate. Wage data, from DWS unemployment insurance records, is then matched with UTech data. Additionally, the American Community Survey Public Use Micro data set (ACS Pums) is used as a comparison group for one model in the study.

Records include data from all eight UTech institutions across the state. Colleges range in enrollment size from just under 1,000 to over 5,000 students. A total headcount of secondary (27%) and post-secondary students (73%) in 2018 at UTech institutions is 34,470 students. These institutions offer a robust and diverse number of programs. (A full list can be found on individual institution websites) This record includes three groups of students receiving certificates.

After 2012, UTech narrowed completion of a certificate into three groups based on length of time needed to complete programs: certificate, certification one year, and certification two year. A certificate designation is given to students with a program length less than 900 hours or one year of classroom study, a one-year program is greater than 900 but less than 1800 membership hours; and a two-year certification program length is greater than 1,800 membership hours.

For this study, wages will be grouped by length of time to complete a certificate. Grouping will be separated by: a long-term certificate (LT) and include graduates with one-year or two-year certificates and short-term certificates (ST) are defined as graduates obtaining a certificate with less than 900 hours. This definition is used as certification types were changed from program specific certifications in 2011 to a unified certificate in 2012. In addition, by using required hours instead of certification type, this calculation excludes records that may have been misclassified in error. Wages are calculated a full calendar year prior to graduation and a year following the completion of a UTech certificate program. This measure is used to show the change of wage that is likely a direct result of the CTE certification.

Wage data includes wages from private and public companies. From the data, 4.7% of records identifying number (Master Person Index) were unable to be matched due to a missing Social Security number.A total of 93.41% of certificate records were able to be matched in the DWS wage file. Some records are not covered by the state unemployment insurance reporting requirements. The people not in records may include out-of-state employees, self-employed, and unemployed persons. The institutions, which are not included in the unemployment insurance system, may include federal government employees or religious institutions. Categorization of the data is used to gather information on demographics, program type and length of certificate.

Methodology

In order to properly calculate the change in wages of UTech graduates, an understanding of the different program lengths is necessary. The length of a certificate can vary from a few months to a much less common two-year certification. To

account for the time in school, where wages may be affected by the period where students are attending college. These foregone wages may result in a negative bias because wages may be lower while the student is progressing with certificate program studies. To avoid the potential bias toward lower than normal wages of a study year, the year prior to enrollment is used as a base wage for the comparison. In 2017, less than 1% of UTech certificate holders were a part of a two-year certification program. As such, holding to the assumption that study concludes after one year is appropriate.

Wage data is recorded for individuals on a quarterly basis by Workforce Services unemployment insurance system. Using the sum of four quarters in wage data quarterly wage is summed into a year. A summed average of all individual wages is used instead of a simple average as the objective is to first capture a complete picture of all wages earned in a given year. By first summing all wages, earnings from workers were calculated with multiple jobs rather than one wage record. This method also accounts for employees who contract with several companies in a given year, which is common in industries like trucking. After calculating, the sum of wages for each individual are then divided by the number of distinct individuals in each quarter to calculate the *summed average*. Summed averages are then added in all four quarters following graduation and subtracted by the summed average of the four quarters prior to the certification year to calculate the change; or mathematically:

$$\Delta Wage = \lceil \{\sum Q1_t +_1 (J_1 + J_2 + J_n)/n_Q 1 ... Q4_t +_1 (J_1 + J_2 + J_n)/n_Q 4\} - \{\sum Q1_t -_1 (J_1 + J_2 + J_n)/n_Q 1 ... Q4_t -_1 (J_1 + J_2 + J_n)/n_Q 4\} \rceil$$

Figure 5

One year is used as the period for wages following certification because change in wage in a longer time-period may or may not be directly related to the certification. For example, if a five-year window was used as the measurement, other events such as additional training, work experience or general economic conditions may have higher correlation to the change in wage than the prior certification. The difference of *(t+1) - (t-1)*, or the year after certification subtracted from the year prior to certification, is then multiplied by the tax rate to calculate the state's return in taxes from the student's certification. J1 + J2 + Jn are the wage records or "jobs" that each distinct person earned in that quarter. The majority of records have one entry. Q1 - Q4 in the model are to denote the time period or "quarter" the wages are summed for.

