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Post Program Earnings Differences Between the Associate in Applied Science and Applied Baccalaureate Degrees:

Companion Report to “Applied Baccalaureate Degree: Policy and Outcomes Evaluation”

Gainful employment and earnings to support a family living are significant policy goals of the applied baccalaureate program. Therefore, employment is an important metric to study; however, there are limitations in the data and process used in past reports that make understanding the true impact of applied baccalaureate programs on an individuals’ earnings difficult to discern. In past years this report has matched graduates with their employment outcomes two years (or seven quarters) following degree completion. The purpose of the 2 year lag was to give graduates time to find a job that was in alignment with their applied baccalaureate degree field, and therefore capture earnings growth at that level. In addition to the snapshot employment rate, graduates who were employed at the time of graduation were also evaluated for increases in median earnings seven quarters following their last quarter enrolled. The purpose of this analysis was to gauge growth in earnings as a function of earning the BAS degree. While the extended length of time and comparison to earlier earnings may potentially show gains more reflective of the applied baccalaureate degree, the paradox is the potential for movement and unknown variation that could impact the employment rate.

Aside from challenges stemming from employment record data, this methodology does not address a question of growing policy significance which is the economic return of an applied baccalaureate degree above and beyond an associate in applied science degree. The question of return on investment for college has been debated nationally for the past several years through the intersecting elements of rising tuition costs, greater accountability for higher education, and the completion agenda. For Washington State, understanding the impact of applied baccalaureate degrees for graduates is particularly critical for the CTC system in the context of the Washington Student Achievement Council’s (WSAC) Road Map goal of 70 percent educational attainment and the role in increasing baccalaureate degree attainment (State Board for Community and Technical Colleges 2015).

The goal of this paper is to analyze the return on investment for students who go on to earn an applied baccalaureate degree as compared to a comparison group of graduates who have the same associate degree but no applied baccalaureate degree. An individual’s characteristics that could impact their earnings outcomes above and beyond degree type are also taken into consideration in the analysis, as described in the literature review on the value-added from higher education summarized in the next section.

Previous Research

There have been numerous studies on the impact or effect of a vocational degree or certificate path on earnings. These have taken shape as a way to compare the value-added by attending a community college versus not going at all (compared to high school only graduates) (Paterson and Weeks 2015a); the value-added by different types of vocational training (associate degree versus bachelor’s degree), and certainly the most prevalent and widely reported studies show the value-added by all types of post-secondary education, from a certificate all the way to professional education at the doctorate level (Carnevale, 2011; Baum 2014).

The outcome of interest that typically serves as the benchmark of the value of a post-secondary credential is earnings



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within a year following completion of the degree program. These have been studied a couple of different ways from simple descriptive comparisons, to fixed regression effects, to quasi-experimental design using propensity score matching techniques. In each case, the goal is to find an un-biased comparison group in order to measure the impact of the credential on the student's future earnings while controlling for other factors. Researchers take characteristics into account that could potentially have an unobserved impact on a student's future earnings; for example, prior work history. Carnevale (2011) found that while college major appears to have the greatest impact on future earnings, work experience improves earnings in any major over time. Prior academic history and proficiency have also been identified as a factor contributing to earnings above and beyond type of degree program (Jaggars and Xu 2015). Dadgar and Trimble (2014) note that the main unobservable factor that can impact future earnings (success) is ability, and therefore suggest that a proxy for academic proficiency is an important control for any model attempting to evaluate program impact.

Gender is another factor for which differences have been observed, mainly within the impact of each type of credential (short certificate, long certificate, or associate degree). The differences are substantial enough and interact with the type of program that estimates for earnings value added are almost always done separately for males and females (Paterson and Weeks 2015a; 2015b). Similarly, multiple studies have observed significant variation in earnings dependent on the field of study, so much so that it too should be estimated separately (Grubb 1999; Dadgar & Trimble 2014). Kerkhoff and Bell (1998) found program to be the most powerful contributor to the differences in earnings of high school graduates versus those with a vocational credential, above and beyond gender. Carnevale (2011) found STEM majors showed the highest earnings from a bachelor's degree; however, Paterson and Weeks (2015b) also found that simply comparing the post-program earnings of STEM and non-STEM majors may overstate the impact of the degree on the STEM majors, because it is likely that, given the characteristics of students within that field, those students may have done well in any other type of degree program as well.

