



**Effects of Training Programs:
Associated Wage Gains and the Impact on the Kansas Economy
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Introduction

This analysis seeks to estimate the wage gains realized by completers of various levels of post-high school training programs and the resulting economic impact on the Kansas economy. Understanding the economic impact is important because of the ongoing public investment in education programs.

Estimating Wage Gains to Vocational and Technical Education

The analysis is based on full-time wage and salary earnings differentials as reported by the Bureau of Labor Statistics for workers 25 and older, by educational attainment in 2005. The number of completers for academic year 2005 is reported by the Kansas Board of Regents 2006 Data Book and is based on the number of degrees conferred at state universities.

Table 1. Estimated Year 1 Earnings Gains From Training

Educational Attainment	Completers	Median Weekly High School Earnings	Median Weekly Earnings in 2005	Median Annual Earnings in 2005	Post-Training Hourly Wage Gain Over High School	Direct Annual Earnings Gain*	Total Pre-Training Earnings	Total Post-Training Earnings	Total Direct Annual Earnings Gains
Doctoral Degree	413	\$583	\$1,421	\$73,892	143.7%	\$43,576	\$12,520,508	\$30,517,396	\$17,996,888
Professional Degree	650	\$583	\$1,370	\$71,240	135.0%	\$40,924	\$19,705,400	\$46,306,000	\$26,600,600
Master's Degree	4,026	\$583	\$1,129	\$58,708	93.7%	\$28,392	\$122,052,216	\$236,358,408	\$114,306,192
Bachelor's Degree	12,105	\$583	\$937	\$48,724	60.7%	\$18,408	\$366,975,180	\$589,804,020	\$222,828,840
Associate Degree	300	\$583	\$699	\$36,348	19.9%	\$6,032	\$9,094,800	\$10,904,400	\$1,809,600
High-School Graduate	Base line	\$583	\$583	\$30,316	0.0%				
Total						#####	\$530,348,104	\$913,890,224	\$383,542,120

Source: Bureau of Labor Statistics, <http://www.bls.gov/emp/emptab7.htm> and KBOR 2006 Data Book, [http://www.kansasregents.org/download/universities/KBOR%20Databook%202006%20\(revised-July%2006\).pdf](http://www.kansasregents.org/download/universities/KBOR%20Databook%202006%20(revised-July%2006).pdf).

* Post-training earnings less high-school graduate earnings = direct annual earnings gain

A Model of Earnings Gains

A framework is constructed for determining the added earnings accruing to those completing training programs relative to their expected earnings without completing the training.

In this study, wage gains are modeled using the basic methodology of Lillard and Tan¹ by assuming that wage gains enjoyed by completers are present for nine years following training for associates degrees, for 11 years following bachelor's degrees and 12 years following master's, professional and doctoral degrees. This framework is used for three reasons. First, the approach allows for the simultaneous specification of two parameters of the expected lifetime earnings pattern: 1) an initial post-training wage increase and 2) a finite life-of-training. This presents a logical framework for modeling the expected life cycle of earnings gains from training.

A nine- to twelve-year life-of-training allows the gains to persist over several years, but diminish to zero over time. This addresses a criticism routinely levied at studies of training programs that use the full working life of the program completer in estimating the incremental wage gains from training. Commonly, the income gains are treated as permanent and then extrapolated across the expected remaining working life of the student, often 40 years or more. This practice, however, receives little support in the labor economics literature and can lead to an overstatement of the returns to education.²

The model also assumes no "settling-in" period, or time lag required for completers of the program to find either employment in a related field or suitable employment in another field. It is well known that many completers do not find immediate employment, while others either pursue higher education or join the Armed Forces. Those not finding immediate employment are modeled through an unemployment adjustment. For those not immediately entering the workforce, the model embodies earnings gains in future earnings. For modeling purposes, the training gains are thus assumed permanent and realized immediately upon program completion rather than upon eventual entry into the workforce.

Labor Force Participation and Unemployment

The Bureau of Labor Statistics (BLS) reports labor force participation rates for varied levels of educational attainment for workers 25 years and older. The BLS reports a 63.1 percent labor force participation rate for high school graduates, a 76.2 percent labor force

¹ Lillard, L. A. and H. W. Tan, "Private Sector Training: Who Gets It And What Are Its Effects," *The Economics of Training*, Vol. 2, 1996. Editors O. C. Ashenfelter and R. J. LaLonde, Edward Elgar: Cheltenham.

² Practical reasons suggesting a finite life for future wage gains are that some programs many produce no immediate wage gain, many program completers eventually move to careers from which their area of training is unrelated, the same skills can often be acquired by competing workers through on-the-job training or self study, and acquired skills may simply become obsolete over time.

participation rate for workers with associates degrees, and 77.9 percent labor force participation rate for bachelor's, professional and doctoral graduates for 2005.³

Furthermore, the BLS reports that the 2005 unemployment rate associated with workers who have attained a high school diploma is 4.7 percent, workers with associate's degrees experience a 3.3 percent unemployment rate. Workers with bachelor's degrees have a 2.6 percent unemployment rate while those with Master's degrees have a 2.1 percent unemployment rate. Professional degree holders have a 1.1 percent unemployment rate and those with doctoral degrees are reported to have a 1.6 percent unemployment rate in 2005.