Because UTech students typically enter a certification program at a young age and with a high school education or equivalent, wages are typically lower than general wages in the Utah workforce. As a person matures in the workforce, wage is expected to rise. Testing the relationship between ages and wage showed a very significant strong positive relationship. Comparing the average wage prior to entering the program UTech students in the 2016 cohort made on average $21,789. In the same year (2015), the average resident of Utah made $42,665. This difference in income is consistent with every year of the study and tends to agree with the

assumption that wage, amongst other variables, is a function of experience and education.

Prior to 2018, the income tax rate was 5%, while the tax rate for 2018 was 4.95% (Utah State Tax Commission, 2019). To simplify for this study, the rate of 5% will be used to calculate income tax collected by the state in each period, including forecasted years. The model may be adjusted in future studies as the tax rate changes over time.

In addition to calculating the marginal taxes and wage growth from CTE programs, a *payback period* will also be presented. In finance, "the payback period is the period of time required for the profit or other benefits of an investment to equal the cost of the investment" (Hollenbeck, 2012). Typically, payback periods(PBP) are calculated as a probability distribution function to determine likely scenarios of when the investment will be paid by using the future value of projected cash flows in a feasibility study. Similar methods can be used to calculate the payback period of additional taxes collected due to increases in wage over time (Kim, 2013). This model assumes all future values of wage after time T (the year the certificate was obtained) is related to receiving a CTE certificate. In feasibility studies the payback period is typically discounted and compared to other investment options. The option with the shortest likely payback period is chosen. This study uses a simple PBP as it does not compare investment in CTE programs to alternatives.

$$PBP = \frac{InitialCashOutlay}{\sum(P_1, P_2, P_n)} \geq 1$$

Figure 6

In the simple PBP calculation, the initial cash outlay is divided but the cash flow from each period (P) until the quotient is greater than or equal to one. Typically, a PBP calculation as a measurement of success in education is inappropriate to use exclusively as additional inflows from tax is not the primary objective. However, monetary gain of students is a measurable form of success and can be a consideration when determining where to invest funds collected from various educational programs. Measured cash flow from each period is obtained by using the figures in the summed average calculation discussed earlier.

Wage Gains From CTE Certification

The calculation is initially broken into two groups: long-term and short-term certificates. As discussed in methodology, long-term certificates are defined as those taking longer than or equal to 900 membership hours (C1Y and C2Y) while short-term certificates are defined as those that take less than 900 membership hours. The 2017 cohort year is the most recent year available.

Table 3: Long-term certificate holder wage information

Cohort	Pre-Certification Wage	Post-Certification Wage	Percent Change	Dollar Difference
2011	$16,926.70	$27,001.96	59.52%	$10,075.26
2012	$18,104.18	$27,766.71	53.37%	$9,662.53
2013	$20,342.10	$29,231.25	43.70%	$8,889.15
2014	$18,814.45	$30,932.04	64.41%	$12,117.58
2015	$17,763.32	$29,705.98	67.23%	$11,942.66
2016	$18,389.78	$30,802.30	67.50%	$12,412.52
AVG	$18,390.09	$29,240.04	59.29%	$10,849.95

Average wage growth through the 2011 - 2016 cohorts from the year prior to the year after obtaining a one-year or two-year certification is 59.29% - an increase of $10,850 on average. This is comparable to the study by USHE and DWS which showed an increase of 38%. The cohort with the largest percent increase is for 2016 certificate holders at 67.5%. The smallest wage increase in the data was in 2013 with a 43.7% increase. Wages in the three most recent years were above average and have increased gradually. Standard deviation for the sample is .0385.

The calculation for short-term certificate holders, or certificates that take less than 900 membership hours to complete, are shown in Table 4:

Table 4: Short-term certificate holder wage information

Cohort	Pre-certification Wage	Post-certification Wage	Percent Difference	Dollar Difference
2011	$15,626.53	$21,076.63	34.88%	$5,450.10
2012	$17,429.06	$22,882.92	31.29%	$5,453.86
2013	$17,052.46	$24,707.97	44.89%	$7,655.51
2014	$23,200.16	$29,912.25	28.93%	$6,712.09
2015	$23,149.69	$30,127.80	30.14%	$6,978.11
2016	$21,789.30	$30,459.14	39.79%	$8,669.84
AVG	$20,042.42	$26,527.79	34.99%	$6,819.92

The change in wage is not as dramatic as would be expected, as certificates take less time to complete. This growth may be because short-term certificates often builds skills in current careers while long-term certificates are aimed at building skills for a change in industry. Employers may also value long-term certificates more than a short-term certification and be willing to pay laborers with long-term certificates higher wage. Average wage growth from the year prior to the year after obtaining a short-term certification is 34.99%. Average dollar increase is $6819.92. The largest increase occurred in 2013 at 44.89% with the smallest increase occurring in 2014 at 28.93%. The standard deviation for the sample is .0335.