Methodology

The study uses a form of quasi-experimental design called inverse propensity score weights to create comparison groups to serve as the counterfactual for applied baccalaureate graduates. In other words, what would earnings in the given program have been had the student not gone through the extra time and resource to complete the baccalaureate program. Propensity score matching is a popular method to use for evaluating program effect because:

- It is designed to lessen the unknown bias that is introduced when there is no pure comparison group (Weeks and Paterson 2015a)
- It allows researchers to re-create an experimental design to estimate the impact of the "treatment" on the treated
- It does not require a complicated set of models to control the effects, as the groups are normalized to each other before comparing the final outcome
- For workforce outcomes, it does not require introducing the unknown bias that can take place when only people with pre and post wages are compared (Trimble and Dadgar 2014).

As discussed in prior research studies, because students who complete an associate degree as their terminal degree may be fundamentally different than students who complete a bachelor's degree, it is possible that the observed difference in earnings is related in some way to those characteristics, rather than just the type of degree program. A way to control for the unknown impact of these differing group characteristics on graduate's earnings is to create balance between the two groups so they function as they would in a random assignment experiment with a treatment and control group. In theory, if the characteristics of the two groups are the same, the type of degree is the only remaining factor to associate to earnings.

This study addresses the following questions:

Research questions

- I. Does having an applied baccalaureate degree result in higher earnings than the associate degree alone?
- II. Does the return to investment in earnings differ by field of study?



III. Do the target populations for applied baccalaureate degrees (historically underserved students) benefit from applied baccalaureate degrees in the same way as their peers?

Data

An initial comparison group was compiled for each type of applied baccalaureate degree program, which was comprised of students who earned the same type of associate degree as their applied baccalaureate counterparts, but who had not gone on to complete the bachelor’s program (see Appendix A for degree program detail). This included graduates from between the years 2008-09 and 2013-14. The characteristics (covariates) that could be a factor in the observed differences in earnings between associate and baccalaureate degree graduates were gathered from CTC records, and the resulting list was matched to ESD employment records for the 3 quarters following completion.

Graduates who did not have a social security number for employment matching were removed from the sample, as well as any graduate who did not have an employment record within the 3 quarters following completion. Graduates with annual earnings greater than \$100,000 were also removed as their earnings are outliers from the normal distribution of the overall sample. See Appendix A for more detail on the propensity score matching process.

Results

The final numbers in the sample of associate and baccalaureate degree completers are displayed in Table I below, along with their characteristics. In order to make the groups as comparable as possible, the characteristics were gathered based on the time period of the associate degree program. For example, the time period for measuring work experience for a student who ultimately completed a baccalaureate degree was the 3 quarters prior to the start of their associate degree program.

Table I. Characteristics and Earnings Outcomes by Terminal Degree Type

Characteristics	Associate	N	Baccalaureate	N
Age	30.16	1,771	33.99	281
Final GPA	3.36	1,771	3.47	281
Family Status (Parent)	0.23	1,771	0.27	281
Working prior to enrollment	0.50	1,771	0.65	281
Gender	0.63	1,771	0.71	281
Student of Color	0.85	1,771	0.80	281
Prior bachelor degree	0.09	1,771	0.04	281
Mean Post Program Earnings	27,668	1,771	38,953	281
Median Post Program Earnings	23,540	1,771	33,237	281

Upon review of Table I, it appears that students who complete just an associate degree differ from those who continue on to complete an applied baccalaureate degree according to some characteristics. Applied baccalaureate degree graduates are on average older, graduate from their associate degree program with a higher GPA, are more likely to be a parent, are more likely to have been working prior to enrollment in their associate degree program, are more likely to be female, less likely to be a student of color, and are less likely to have already completed a bachelor’s degree prior to enrolling in their associate degree program. Applied baccalaureate degree students also show higher mean and median earnings within a year following completion. Table 2 below demonstrates the results of the actual impact of degree type on earnings, after balancing the group mean characteristics to make them comparable, and estimating the treatment effect through a weighted linear regression model. See Appendix B for group means before and after weighting by program.



