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Analyzing the Cost-Effectiveness of Instruction Expenditures towards High School Completion among Oahu's Public School Districts

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Abstract: The following study attempted to ascertain the instructional cost-effectiveness of public high school teachers towards high school completion through a financially based econometric analysis. Essentially, public high school instruction expenditures and completer data were collected from 2000 to 2007 and bivariate interaction analyzed through a correlation and linear regression procedure. Based on the collective results, with the exception of the Leeward District that reported a statistically significant positive relationship, a statistically insignificant positive relationship was noted for the Central District; and a statistically insignificant negative relationship noted for both the Honolulu and the Windward District. Consequently, based on the findings of this study, public high school teachers in the Leeward District had a more economically positive influence towards high school completers in contrast to the other school districts on Hawaii's Island of Oahu from 2000 to 2007.

Key words: instruction expenditures; high school completion; public school teaching effectiveness

1. Introduction

Instruction is one of the most critically important factors that contribute to high school completion, where it is the teachers that facilitate the transfer of knowledge necessary for students to graduate high school (Westfall, Peltier, Sheehan and Weber, 2006). Although there are many techniques to measure the productivity of educational instruction, assessing its effectiveness through a financial perspective remains one practical way to accomplish this task (Beard, 2009). Consequently, this study will specifically analyze Hawaii's Department of Education's (DOE) high school instruction expenditures (i.e., teacher salaries and benefits, substitutes, instructional paraprofessionals, pupil-use technology, software and instructional materials, trips, and supplies) and its econometric relationship with high school completers among the four school districts on Hawaii's Island of Oahu (Hawaii Department of Education, n.d.). With this research, it is hoped that the findings will provide a current snapshot of the effectiveness of Hawaii's DOE high school teachers in fostering completion within the four school districts on Oahu from an economics perspective.

2. Instruction Expenditures, Graduation Classes, and Completers

The following section will go over the DOE's high school instruction expenditures, size of its graduation

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classes, and high school completers for the four school districts on Oahu from 2000 to 2007.

2.1 Historical Results: Honolulu District

Table 1 summarizes the DOE's inflation adjusted (i.e., Base Year = 2000) high school instruction expenditures, size of graduation classes, and high school completers in the Honolulu District from 2000 to 2007. Based on Table 1, high school instruction expenditures have been consistently increasing on an average of 6.3% with a standard deviation of $5,777,270 per year, respectively. The lowest increase in high school instruction expenditures was actually a decrease occurring during 2000 to 2001 and its highest increase seen during 2002 to 2003. Graduating classes has been slowly declining during this period and had an overall negative average growth rate of -0.7% with a standard deviation of 96 students per year, respectively. The smallest graduating class was reported in 2003 and its largest reported in 2000. Completers also experienced a similar trend during this time frame with a negative average growth rate of -0.7% and a standard deviation of 99 students per year, respectively. The lowest number of completers was recorded in 2003 and its highest recorded in 2000.

2.2 Historical Results: Central District

Table 2 summarizes the DOE's inflation adjusted (i.e., Base Year = 2000) high school instruction expenditures, size of graduation classes, and high school completers in the Central District from 2000 to 2007. Based on Table 2, high school instruction expenditures have been consistently increasing on an average of 7.6% with a standard deviation of $6,225,588 per year, respectively. The lowest increase in high school instruction expenditures was actually a decrease occurring during 2000 to 2001 and its highest increase seen during 2002 to 2003. Graduating classes has been slowly increasing during this period and had a low average growth rate of 1.2% with a standard deviation of 71 students per year, respectively. The smallest graduating class was reported in 2001 and its largest reported in 2007. Completers also experienced similar growth during this time frame with a low average growth rate of 1.2% and a standard deviation of 77 students per year, respectively. The lowest number of completers was recorded in 2003 and its highest recorded in 2007.

2.3 Historical Results: Windward District

Table 3 summarizes the DOE's inflation adjusted (i.e., Base Year = 2000) high school instruction expenditures, size of graduation classes, and high school completers in the Windward District from 2000 to 2007. Based on Table 3, high school instruction expenditures have been consistently increasing on an average of 7.3% with a standard deviation of $4,333,084 per year, respectively. The lowest increase in high school instruction expenditures was actually a decrease occurring during 2000 to 2001 and its highest increase seen during 2002 to 2003. Graduating classes has been slowly declining during this period and had a negative average growth rate of -0.5% with a standard deviation of 37 students per year, respectively. The smallest graduating class was reported in 2003 and its largest reported as a tie in 2001 and 2002. Completers also experienced similar slow declining growth during this time frame with a negative average growth rate of -0.5% and a standard deviation of 36 students per year, respectively. The lowest number of completers was recorded in 2005 and its highest recorded in 2001.