For comparison, general wage growth in Utah using the same method and same time periods has varied from 3.8% to 6.2%. The average wage growth over two years (from 2011-2016) was 4.993% or $2,105.59. The standard deviation of the sample is .0086. Adjusting for this difference in statewide wage growth for the state, the growth for the 2016 UTech cohort would be 31.98% for long-term certificates (C1Y and C2Y) and 20.52% growth for short-term certificates. Growth of wages for 2016 long-term graduates outpaces general wage growth by 55%.

Additional Tax Collected from CTE Certification

An increase in income is not only beneficial to CTE program graduates, but is beneficial to the state through collection of income tax. The impact on taxes collected one year after graduation is calculated by taking the increase in wage over one year and multiplying it by the number of graduates. Because some records are not listed in the DWS wage record, the earners not found will be assigned a weighted average wage. The weight will be determined on the ratio of long-term and short-term certificate holders. This accounted for the omitted social security numbers (4.72% of data). Finally, the figure will then be inflation adjusted to 2017 dollars.

The total number of graduates was then applied to the weight and multiplied using the inflation adjusted number to 2017 dollars.(BLS CPI) (US Official Inflation Data 2019) Short- and long-term increases of wage are then multiplied by the state tax rate of 5% to calculate an estimate of the increased dollars collected in taxes one year after receiving a certificate. Table 5 shows this one year return.

Table 5: One-year Additional Tax Collected from CTE Graduates

Cohort	Graduates	LT Wage Gain	ST Wage Gain	Increased Tax
2011	4,967	$10,979.19	$5,939.07	$1,800,413.62
2012	5,379	$10,315.95	$5,822.67	$1,878,976.65
2013	5,427	$9,353.26	$8,055.21	$2,282,026.92
2014	6,069	$12,546.72	$6,949.80	$2,503,850.49
2015	6,576	$12,350.95	$7,216.67	$2,719,956.35
2016	7,056	$12,676.95	$8,854.54	$3,417,310.78

The increase in taxes collected one year after graduation was $1.8 million in 2011 and $3.41 million in 2016 (inflation adjusted for comparison). The increase in collected income tax is due to increased number of graduates over time and an increase in the change of wage from receiving a certificate. After inflation adjustment, the increase in tax revenue from 2011 to 2016 was $1,697.76 per year. For additional information in regard to wage changes per institution, refer to Appendix Table 2A which shows both one-year and five-year changes in wage.

Retention

Additional wages and taxes collected from technical college graduates were calculated one year after receiving certification. A payback period, however, potentially considers multiple years. Because of the long-term nature of the calculation, retention of graduates in the state is a factor that should be considered. Retaining workers in the state's labor force after they receive certification is important to the economic success of state and technical colleges. Providing residents of Utah with incentives to retain their talent within the state is as important as the tools needed to educate and train the workforce. An individual educated in Utah that moves to another state does not benefit the state in terms of future income tax collected.

Although the payback period function of this research assumes perfect retention, violation of this assumption would extend the time it takes for the state to realize positive return.

Retention is measured using the number of individuals in a graduating cohort as the base for the calculation. For example, if 5,000 individuals (unique records) were counted in 2014's workforce records 5,000 would be used as the denominator for each following year. At least one wage record in the year must be present to be counted. The count is then measured from one to five years following certification. In a five-year period, for example, the calculation would be unique wage records for period five divided by graduating cohort in period one.

Because only 2011-2018 records are available, five years of data is only complete for three graduating cohorts(2011, 2012, 2013). Averaging the three cohorts with equal weight show 97.3% of graduates are retained in wage records after one year. After five years, that number decreases to 86.8% retained within wage records. Because of high retention, the assumption of perfect retention is used later in the payback period.

Payback Period of CTE Programs

The payback period is another measure to gauge the return of CTE programs. Two payback period models will be used to calculate the amount of time it takes to recoup tax appropriated funds invested by the state. The first model uses the wage prior to graduation as the base wage and the comparison group is inflation adjusted by wage growth in Utah (similar to the exercise in wage growth calculation). This group is then compared to the graduating cohort's wages. The second model uses an adjusted average of adults with a high school education or equivalent as the comparison group. Similar to the first model, their difference in wages is subtracted from CTE graduates' wage to calculate the increase from certification. The first measured cohort where data is available is 2011 for both models.

