Does college pay off? Exploring the differences in salary by educational level and occupation.

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Abstract

As education cost keep on rising, the question remains of whether continuing education to the highest level is worth it. This study examines the salary differences among employees with same occupation but with different educational level using the most recent data from a longitudinal survey of Aston Carter Staffing Company employees. The final sample consisted of 276 individuals. We conducted a two-way between factorial ANOVA to test for mean differences in salary among employees who had a high school, bachelor or doctorate educational background and their occupation. Our results show that employees with employees with higher educational level such as the doctorate and bachelor’s degree earn significantly higher salary than high school graduates in the same occupation. The evidence strongly suggests that continuing educational to the highest level is worth it as the salary gap between educational level is present among employees even in the same occupation.

Introduction

Economic opportunity depends on having a college degree, as individuals with qualifications earn significantly more than those lacking. In today's job economy, education is becoming incredibly essential. Numerous studies from dozens of nations and eras have shown that those with higher levels of education had better earnings, lower unemployment rates, and more prestigious jobs than those with lower levels of education. However, there is ongoing discussion about whether education is worthwhile due to rising educational costs in both political and academic areas. This suggest the need for ongoing research, using evidence to delve into the issue and determine the extent to which the educational level and occupation influences the salary is still pertinent.

According to Becker's human capital theory, which views schools as institutions for the production of human capital, there is a relationship between education, productivity, and wages (1964). In the Human Capital theory, higher educational level gives employees more earnings. Knowledge, skills, abilities, which people get in process of education improve their productivity (Ibid). They viewed education as a good investment in this literature, allowing a person to accrue human capital in order to receive a higher salary subsequently.

Another study investigating a sample size of 100 conducted a simple linear regression and revealed that there is a positive relationship between education and wages differentials and that they may be other factors such as occupation that may account for the differences in wages among the various educational categories (Enu et al, 2014, p.292).

Baum also argues that there are significant differences in earnings premiums and earnings premiums across occupations and in addition to being influenced by geographic factors, there are other factors present too as students with specific majors enter a diverse range of professions and employees in most occupations come from a diverse educational background (2014, p.3). Also, those with any level of postsecondary education, including those without credentials, and those with only a high school diploma have considerable variations in average salaries (p.7). Another research conducted a correlation study and revealed that there is a strong relationship between salary earned and education and concluded that employees with a higher educational level earn more income (Wolla et al., 2017, p.2).

Other scholars however posit that a higher level of education does not guarantee higher salary, while less education does not always result in lower salary and contends that differences in the salary can be explained by the different educational degrees in different fields of study as well as their profession (Carnevale et al., 2021, p. 4)

Fan et al., (2019) conducted a study on a sample of 245 performed a series of one-tailed independent samples t tests to examine whether male graduates' wages were substantially higher than female graduates' wages with same degrees and discovered that newly graduated men with an associate, bachelor's, or master's degree even now earn a lot more than recently graduated women with the same degree. A similar study of gender and race In a similar study utilizing the 1979–2012 waves of the American National Longitudinal Survey of Youth (NLSY79), researchers conducted a t-tests with means and chi-square with proportions to look for significant group differences. They discovered that men of both races earn more than women relative to their wages for master's degrees, however black women earn lesser compared to all races. (Budig et al., 2021; Sloane et al., 2021). Where you stay in the United States also has an impact on your salary. Winters posits that there is clear difference in earnings by education level across states in the United States with employees of bachelor's degrees earning way more than those with a lower educational background. (2020, p.21). The U.S. Department of Labor(2022) indicates that when a worker's level of education rises, incomes increases dramatically. This paper will therefore replicate previous research by examining whether there is a difference in the salary between each educational category and occupation. We turn to recent data on workforce entrants in order to answer our research question: Is there a difference in the salary between each educational level and occupation? Hence the paper will be testing these hypotheses: a) there is no difference in the mean salary between educational levels b) there is no difference in the mean salary between occupations, c) there is no interaction between educational level and occupation on salary.

Methods

Participants and Design

The workforce study is a longitudinal study of employees' salary conducted by Aston Carter Staffing company. The parent data set contains employees' educational level which includes high school, bachelors, and doctorate degree. The full dataset has a size of 601 employees. With the use of SPSS, the cases in the dataset were sorted by educational level and its occupation respectively, then random numbers were computer from 0.00 to 1.0000 where .00 marked the beginning of a new level. With this design a new id was computed to count each level. To reflect a balanced design, the smallest cell in the cell frequency in the occupation and education cross table (22) was used to filter all id less than or equal to the smallest (22) to obtain orthogonality, see table 1. The final sample consisted of 276 individuals, 23 in each in each group as shown in table 1.