2.4 Historical Results: Leeward District

Table 4 summarizes the DOE's inflation adjusted (i.e., Base Year = 2000) high school instruction expenditures, size of graduation classes, and high school completers in the Leeward District from 2000 to 2007. Based on Table 4, high school instruction expenditures have been consistently increasing on an average of 9.7% with a standard deviation of $9,535,619 per year, respectively. The lowest increase in high school instruction expenditures was seen during 2000 to 2001 and its highest increase seen during 2002 to 2003. Graduating classes has seen much consistency during this period and had a low average growth rate of 2.7% with a standard deviation of 185 students

per year, respectively. The smallest graduating class was reported in 2001 and its largest reported in 2006. Completers also experienced similar consistency during this time frame with a low average growth rate of 2.8% and a standard deviation of 162 students per year, respectively. The lowest number of completers was recorded in 2000 and its highest recorded in 2006.

Table 1 Honolulu District High School Instruction Expenditures, Graduation Class, and Completers

School year	Instruction expenditures	Percentage change	Graduation class size	Percentage change	Total completers	Percentage change
1999-00	$28,061,137	N.A.	2,171	N.A.	2,072	N.A.
2000-01	$26,080,230	-7.1%	1,916	-11.7%	1,827	-11.8%
2001-02	$28,647,440	9.8%	2,047	6.8%	1,994	9.1%
2002-03	$35,226,920	23.0%	1,880	-8.2%	1,785	-10.5%
2003-04	$35,546,550	0.9%	1,908	1.5%	1,836	2.9%
2004-05	$37,736,230	6.2%	1,953	2.4%	1,824	-0.7%
2005-06	$38,733,640	2.6%	1,961	0.4%	1,870	2.5%
2006-07	$42,169,230	8.9%	2,036	3.8%	1,934	3.4%
Totals	$272,201,377	N.A.	15,872	N.A.	15,142	N.A.
Mean	$34,025,172	6.3%	1,984	-0.7%	1,893	-0.7%
Std. Dev.	$5,777,270	9.3%	96	6.7%	99	7.7%

Note: Hawaii DOE high school instruction expenditure data are from *Reports, Expenditures by School* [Data file], n.d.a, Hawaii Department of Education at http://doe.k12.hi.us/reports/expenditures.htm, while graduating class size and completer data are from *Reports, High School Completer Statistics* [Data file], n.d.b, Hawaii Department of Education at http://doe.k12.hi.us/reports/highschoolcompleter.htm; and all collectively retrieved on July 1, 2009.

Table 2 Central District High School Instruction Expenditures, Graduation Class, and Completers

School year	Instruction expenditures	Percentage change	Graduation class size	Percentage change	Total completers	Percentage change
1999-00	$23,738,256	N.A.	1,981	N.A.	1,956	N.A.
2000-01	$21,971,510	-7.4%	1,895	-4.3%	1,879	-3.9%
2001-02	$24,922,000	13.4%	1,975	4.2%	1,955	4.0%
2002-03	$32,078,330	28.7%	1,988	0.7%	1,862	-4.8%
2003-04	$32,582,120	1.6%	1,947	-2.1%	1,901	2.1%
2004-05	$34,706,080	6.5%	2,022	3.9%	1,978	4.1%
2005-06	$36,438,040	5.0%	2,019	-0.1%	1,980	0.1%
2006-07	$38,376,550	5.3%	2,139	5.9%	2,108	6.5%
Totals	$244,812,886	N.A.	15,966	N.A.	15,619	N.A.
Mean	$30,601,611	7.6%	1,996	1.2%	1,952	1.2%
Std. Dev.	$6,225,588	11.2%	71	3.7%	77	4.2%

Note: Hawaii DOE high school instruction expenditure data are from *Reports, Expenditures by School* [Data file], n.d.a, Hawaii Department of Education at http://doe.k12.hi.us/reports/expenditures.htm, while graduating class size and completer data are from *Reports, High School Completer Statistics* [Data file], n.d.b, Hawaii Department of Education at http://doe.k12.hi.us/reports/highschoolcompleter.htm; and all collectively retrieved on July 1, 2009.

3. Methodology

In order to investigate the econometric relationship of high school instruction expenditures towards high school completion among the DOE's four school districts on Oahu, this research employed the following

methodology. The study initially acquired the DOE's high school instruction expenditures and completer data from 2000 to 2007. Upon separating the data by high school and adjusting instruction expenditures for inflation (i.e., Base Year = 2000), econometric techniques consisting of both correlation and linear regression were utilized and key statistics recorded. The study then analyzed the statistical relationship between high school instruction expenditures and completers. Data used for these analyses were acquired from Hawaii's DOE websites and the study's econometric results were generated with the use of PASW 18.0 for Windows.