Model 1

The base wage is defined as the wage earned a year prior to obtaining a UTech certification. For example, for the cohort graduating in 2015, the 2014 wage was used as a base. The base wage was adjusted using the wage growth figure for the general working Utah population. This methodology gives a more accurate picture of what a wage earner similar in age to UTech graduates had earned (mean 26.8 years). Using average wage for high school graduates captures a larger group but may capture a population at a different stage of their career. After the inflation adjustment from the base wage, CTE certificate wages were subtracted from the base wage figure to get the increase in each given year. For years that went beyond the data set, a linear average of the difference was taken starting one year after certification. For example, the 2011 cohort's first year considered is 2012. The reason for this is the increase in the first year is an outlier in a small data set, because of the additional education acquired, and would bias the remaining years in the sample. This average was then applied to each subsequent year until additional taxes paid equaled the amount of tax-appropriated funds in that given

year. Because the calculation is dependent on the average change in prior years, the methodology can only be extended to 2015 as it provides two differences to be averaged in addition to the subsequent change in a graduate's wage the following year. The results of the first calculation are shown in Table 6.

Table 6: Payback Period in years by Cohort (Model 1)

Cohort	Graduates	Budget	Payback Period
2011	4,967	$48,019,600.00	10.71
2012	5,379	$47,895,800.00	10.27
2013	5,427	$51,211,400.00	9.81
2014	6,069	$57,830,600.00	10.14
2015	6,576	$65,975,100.00	9.98

The mean payback period for 2011-2015 was 10.18 years with .34 years standard deviation. It should be considered this calculation only examines additional taxes from a one-year cohort. Additional considerations from students who may have benefited from tax appropriated funds but either did not receive a certificate or received it in a later year were not considered in the calculation. This includes students who took one course and did not pursue a certificate. Other variables like need of government assistance, additional sales tax, and additional GDP to the Utah economy were also not considered for simplicity of the model.

Model 2

The second payback model compares CTE graduate wages against reported wages using the American Community Survey (ACS). The American Community Survey is conducted annually by the Census Bureau. The survey is sent to 295,000 households a month nationally and asks questions about race, ethnicity, educational attainment, migration and disability. Weights are then applied to each respondent group to be representative of the population in their area. The survey seeks to compliment the work of the census which is only taken every 10 years. ACS uses a standard confidence interval of 90%.

Using each one-year ACS survey, data was filtered to best compare with CTE data from the UTech certificate information. Age was restricted to 18 and above to account for UTech students generally entering programs after high school. Educational attainment was limited to respondents with a high school diploma and equivalent to be used as a comparison group. Finally, respondents that reported "0" wage were excluded from the data to match wage records that were obtained for CTE graduates. Zero values were also excluded in the unemployment insurance wage record. By comparing these individuals to graduates of a CTE program and subtracting the difference, a measure of the positive impact of certification is used to calculate the payback period. The additional tax was subsequently subtracted from the original tax appropriated funds from that cohort. PUMS data from 2010 to 2017 was used. Linear estimates based on the average change were used for estimates after 2017.

Although filtering the data provided a comparison group, age bias amongst the two populations should be considered. ACS surveys are not mandatory and are given to heads of households. Due to the survey procedure, in a five-year ACS

survey for Utah (2013-2017) the average high school graduate or equivalent in the workforce was 39.2 years old (Census, 2019). This figure is significantly older than the average UTech graduate of 26.8 years old. Because of an older population and heads of households filling out surveys, expected results from those surveyed in Census data would be further along in their career, and therefore, as discussed earlier, are likely to have higher income than the younger sample. Upon testing for correlation, a very strong positive relationship (p-value $< .005$) was shown between the age of a worker and wage received. When wages from the PUMs survey are higher than CTE graduates a zero value is used for the payback period calculation in place of the negative value. In other words, higher wages from ACS respondents will not negatively affect the payback-period calculation. In addition, the payback period in the second calculation is anticipated to be significantly higher than the first due to the older sample in the PUMs data.