Table 1

Demographic characteristics of sample data

	Occupation				
Education	AC	Sales	ProfS	ExecM	Total
High School	23	23	23	23	92
Bachelor	23	23	23	23	92
Doctorate	23	23	23	23	92
Total	69	69	69	69	276

Note: AC- Administration Clerical, ProfS= Professional Specialty, ExecM= Executive Managerial.

Measurements and Analysis

The dependent variable in our study is salary. The salary is the yearly earnings an employee gets. The study has two independent variables: the first one is education, it has three levels which are high school, bachelor and doctorate. The second is occupation and it has four levels which includes Administration clerical, sales, professional specialty and executive managerial. Each educational level has each of these occupational levels making our analysis possible. The educational levels and occupation were recorded. High school was recorded to 1, bachelor to 2 and doctorate to 3. Administration clerical was recorded to 1, sales to 2, professional specialty to 3 and Executive managerial to 4.

A 3 x 4 factorial design was conducted to test for mean differences in salary among employees who had a high school, bachelor or doctorate educational background and their occupation. A Tukey post hoc test was conducted to make every possible pairwise comparison. A post hoc power analysis was also conducted to determine statistical power

Results

To address our research question, we conducted a two-way between factorial ANOVA was conducted to test for mean differences in salary among employees who had a high school, bachelor or doctorate educational background and their occupation (Administration clerical, sales, Professional specialty and Executive managerial). Table 2 presents a descriptive statistic of the educational background and its occupation. Initial examination of the model assumptions indicated normality (Shapiro-Wilk W=.929, $p<.001$) and homogeneity of variance (Levene's test. F (11, 264) =24.09, $p=.001$) were not met. Examination of the skewness and kurtosis values in Table 2 suggest that normality was a reasonable assumption as all fell within |2|. Overall skewness and Kurtosis values for salary collapsing all groups fell within |2| for both variables (skew=-.037, kurtosis=-1.300).

From table 2, it can be seen that when comparing the educational categories, the high school evidently reported lower mean salary when compared to the bachelor and doctorate educational level. We can also see from the that High School-Sales reported lower mean salary when compared to all high school occupation group which differed from each other. Doctorate as the highest educational level reports higher mean salary than all educational groups.

Table 2

Group statistics by Education and Occupation for study participants, N=276

Group	Mean	St Dev	Skewness	Kurtosis
High School	81069.32	19105.581	-.686	-1.111
Bachelor	167060.08	41421.239	-.306	-.332
Doctorate	208769.36	35008.589	-.642	-.151
AC	143070.25	50070.558	-.184	-1.395
Sales	146955.36	72429.954	-.347	-1.387
ProfS	150445.20	71232.612	.678	-1.520
ExecM	168727.52	51751.660	-.579	-1.562
High School-AC	79596.35	3929.873	-.244	-1.595
High School-Sales	50977.22	1051.504	.443	-1.907
High School-ProfS	95691.61	3854.355	-.066	-1.356
High School-ExecM	98012.09	2421.618	.158	-1.998
Bachelor-AC	173693.87	12959.043	.267	-2.047
Bachelor-Sales	192467.13	31130.432	1.327	1.054
Bachelor-ProfS	106146.09	14053.661	1.191	-.182
Bachelor-ExecM	195933.22	17049.888	-.157	-1.895
Doctorate-AC	175920.52	35284.851	-.123	-.879
Doctorate-Sales	197421.74	28042.597	.375	-1.789
Doctorate-ProfS	249497.91	5284.026	-1.392	3.080
Doctorate-ExecM	212237.26	836.472	-1.170	-.195

Note: AC- Administration Clerical, ProfS= Professional Specialty, ExecM= Executive Managerial.

Given the linear model is robust to assumption violation when the design is orthogonal, the analysis continued with an examination of the overall model. Results indicated both main effects were statistically significant; occupation F (3, 264) = 28.69, p<0.001 and education F (2, 264) =1257.53, p<0.001 and so was the interaction F (6, 264) =103.30, p<0.001 precluding interpretation of the two main effects. A post hoc test was conducted on the interaction. Turkey post hoc tests revealed that for the Administration-clerical position, high school mean salary differed from all three educational groups (p<.05), but bachelor and doctorate did not differ(p=.668), see Figure 1. For the sales position, high school mean salary also differed from all the educational groups(p<.05), but bachelor and doctorate did not differ too. For the Professional Specialty position, all three educational groups differed from each other (all *p's* < .05). Finally for the Executive managerial positions, all three educational groups mean salary differed (see table 3). A Tukey host hoc test was used because we to make every possible pairwise comparison and to control the type 1 error as it is more powerful when testing large numbers of means.