Table 2. Average Effect of Baccalaureate Degree Program on Earnings by Field of Study

	Mean Weighted Earnings		Model Statistics			
	Associate Degree	Baccalaureate Degree	Model R Square	Beta for Type of Degree	Sig. (p-value)	Additional significant predictors**
Bellevue: Interior Design	24,429	29,631	0.068	0.332	0.602	None
Bellevue: Radiology	49,326	76,113	0.387	0.562	*0.000	Gender
Lake Washington: Applied Design	29,964	40,239	0.303	0.199	*0.000	Parent, prior work experience, gender, and prior bachelor's degree
Peninsula: Management	20,448	29,171	0.248	0.260	*0.000	None
Columbia Basin: Management	29,503	33,185	0.097	0.111	0.150	None
Olympic: Nursing	45,621	58,296	0.267	0.348	*0.000	Parent
Seattle Central: Behavioral Science	23,968	30,886	0.226	0.234	*0.002	Prior work experience
South Seattle: Hospitality	20,909	31,930	0.228	0.433	*0.000	None

*Sig. (1-tailed) < .05; Tolerance > .5

The results in Table 2 demonstrate that the impact of the baccalaureate degree program on earnings varies by program. Columbia Basin’s applied management program shows no relationship between earnings and any of the covariates, including type of degree program. Due to significant variation in the types of degree programs that the applied baccalaureate graduates earned prior to entering the program, the matched sample for this study was limited to business degree students only. It is possible that the impact of the baccalaureate degree would be different if for example a matched sample of students completing the Associate in Arts degree was evaluated. Consequently, these results should not be generalized to the whole management program, but only within the context of the business degree.

Similarly, Bellevue’s Interior Design program shows no significant difference in earnings between associate degree only and baccalaureate degree earners. In addition to type of degree program, no other covariates (from Table 1) explain any significant variation in the small difference in earnings between the different types of graduates for that program. One possible explanation for this finding is students may pursue Interior Design as a secondary degree program at both associate and applied baccalaureate degree levels, for non-economic reasons. As noted in Table B.1, as compared to any other type of baccalaureate degree program, both types of students are more likely to enter their program already having earned a bachelor’s degree as well as more likely to have been working prior to their first enrollment.

Bellevue’s other program in the study, Radiology, shows a very different pattern in that baccalaureate graduates are significantly more likely to have higher earnings as compared to the associate degree alone. Type of degree program was the greatest factor in explaining the variance in earnings; however, even with the weighting effect to balance the impact of the covariates, gender was a significant factor as well. A further analysis showed that male baccalaureate graduates were earning significantly higher wages than their female counterparts within a year after completion (average of approximately \$91,000 annual earnings compared to \$70,000, respectively).

Lake Washington’s Applied Design program showed a different pattern for factors explaining earnings. Type of degree program had a significant effect on earnings, but higher earnings were also associated with students who were parents, were working prior to enrollment in their associate degree program, were male, and those students who already had a bachelor’s degree prior to starting their program. This suggests that experience, both academic and work, play a significant role in earnings in addition to the baccalaureate degree itself. It is also possible that there is significant variation in expected outcomes among the types of associate degrees that were included in the study.



As noted in Appendix B, baccalaureate degree graduates came from a variety of six different types of associate degrees as their starting program. Recent studies by Carnevale, Jayasundera, and Gulish (2015) as well as Baum (2014) argue that analyzing earnings by occupation rather than industry is a more comprehensive way to understand patterns of growth over time. This study assumes one “industry” for all six types of associate degree only graduates (applied design) by comparing their earnings outcomes to the baccalaureate graduates. However, in reality, those associate degree programs may serve fundamentally different occupations, thus the relevance of an applied baccalaureate degree may differ based on the occupation more so than in a more unidimensional field, such as nursing.