Table 3 Windward District High School Instruction Expenditures, Graduation Class, and Completers

School year	Instruction expenditures	Percentage change	Graduation class size	Percentage change	Total completers	Percentage change
1999-00	$18,192,436	N.A.	1,142	N.A.	1,067	N.A.
2000-01	$17,394,830	-4.4%	1,167	2.2%	1,095	2.6%
2001-02	$19,044,220	9.5%	1,167	0.0%	1,091	-0.4%
2002-03	$23,662,920	24.3%	1,069	-8.4%	1,017	-6.8%
2003-04	$23,938,160	1.2%	1,150	7.6%	1,086	6.8%
2004-05	$25,591,820	6.9%	1,101	-4.3%	1,012	-6.8%
2005-06	$26,849,640	4.9%	1,147	4.2%	1,081	6.8%
2006-07	$29,196,430	8.7%	1,091	-4.9%	1,022	-5.5%
Totals	$183,870,456	N.A.	9,034	N.A.	8,471	N.A.
Mean	$22,983,807	7.3%	1,129	-0.5%	1,059	-0.5%
Std. Dev.	$4,333,084	8.9%	37	5.6%	36	6.1%

Note: Hawaii DOE high school instruction expenditure data are from *Reports, Expenditures by School* [Data file], n.d.a, Hawaii Department of Education at http://doe.k12.hi.us/reports/expenditures.htm, while graduating class size and completer data are from *Reports, High School Completer Statistics* [Data file], n.d.b, Hawaii Department of Education at http://doe.k12.hi.us/reports/highschoolcompleter.htm; and all collectively retrieved on July 1, 2009.

Table 4 Leeward District High School Instruction Expenditures, Graduation Class, and Completers

School year	Instruction expenditures	Percentage change	Graduation class size	Percentage change	Total completers	Percentage change
1999-00	$27,599,848	N.A.	1,872	N.A.	1,779	N.A.
2000-01	$28,309,690	2.6%	1,854	-1.0%	1,793	0.8%
2001-02	$31,279,600	10.5%	1,884	1.6%	1,818	1.4%
2002-03	$40,771,380	30.3%	1,901	0.9%	1,838	1.1%
2003-04	$43,151,300	5.8%	2,145	12.8%	2,060	12.1%
2004-05	$46,586,500	8.0%	2,152	0.3%	1,961	-4.8%
2005-06	$48,727,980	4.6%	2,307	7.2%	2,186	11.5%
2006-07	$51,845,330	6.4%	2,235	-3.1%	2,130	-2.6%
Totals	$318,271,628	N.A.	16,350	N.A.	15,565	N.A.
Mean	$39,783,953	9.7%	2,044	2.7%	1,946	2.8%
Std. Dev.	$9,535,619	9.4%	185	5.5%	162	6.5%

Note: Hawaii DOE high school instruction expenditure data are from *Reports, Expenditures by School* [Data file], n.d.a, Hawaii Department of Education at http://doe.k12.hi.us/reports/expenditures.htm, while graduating class size and completer data are from *Reports, High School Completer Statistics* [Data file], n.d.b, Hawaii Department of Education at http://doe.k12.hi.us/reports/highschoolcompleter.htm; and all collectively retrieved on July 1, 2009.

4. Results

The following will initially present the econometric results of both the correlation and linear regression analyses that were utilized to ascertain the statistical relationship of the DOE's high school instruction expenditures towards completers among the four school districts on Oahu.

4.1 Quantitative Results: Honolulu District

Based on Table A5, the Pearson correlation coefficient was -0.333 and found statistically insignificant. This figure suggests that there was a weak negative correlation between the DOE's high school instruction expenditures and completers from 2000 to 2007. In looking at the results of the linear regression, an R^2 of 0.111, ANOVA significance value of 0.420, and an unstandardized coefficient of -0.000005707 were reported (See Table 5). Hence, although the results of the linear regression revealed the existence of a negative relationship between the DOE's high school instruction expenditures and completers, it was not a statistically significant relationship during 2000 to 2007.

4.2 Quantitative Results: Central District

Based on Table A5, the Pearson correlation coefficient was 0.544 and found statistically insignificant. This figure suggests that there was a moderate positive correlation between the DOE's high school instruction expenditures and completers from 2000 to 2007. In looking at the results of the linear regression, an R^2 of 0.296, ANOVA significance value of 0.163, and an unstandardized coefficient of 0.000006762 were reported (See Table 5). Hence, although the results of the linear regression revealed the existence of a positive relationship between the DOE's high school instruction expenditures and completers, it was not a statistically significant relationship during 2000 to 2007.