Figure 1

Profile plot of salary between Occupation and Education

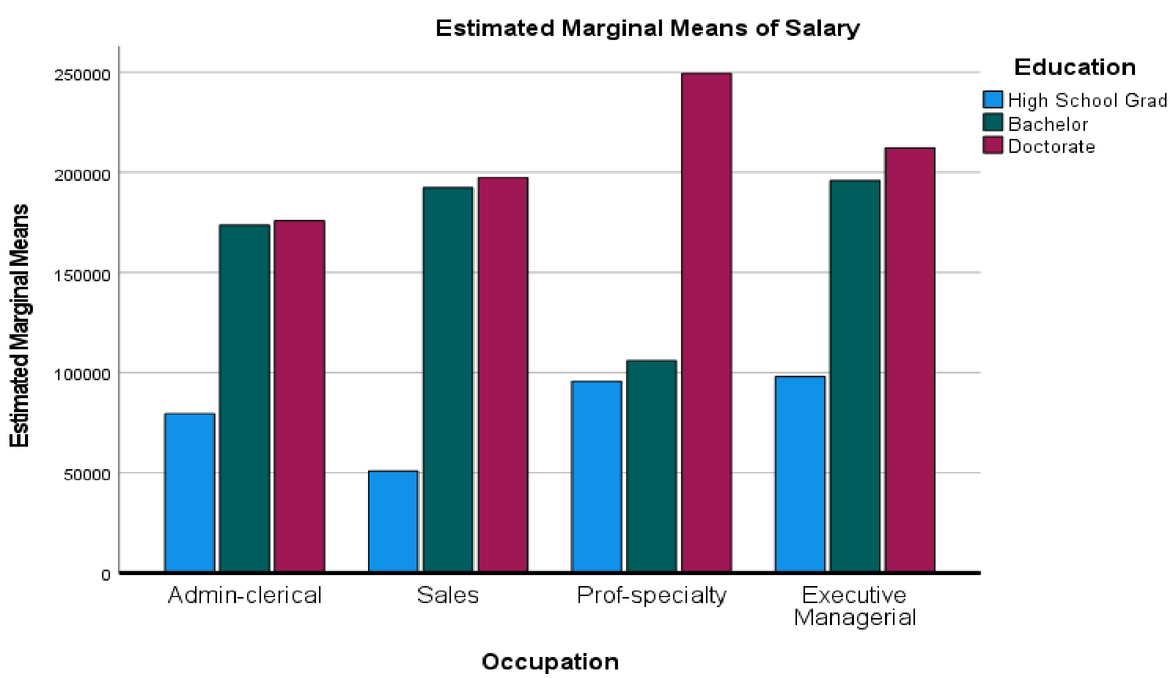

Figure 2 also displays a post hoc power study for the hypothesis. Power study was conducted in G* Power, Figure 2 presents the parameters of the analysis. As can be seen from this figure, a sample size of 80 would be needed to achieve 0.92 statistical power. Our sample size is 276 which achieves a 1.000 statistical power. Hence, we only needed 80 sample size to get sufficient power to correctly reject a false null hypothesis.