The results of Olympic’s Nursing program show type of degree to be the most significant factor in explaining the difference in earnings, along with parental status. Similar to Lake Washington’s program, even though baccalaureate degree graduates have higher earnings, students who have more life experience (are parents) are likely to have higher earnings as well regardless of degree program. Similarly, Seattle Central’s Behavioral Science program shows a significant difference in earnings for baccalaureate degree graduates. Of all of the graduates in this study, students from this program are on average the oldest, both in the associate degree only and baccalaureate degree groups. In addition to type of degree program, prior work experience is also a significant factor in higher earnings, regardless of type of degree program. Finally, in both South Seattle’s Hospitality program and Peninsula’s Applied Management program, differences in earnings are explained by degree type alone. This suggests that having a baccalaureate degree in those fields is a worthwhile return on the time and money investment above and beyond an associate degree.

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Appendix A. Methodology and Data Definitions

The impact of the covariates on earnings by degree type is balanced to create equal group means using an inverse propensity score weighting methodology, where applied baccalaureate degree graduates are the treatment group and the associate degree graduates serve as the control group to estimate the average treatment effect on the treated (ATT). Logistic regression is used to calculate the probability (p) of being in the treatment group, which is used to create a weighting factor (w) to be applied to the control group as follows:

- Treated, $w = 1$
- Control, $w = \frac{p}{1-p}$

The treatment effect (baccalaureate degree) on earnings is then estimated using the weighting variable from the formula above (IPW) applied in a weighted linear regression model along with the significant covariates for double robustness. Meaning, this allows the effect of program type of earnings to be estimated along with the additional explained variance of covariates. Each type of applied baccalaureate program is estimated separately (see Appendix B for group characteristics before and after weighting by program).

College	Baccalaureate Degree	Type of Associate Degree for Control Group
Seattle Central	BAS Applied Behavioral Science	AAS Social and Human Services
South Seattle	BAS Hospitality Management	AAS Catering Banquet Restaurant Baking
Olympic	Bachelor of Science in Nursing	ATA Nursing
Bellevue	BAA Interior Design	AA Interior Design/Studies
Bellevue	BAS Radiation and Imaging Science	AA Radiation Therapy; AA Radiologic Technology;
Lake Washington	BTAD Applied Design	AAS(T) Architectural Graphics; AAS Digital Gaming & Media; AAS ENGR Graphics Design Emph; AAS Multimedia Design and Production; AAS Video and Web Production; Animation Game Design
Columbia Basin	BAS in Applied Management	AAS Business Administration
Peninsula	BAS Applied Management	AAS Office Administration; AAS Business Administration; Associate in Arts-DTA;

Covariate	Data Label	Code
Type of Degree Program	Associate Degree	0
	Baccalaureate Degree	1
Age	Age as of associate program start	Continuous (included as quadratic terms in propensity estimations and multivariate regression models)
GPA	Final associate degree GPA	Continuous (included as quadratic terms in propensity estimations and multivariate regression models)
Family status	Not a parent	0
	Parent	1
Prior work experience	No employment record 3 quarters prior to start of associate degree program	0
	Employment record 3 quarters prior to start of associate degree program	1
Gender	Male	0
	Female	1
	Unknown	2
Student of Color	Non-white	0
	White	1
Prior bachelor's degree	Prior_ed status (SMIS_STUDENT) not 17	0
	Prior_ed status = 17	1

Appendix B: Pre and Post Weighted Covariate Means by Program

B.1 Bellevue Interior Design

	Pre-Weight		Post-Weight	
	Associate	Baccalaureate	Associate	Baccalaureate
Age	32.96	31.44	31.59	31.44
GPA at graduation	3.43	3.51	3.52	3.51
Has Children	0.25	0.07	0.07	0.07
Working prior to enrollment	0.63	0.68	0.67	0.68
Gender	0.93	0.90	0.89	0.90
Student of Color	0.86	0.95	0.95	0.95
Bachelor Degree before program	0.27	0.22	0.24	0.22
Earnings	24,834	29,631	24,429	29,631