To correct for age bias an additional column for adjusted years was added. The adjustment function is calculated by the linear regression between wages and age for each one-year survey. Each regression showed a p-value well below the level of alpha = .05 and a standard error of approximately $30. The average adjustment figure is $503.65 a year, or in other words, as age increases, one-year salary is expected to increase by that amount. The adjusted salary is multiplied by the difference between mean ages in each group. Mean age for UTech grads are observed by the given year for the cohort and five-year average using the survey data. By standardizing age between both samples a better comparison of the two groups can be achieved. The payback period for the original calculation and adjusted calculation are shown in Table 7.

Table 7: Payback Period in Years by Cohort (Model 2)

Cohort	Payback Period	Adjusted Payback Period
2011	15.48	12.80
2012	14.29	11.82
2013	13.73	11.25
2014	12.09	10.08
2015	11.62	10.35

The adjusted figures resulted in a mean payback period of 11.26 years. Standardizing the age brought the standard deviation down by 30.28%. In addition, the adjusted value more closely resembles that of the first model. The payback periods for both the unadjusted and adjusted models are higher than that of our first model.

Discussion

The average age of a UTech certificate holder is 26.8 years old with 38% being younger than 21. Prior to certification these individuals likely have less work experience than the median aged person in the Utah's workforce who is 36.5 years old (Census, 2017). Wage prior to graduation is well below the mean wage in Utah. For example in 2015, mean wage in Utah was $42,665.39 as compared to students before certification, which was $18,390. Although wage increase for graduates is

still lower than Utah's mean wage, for some, the increase may be the difference of moving out of poverty to a living wage. This percentage wage increase for UTech students is higher than four-year programs in the state while total wage is lower (Carruth, 2017).

The benefits to the state not only include higher wages for the residents, but also additional income tax collected by the state. The expansion of available certificates within UTech has led to additional graduates in most years. In addition, adjusting for inflation wages have also rose over time. These two factors have led to an increase in estimated taxes from certificate holders.

Additional taxes summed over years resulted in a payback period calculation estimated between 10.18 years and 13.44 years. Assuming a person works consistently from 18 to 65, adults may spend 47 years in the workforce. Additional taxes gained after the initial funding is paid back can be reinvested into other programs in the state. Long-term retention, after five years, was not available for this study due to the lack of availability of data prior to 2011, which may affect additional taxes collected over time. Looking forward to years not included in the study, due to increased funding and a decreased number of graduates in 2016, it is likely that the payback period for those cohorts would increase.

Conclusion

Return from CTE programs can be measured in a variety of ways. Prior research has shown the benefit of CTE education using measures like wage increase, state return on taxes, societal benefit, and GDP change. Although there is value in measuring the positive impacts in CTE education, this report is limited to showing growth of wages from certificate holders and a payback period from tax appropriated funds. The reason these measures were chosen is that they can easily be duplicated to compare UTech programs with other institutions, CTE programs, apprenticeships, and university or college education.

Positive return from CTE graduates were observed from both long-term certificate holders at 59.29% and 34.99% for those with short term certificates. As UTech students made significantly less than the average wage in the state prior to entering their program, percentage growth is high. The additional income after attaining a certificate may also affect dependence on others or government welfare programs. This growth is significantly higher than general wage growth for high school graduates and the general Utah population. Compared to USHE's CTE program, long-term certificate wage growth is similar to their CTE programs.

Additional tax collected has increased even when wages are standardized for inflation. This increase over time is due to additional graduates over time and increased wage. Comparing taxes one year after graduation from one year prior to enrollment, an additional $3.41 million was collected in 2016. This number has increased drastically from the $1.8 million collected in 2011.

Tax appropriated budgets have increased from $49.32 million to $95.46 million from 2011 to 2019 for UTech (UTech, 2018). The first model (2011-2015) showed an average payback period of 10.18 years. When an age-adjusted PUMs data is used, the payback period is 11.26 years; without adjustment, for age the figure increases to 13.44 years. The data available for this study was limited to

cohorts dating back to 2011. The limited years of wage data suggested a linear trend in wage growth for technical colleges. Long-term studies suggest that wage growth eventually plateaus (Kim, 2019) and as more data becomes available, different models should be considered.

CTE education through UTech programs increases wages for students at a statistically significantly higher rate than normal Utah wage growth and, as a result, increase taxes collected by the state over time.

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Appendix

*UTech student survey respondents that selected multiple races were excluded from the table to simplify results. Census data classifies two or more races into one category while UTech allows for multiple selections of any of their 6 race categories. In 2017, of the 6,218 respondents of race, 1.9% of respondents selected multiple races from 14 different combinations. To bring unity to the two surveys two or more races were omitted from the results.