Figure 2

Post hoc power analysis

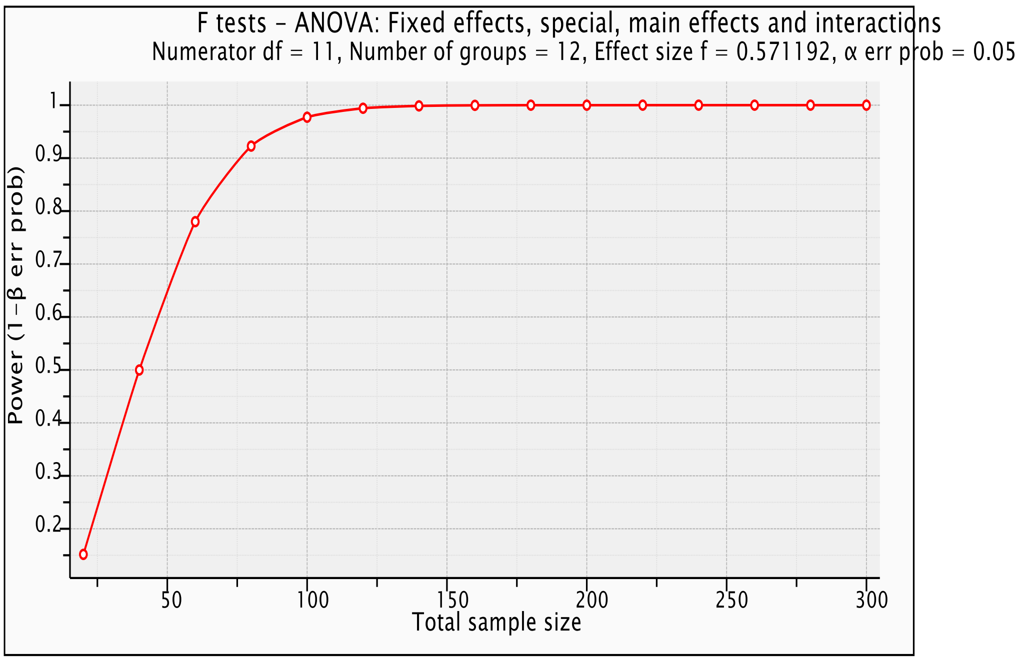

Table 3

Post Hoc Analyses for salary on occupation and education

Occupation	(I) Education	(J) Education	Mean Difference (I-J)	Std. Error	Sig.[b]
Admin-clerical	High School	Bachelor	-94097.522*	5193.741	<.001
		Doctorate	-96324.174*	5193.741	<.001
	Bachelor	High School	94097.522*	5193.741	<.001
		Doctorate	-2226.652	5193.741	.668
	Doctorate	High School	96324.174*	5193.741	<.001
		Bachelor	2226.652	5193.741	.668
Sales	High School	Bachelor	-141489.913*	5193.741	<.001
		Doctorate	-146444.522*	5193.741	<.001
	Bachelor	High School	141489.913*	5193.741	<.001
		Doctorate	-4954.609	5193.741	.341
	Doctorate	High School	146444.522*	5193.741	<.001
		Bachelor	4954.609	5193.741	.341
Prof-specialty	High School	Bachelor	-10454.478*	5193.741	.045
		Doctorate	-153806.304*	5193.741	<.001
	Bachelor	High School	10454.478*	5193.741	.045
		Doctorate	-143351.826*	5193.741	<.001
	Doctorate	High School	153806.304*	5193.741	<.001
		Bachelor	143351.826*	5193.741	<.001
Executive Managerial	High School	Bachelor	-97921.130*	5193.741	<.001
		Doctorate	-114225.174*	5193.741	<.001
	Bachelor	High School	97921.130*	5193.741	<.001
		Doctorate	-16304.043*	5193.741	.002
	Doctorate	High School	114225.174*	5193.741	<.001
		Bachelor	16304.043*	5193.741	.002

Note: The mean difference is significant at the .05 level.

Conclusion And Limitations

As the cost of education keeps on rising in the United States, people tend to question if continuing your education to the highest level is worth it. Existing literature has mixed results with some scholars saying the higher your education the higher your earnings made while others say it does not. The findings from this study shows that salary varies within the same occupation by educational level and hence supports the existing literature on higher educational levels leading to higher salary. Employees with lower educational level tend to receive lower salary than employees with higher educational level suggesting that employers tend to value education more in their workplace. These results suggest that educational level and occupation differences in salary may have social implications for individuals with lower educational level. Those with a bachelor's or graduate degree can expect to earn at least twice as much as those only possessing a diploma from high school.

It is noteworthy that our conclusions are based on employees form the Aston Carter staffing company. One key explanation that we cannot test with these data is whether these salaries are also being influenced by gender or race as our sample does not include such information. Our sample also excludes those who obtained a professional degree or a master’s degree. As a result, our sample was limited to those with a high school diploma, bachelor’s, and doctorate degree. Our study was thus limited as we do not include gender and race, which are key factors to consider in addressing our research question.