B.2 Bellevue: Radiology

	Pre-Weight		Post-Weight	
	Associate	Baccalaureate	Associate	Baccalaureate
Age	32.80	33.60	33.68	33.60
GPA at graduation	3.60	3.58	3.60	3.58
Has Children	0.26	0.28	0.28	0.28
Working prior to enrollment	0.70	0.80	0.79	0.80
Gender	0.62	0.72	0.72	0.72
Student of Color	0.78	0.88	0.88	0.88
Bachelor Degree before program	0.25	0.00	0.00	0.00
Earnings	51,200	76,113	49,326	76,113

B.3 Lake Washington: Applied Design

	Pre-Weight		Post-Weight	
	Associate	Baccalaureate	Associate	Baccalaureate
Age	29.37	31.32	31.50	31.32
GPA at graduation	3.60	3.74	3.74	3.74
Has Children	0.21	0.24	0.25	0.24
Working prior to enrollment	0.55	0.57	0.57	0.57
Gender	0.30	0.38	0.39	0.38
Student of Color	0.87	0.84	0.83	0.84
Bachelor Degree before program	0.10	0.03	0.03	0.03
Earnings	28,864	40,239	31,007	40,239

B.4 Peninsula: Management

	Pre-Weight		Post-Weight	
	Associate	Baccalaureate	Associate	Baccalaureate
Age	25.23	33.33	33.67	33.33
GPA at graduation	3.12	3.30	3.30	3.30
Has Children	0.14	0.18	0.18	0.18
Working prior to enrollment	0.32	0.55	0.56	0.55
Gender	0.64	0.66	0.65	0.66
Student of Color	0.93	0.95	0.95	0.95
Bachelor Degree before program	0.00	0.00	0.00	0.00
Earnings	16,364	29,171	20,448	29,171

B.5 Columbia Basin: Management (limited to students receiving a prior business degree)

	Pre-Weight		Post-Weight	
	Associate	Baccalaureate	Associate	Baccalaureate
Age	34.77	35.64	35.67	35.64
GPA at graduation	3.06	3.08	3.09	3.08
Has Children	0.32	0.28	0.27	0.28
Working prior to enrollment	0.64	0.79	0.80	0.79
Gender	0.67	0.66	0.66	0.66
Student of Color	0.70	0.66	0.65	0.66
Bachelor Degree before program	0.01	0.00	0.00	0.00
Earnings	27,618	33,185	29,767	33,185

B.6 Olympic: Nursing

	Pre-Weight		Post-Weight	
	Associate	Baccalaureate	Associate	Baccalaureate
Age	34.25	33.29	33.13	33.29
GPA at graduation	3.64	3.54	3.56	3.54
Has Children	0.37	0.40	0.39	0.40
Working prior to enrollment	0.52	0.57	0.54	0.57
Gender	0.86	0.83	0.83	0.83
Student of Color	0.91	0.83	0.80	0.83
Bachelor Degree before program	0.14	0.07	0.07	0.07
Earnings	45,840	58,296	45,621	58,296

B.7 Seattle Central: Behavioral Science

	Pre-Weight		Post-Weight	
	Associate	Baccalaureate	Associate	Baccalaureate
Age	39.85	41.08	41.27	41.08
GPA at graduation	3.43	3.52	3.52	3.52
Has Children	0.46	0.50	0.50	0.50
Working prior to enrollment	0.65	0.71	0.70	0.71
Gender	0.71	0.79	0.78	0.79
Student of Color	0.46	0.50	0.49	0.50
Bachelor Degree before program	0.02	0.00	0.00	0.00
Earnings	23,563	30,886	23,968	30,886

B.8 South Seattle: Hospitality

	Pre-Weight		Post-Weight	
	Associate	Baccalaureate	Associate	Baccalaureate
Age	30.32	29.30	29.38	29.30
GPA at graduation	3.37	3.42	3.42	3.42
Has Children	0.20	0.19	0.16	0.19
Working prior to enrollment	0.62	0.59	0.61	0.59
Gender	0.61	0.70	0.70	0.70
Student of Color	0.87	0.81	0.81	0.81
Bachelor Degree before program	0.13	0.00	0.00	0.00
Earnings	21,710	31,930	20,909	31,930