**Calculation for wage growth was separated into two categories over 899 membership hours and less than 900 membership hours. The separation is based on UTechs definition of a short-term and long-term certificate. Designations of long-term and short-term certificate are also given under the u_cert_type field, however, 125 entries were labeled in error in long-term degrees and 63 in short-term degrees. Data for 2011 is provided but C1Y, CY2 and CER designations were categorized in a much more complex system to mirror USHE institutions. These designations were discontinued in 2012. To add unity to the calculation and account for errors, the column u_req_hours was used as a measure of long-term and short-term degrees.

TABLE 1A - Tax Appropriated budget and Total Budget per year

Fiscal Year	State Funding	Total Budget
2010	$44,343,300	$49,323,700
2011	$48,019,600	$53,941,000
2012	$47,895,800	$54,286,200
2013	$51,211,400	$57,974,400
2014	$57,830,600	$65,206,700
2015	$65,975,100	$73,092,600
2016	$70,355,700	$77,473,200
2017	$76,734,000	$83,504,700
2018	$85,962,400	$93,046,600
2019	$95,468,300	$103,107,200

TABLE 1B - Budgets by Institutions per Year

Institution Name	Fiscal Year	Budget	Students
Bridgerland	2010	$8,128,600	7,525
Davis	2010	$8,081,800	8,637
Dixie	2010	$1,929,100	5,841
Mountainland	2010	$4,350,300	5,453
Ogden Weber	2010	$8,502,600	5,969
Southwest	2010	$2,262,200	2,559
Tooele	2010	$928,100	394
Uintah Basin	2010	$4,681,400	6,146
Bridgerland	2011	$8,814,500	7,108

Institution Name	Fiscal Year	Budget	Students
Davis	2011	$9,256,200	8,322
Dixie	2011	$2,016,300	6,539
Mountainland	2011	$4,792,700	4,733
Ogden Weber	2011	$10,346,300	5,592
Southwest	2011	$2,206,000	1,993
Tooele	2011	$946,600	450
Uintah Basin	2011	$4,866,700	6,755
Bridgerland	2012	$8,725,000	6,577
Davis	2012	$9,177,700	7,579
Dixie	2012	$2,005,300	6,679
Mountainland	2012	$4,946,700	4,051
Ogden Weber	2012	$10,320,900	5,359
Southwest	2012	$2,192,900	1,915
Tooele	2012	$936,700	444
Uintah Basin	2012	$4,824,700	6,733
Bridgerland	2013	$9,146,000	5,990
Davis	2013	$9,947,800	6,292
Dixie	2013	$2,271,600	7,093
Mountainland	2013	$5,311,300	3,797
Ogden Weber	2013	$10,472,500	5,227
Southwest	2013	$2,462,500	1,433
Tooele	2013	$1,337,400	431
Uintah Basin	2013	$5,191,900	5,709
Bridgerland	2014	$10,099,700	5,582
Davis	2014	$10,963,000	5,869
Dixie	2014	$2,774,700	6,423
Mountainland	2014	$6,087,400	3,740
Ogden Weber	2014	$11,690,100	4,952
Southwest	2014	$2,975,400	1,541
Tooele	2014	$2,602,100	607
Uintah Basin	2014	$5,839,900	5,890
Bridgerland	2015	$10,925,600	5,306
Davis	2015	$12,183,800	6,246
Dixie	2015	$3,427,700	7,644
Mountainland	2015	$8,232,200	4,184
Ogden Weber	2015	$12,574,900	5,424
Southwest	2015	$3,389,500	1,508
Tooele	2015	$3,002,500	641
Uintah Basin	2015	$6,377,100	5,240
Bridgerland	2016	$11,371,800	5,709
Davis	2016	$13,057,900	6,007
Dixie	2016	$3,962,800	10,097
Mountainland	2016	$9,795,400	4,241
Ogden Weber	2016	$12,816,300	5,835
Southwest	2016	$3,997,600	1,884
Tooele	2016	$3,065,100	745
Uintah Basin	2016	$6,699,600	4,467
Bridgerland	2017	$11,995,800	5,690
Davis	2017	$13,747,000	6,039
Dixie	2017	$4,844,100	4,634