4.3 Quantitative Results: Windward District

Based on Table 5, the Pearson correlation coefficient was -0.587 and found statistically insignificant. This figure suggests that there was a moderately negative correlation between the DOE's high school instruction expenditures and completers from 2000 to 2007. In looking at the results of the linear regression, an R^2 of 0.344, ANOVA significance value of 0.126, and an unstandardized coefficient of -0.000004837 were reported (See Table 5). Hence, although the results of the linear regression revealed the existence of a negative relationship between the DOE's high school instruction expenditures and completers, it was not a statistically significant relationship during 2000 to 2007.

Table 5 Econometric Results: Instruction Expenditures and Completers (2000-2007)

	Honolulu district	Central district	Windward district	Leeward district
Correlation analysis				
Pearson coefficient	-0.333	0.544	-0.587	0.889
Linear regression analysis				
R^2	0.111	0.296	0.344	0.791
ANOVA significance value	0.420	0.163	0.126	0.003
Unstandardized coefficient	-0.000005707	0.000006762	-0.000004837	0.00001512

Note: Correlation and linear regression results were generated with PASW 18.0 for Windows.

4.4 Quantitative Results: Leeward District

Based on Table 5, the Pearson correlation coefficient was 0.889 and found statistically significant. This figure suggests that there was a very strong positive correlation between the DOE's high school instruction expenditures

and completers from 2000 to 2007. In looking at the results of the linear regression, an R^2 of 0.791, ANOVA significance value of 0.003, and an unstandardized coefficient of 0.00001512 were reported (See Table 5). Hence, there was a very strong statistically significant positive relationship between high school instruction expenditures and completers during 2000 to 2007.

5. Conclusions

The following will present this study's major findings/implications, limitations, and areas for future research.

5.1 Major Findings/Implications

The results of this study provided an econometric view of the nature of the relationship between the DOE's high school instruction expenditures and completers among Oahu's four school districts from 2000 to 2007. From a historical standpoint, although instruction expenditures had increased in each case, the expected symbiotic increases in completion did not positively correlate for both the Honolulu and Windward Districts during that period. Based on the econometric analysis, only in the Central and Leeward Districts did positive linear relationships were observed and with only the Leeward District having any kind of statistical significance. In summary, instruction expenditures were statistically observed as cost-effective for only the Leeward District, but seen as a marginal influence in the Central District and actually observed as a negative influence towards high school completion in the Honolulu and Windward District from 2000 to 2007.

Based on the results, it would appear from this study that instruction expenditures had lackluster influence on high school completion in only half of the school districts on Oahu. Given the current budgetary crises facing Hawaii, it would behoove DOE officials and State lawmakers to begin assessing and refocusing their efforts in making those deciding on the use of district and high school funds for instruction more accountable to the benchmark goals set forth by the DOE in conjunction with their communities. Fiscal accountability to the parents whose children attend public school is one of the major keys in sustaining quality education. Hence, active scrutiny from both the DOE and its community partners must be practiced to ensure what little educational funds are available are maximized in the public school students' interest.

5.2 Study Limitations

The first major limitation of this study revolved around the issue of representation. The independent variables of this study were more of a vector rather than scalar in nature. In particular, the aggregated values for each of the examined Oahu school district does not actually represent the actual data for each of its high schools; hence, possibly giving the wrong impression that all the high schools within the district as having the same performance with the district as a whole. The second major limitation of this research lies with the complexity of measuring instructional effectiveness. In any assessment oriented quantitative studies that are undertaken, it is not sufficient to gauge instructional effectiveness by quantitative means alone. Consequently, this study should serve as but one quantitative study in a succession of other studies that tries to assess the cost-effectiveness of instruction towards high school completion.

5.3 Areas for Future Research

This study compared the econometric relationship of the DOE's high school instruction expenditures towards completers among the school district's located on Oahu. However, similar studies on the individual high schools should be conducted. Such studies would allow for a clearer picture on what schools were seen as being most influential in steering the current trends for their respective school district. In addition, research that seeks to

uncover the econometric relationship between the other functional areas of the DOE's educational expenditures (i.e., instructional support, leadership, operations, and other commitments) towards high school completion should be conducted (Hawaii Department of Education, n.d.). Such studies would provide a cross-expenditure effectiveness perspective as well as illustrate how the other functional expenditure areas of the DOE contribute to high school completion. Finally, given the budget shortfall besieging Hawaii, the suggestions above should be undertaken with a sense of urgency by educational, legislative, as well as community researchers. Such research would ultimately work making sure that educational quality is not being circumvented, despite the current financial situation.

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