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Appendix

SPSS scripts

```
DATA LIST
   file='C:\Users\ekwakye\Desktop\spss\SalaryDataNWW.xlsx'
   fixed
   /education 1 occupation 3 salary 5-10.
  EXECUTE.

*examine original crosstabulation table to find minimum cell frequency.
CROSSTABS
  /TABLES=Education BY Occupation
  /FORMAT=AVALUE TABLES
  /CELLS=COUNT
  /COUNT ROUND CELL.

*compute a random number from a uniform distribution and assign this value to new variable called
        random.
COMPUTE random=RV.UNIFORM(0.0000, 1.0000).
EXECUTE.

* value of newid is the smallest cell frequency in the FactorA*FactorB crosstab table.

SORT CASES BY Education(A) Occupation(A) random.

*Following code will create a variable called newID which is a sequenced number corresponding to
 each case in each cell in the FactorA * FactorB crosstabulation table.

*values used in compute statement in lines {23,25,27,30,32,34,36}
 are the cumulative case number after sorting data by FactorA and Factor B.
DO IF (Education=1 and Occupation=1).
    COMPUTE  newid=$casenum-1.
ELSE IF (Education=1 and Occupation=2).
   COMPUTE newid=$casenum-46.
ELSE IF (Education=1 and Occupation=3).
   COMPUTE newid=$casenum-91.
ELSE IF (Education=1 and Occupation=4).
   COMPUTE newid=$casenum-125.
*ELSE IF (FactorA=1 and FactorB=4).
*    COMPUTE newID=$CASENUM-76.

ELSE IF (Education=2 and Occupation=1).
   COMPUTE newid=$Occupation-147.
ELSE IF (Education=2 and Occupation=2).
   COMPUTE newid=$casenum-192.
ELSE IF (Education=2 and Occupation=3).
   COMPUTE newid=$casenum-252.
ELSE IF (Education=2 and Occupation=4).
   COMPUTE newid=$casenum-312.
```

```
ELSE IF (Education=3 and Occupation=1).
   COMPUTE newid=$Occupation-372.
ELSE IF (Education=3 and Occupation=2).
   COMPUTE newid=$casenum-432.
ELSE IF (Education=3 and Occupation=3).
   COMPUTE newid=$casenum-507.
ELSE IF (Education=3 and Occupation=4).
   COMPUTE newid=$casenum-578.
*ELSE IF (FactorA=2 and FactorB=4).
*    COMPUTE newID=$CASENUM-360.
END IF.
EXECUTE.

* value of newid is the smallest cell frequency in the FactorA*FactorB crosstab table.
COMPUTE filter_$=(newid <=22).
VALUE LABELS filter_$ 0 'Not Selected' 1 'Selected'.

FILTER BY filter_$.
EXECUTE.

* Crosstabulation table sould reflect a balanced design.
CROSSTABS
  /TABLES=Education BY Occupation
  /FORMAT=AVALUE TABLES
  /CELLS=COUNT MEAN STDDEV SKEW.
EXECUTE.

MEANS TABLES=Salary BY Occupation
   /CELLS COUNT MEAN STDDEV SKEW KURT.
EXECUTE.

MEANS TABLES=Salary BY  Education
   /CELLS COUNT MEAN STDDEV SKEW KURT.
EXECUTE.

MEANS TABLES=Salary BY Occupation Education
   /CELLS COUNT MEAN STDDEV SKEW.
EXECUTE.

EXAMINE VARIABLES=Salary
  /PLOT BOXPLOT STEMLEAF NPPLOT
  /COMPARE GROUPS
  /STATISTICS DESCRIPTIVES
  /CINTERVAL 95
  /MISSING LISTWISE
  /NOTOTAL.

DATASET ACTIVATE DataSet26.
UNIANOVA Salary BY Occupation Education
  /METHOD=SSTYPE(3)
  /INTERCEPT=INCLUDE
```

```
  /POSTHOC=Occupation Education(TUKEY)
  /PLOT=PROFILE(Occupation*Education) TYPE=BAR ERRORBAR=NO MEANREFERENCE=NO
  /EMMEANS=TABLES(OVERALL)
  /EMMEANS=TABLES(Occupation)
  /EMMEANS=TABLES(Education)
  /EMMEANS=TABLES(Occupation*Education)
  /PRINT ETASQ DESCRIPTIVE HOMOGENEITY
  /CRITERIA=ALPHA(.05)
  /DESIGN=Occupation Education Occupation*Education.

UNIANOVA Salary BY Occupation Education
  /METHOD=SSTYPE(3)
  /INTERCEPT=INCLUDE
  /POSTHOC=Occupation Education(TUKEY)
  /PLOT=PROFILE(Occupation*Education) TYPE=BAR ERRORBAR=NO MEANREFERENCE=NO
  /EMMEANS=TABLES(OVERALL )
  /EMMEANS=TABLES(Occupation) COMPARE ADJ(LSD)
  /EMMEANS=TABLES(Education) COMPARE ADJ(LSD)
  /EMMEANS=TABLES(Occupation*Education) COMPARE(Occupation) ADJ(LSD)
  /EMMEANS=TABLES(Occupation*Education) COMPARE(Education) ADJ(LSD)
  /PRINT ETASQ DESCRIPTIVE HOMOGENEITY
  /CRITERIA=ALPHA(.05)
  /DESIGN=Occupation Education Occupation*Education.
```