Institution Name	Fiscal Year	Budget	Students
Mountainland	2017	$10,417,300	4,293
Ogden Weber	2017	$13,442,200	5,500
Southwest	2017	$4,756,800	2,308
Tooele	2017	$3,378,400	805
Uintah Basin	2017	$7,133,000	3,967
Bridgerland	2018	$13,494,700	6,082
Davis	2018	$15,405,100	5,841
Dixie	2018	$6,738,200	5,212
Mountainland	2018	$11,592,000	4,420
Ogden Weber	2018	$15,738,800	5,641
Southwest	2018	$5,046,700	2,253
Tooele	2018	$4,109,000	868
Uintah Basin	2018	$7,910,500	4,153

TABLE 2A - Cohort 2013 Change in Wage by Institution

Institution Name	Year	Wage	Change
Bridgerland	2012	$24,094.92	
Bridgerland	2014	$26,886.81	12%
Bridgerland	2018	$42,043.76	74%
Davis	2012	$15,577.83	
Davis	2014	$23,770.89	53%
Davis	2018	$36,938.45	137%
Dixie	2012	$38,960.12	
Dixie	2014	$57,958.67	49%
Dixie	2018	$86,888.62	123%
Mountainland	2012	$12,714.27	
Mountainland	2014	$21,408.27	68%
Mountainland	2018	$34,346.64	170%
Ogden Weber	2012	$24,094.92	
Ogden Weber	2014	$28,946.11	20%
Ogden Weber	2018	$41,720.49	73%
Southwest Tech	2012	$13,310.22	
Southwest Tech	2014	$20,971.28	58%
Southwest Tech	2018	$31,007.15	133%
Tooele Tech	2012	$15,894.32	
Tooele Tech	2014	$26,342.46	66%
Tooele Tech	2018	$38,442.96	142%
Uintah Basin	2012	$22,970.96	
Uintah Basin	2014	$34,609.02	51%
Uintah Basin	2018	$41,086.27	79%

TABLE 2B - Cohort 2012 Change in Wage by Institution

Institution Name	Year	Wage	Change
Bridgerland	2011	$19,319.95	
Bridgerland	2013	$26,455.47	37%
Bridgerland	2017	$39,740.47	106%
Davis	2011	$13,531.79	
Davis	2013	$20,465.26	51%
Davis	2017	$31,286.58	131%
Dixie	2011	$48,664.61	
Dixie	2013	$55,995.40	15%
Dixie	2017	$77,506.95	59%
Mountainland	2011	$12,981.12	
Mountainland	2013	$19,283.47	49%
Mountainland	2017	$32,222.08	148%
Ogden Weber	2011	$20,910.90	
Ogden Weber	2013	$26,254.90	26%
Ogden Weber	2017	$38,161.86	82%
Southwest Tech	2011	$12,340.78	
Southwest Tech	2013	$23,854.44	93%
Southwest Tech	2017	$29,633.57	140%
Tooele Tech	2011	$22,404.35	
Tooele Tech	2013	$26,413.49	18%
Tooele Tech	2017	$35,437.24	58%
Uintah Basin	2011	$23,308.85	
Uintah Basin	2013	$35,070.85	50%
Uintah Basin	2017	$40,709.27	75%

TABLE 2C - Cohort 2011 Change in Wage by Institution

Institution Name	Year	Wage	Change
Bridgerland	2010	$18,314.47	
Bridgerland	2012	$27,211.70	49%
Bridgerland	2016	$38,536.53	110%
Davis	2010	$12,708.79	
Davis	2012	$19,322.22	52%
Davis	2016	$29,521.48	132%
Dixie	2010	$34,476.32	
Dixie	2012	$40,745.73	18%
Dixie	2016	$56,288.30	63%
Mountainland	2010	$11,946.30	
Mountainland	2012	$18,094.90	51%
Mountainland	2016	$29,574.39	148%
Ogden Weber	2010	$21,421.24	
Ogden Weber	2012	$26,828.06	25%
Ogden Weber	2016	$42,625.63	99%
Southwest Tech	2010	$11,541.59	
Southwest Tech	2012	$20,605.03	79%
Southwest Tech	2016	$30,277.83	162%
Tooele Tech	2010	$20,759.55	

Institution Name	Year	Wage	Change
Tooele Tech	2012	$36,997.90	78%
Tooele Tech	2016	$55,457.54	167%
Uintah Basin	2010	$15,909.00	
Uintah Basin	2012	$31,378.37	97%
Uintah Basin	2016	$40,682.25	156%