Table 2. Employment Statistics for 2005

Educational Attainment	Unemployment Rate	Labor Force Participation Rate
Doctoral Degree	1.6%	77.9%
Professional Degree	1.1%	77.9%
Master's Degree	2.1%	77.9%
Bachelor's degree	2.6%	77.9%
Associate Degree	3.3%	76.2%
High-School Graduate	4.7%	63.1%

Source: Bureau of Labor Statistics

Migration Loss

The wage gain estimates further assume that some program completers will leave the state following training. The migration adjustment assumes that 2.15 percent of program completers leave the state each year beginning in year 1 and do not return. The estimate is derived using the U. S. Census Bureau's Net Internal Migration from the Cumulative Components of Population Change for Kansas.⁴

³ Bureau of Labor Statistics, <http://www.bls.gov/emp/emptab7.htm>.

⁴ U.S. Census Bureau, Population Division, <http://www.census.gov/popest/counties/CO-EST2005-04.html>.

Table 3. Calculation of Income Earners From Completers of Educational Programs

	Percent in State, 2.15% out Year migration	Number of Completers Remaining in Kansas*					Number of Completers Participating in Labor Force**					Number of Completers Employed***				
		Doctoral	Professional	Master's	Bachelor's	Associate	Doctoral, 77.9%	Professional, 77.9%	Master's, 77.9%	Bachelor's, 77.9%	Associate, 76.2%	Doctoral, 98.4%	Professional, 98.9%	Master's, 97.9%	Bachelor's, 97.4%	Associate, 96.7%
0	100.0	413	650	4,026	12,105	300										
1	97.9	404	636	3,939	11,845	294	315	495	3,069	9,227	224	310	490	3,004	8,987	216
2	95.7	395	622	3,855	11,590	287	308	485	3,003	9,029	219	303	479	2,940	8,794	212
3	93.7	387	609	3,772	11,341	281	301	474	2,938	8,835	214	297	469	2,877	8,605	207
4	91.7	379	596	3,691	11,097	275	295	464	2,875	8,645	210	290	459	2,815	8,420	203
5	89.7	370	583	3,611	10,858	269	289	454	2,813	8,459	205	284	449	2,754	8,239	198
6	87.8	363	571	3,534	10,625	263	282	444	2,753	8,277	201	278	440	2,695	8,062	194
7	85.9	355	558	3,458	10,397	258	276	435	2,694	8,099	196	272	430	2,637	7,888	190
8	84.0	347	546	3,383	10,173	252	270	426	2,636	7,925	192	266	421	2,580	7,719	186
9	82.2	340	535	3,311	9,954	247	265	416	2,579	7,754	188	260	412	2,525	7,553	182
10	80.5	332	523	3,240	9,740		259	407	2,524	7,588		255	403	2,471	7,390	
11	78.7	325	512	3,170	9,531		253	399	2,469	7,425		249	394	2,417	7,232	
12	77.0	318	501	3,102			248	390	2,416			244	386	2,366		

* Source: Bureau of Labor Statistics, Cumulative Estimates of Population Change, 2000-2005. <http://www.census.gov/popest/counties/C>

**Source: Bureau of Labor Statistics, 2005 Annual Labor Force Participation Rate, 25 years and over

*** Source: Bureau of Labor Statistics, <http://www.bls.gov/emp/emptab7.htm>

Summary of Model Assumptions

A summary of the basic assumptions underlying the model of wage gains due to training are as follows:

1. The study group includes completers of full-time programs.
2. The comparison group is high school completers with no education beyond high school.
3. Wage gains from training have a finite life-of-training (Lillard and Tan, 1996).
4. Annual migration loss is equal to 2.15 percent.
5. Training gains are either realized immediately or embodied in future earnings.
6. The labor force participation rate among completers (age 25 and older) varies by educational attainment levels.
7. Unemployment rates vary by level of educational attainment.

Life-of-Training Estimated Earnings Gains

Table 4 details estimates of direct earnings gains over the expected life-of-training. The estimates are determined by using constant earnings and are discounted by 3 percent annually for present value calculations.

Table 4. Life-of-Training Direct Earnings Gains						
Adjusted* Direct Earning Gains						
Year	Doctoral	Professional	Master's	Bachelor's	Associate	Total
1	\$15,522,496	\$23,313,617	\$104,563,848	\$221,956,565	\$2,510,691	\$367,867,217
2	\$15,188,763	\$22,812,374	\$102,315,725	\$217,184,499	\$2,456,711	\$359,958,072
3	\$14,862,204	\$22,321,908	\$100,115,937	\$212,515,032	\$2,403,891	\$352,218,973
4	\$14,542,667	\$21,841,987	\$97,963,444	\$207,945,959	\$2,352,208	\$344,646,265
5	\$14,229,999	\$21,372,385	\$95,857,230	\$203,475,121	\$2,301,635	\$337,236,371
6	\$13,924,054	\$20,912,878	\$93,796,300	\$199,100,406	\$2,252,150	\$329,985,789
7	\$13,624,687	\$20,463,252	\$91,779,679	\$194,819,747	\$2,203,729	\$322,891,094
8	\$13,331,756	\$20,023,292	\$89,806,416	\$190,631,123	\$2,156,349	\$315,948,936
9	\$13,045,124	\$19,592,791	\$87,875,578	\$186,532,554	\$2,109,987	\$309,156,033
10	\$12,764,654	\$19,171,546	\$85,986,253	\$182,522,104	\$0	\$300,444,556
11	\$12,490,214	\$18,759,358	\$84,137,549	\$178,597,878	\$0	\$293,984,998
12	\$12,221,674	\$18,356,031	\$82,328,591	\$0	\$0	\$112,906,297
Total	\$165,748,292	\$248,941,419	\$1,116,526,549	\$2,195,280,989	\$20,747,351	\$3,747,244,601

PV of Adjusted Direct Earnings Gains						
1	\$15,070,385	\$22,634,580	\$101,518,299	\$215,491,811	\$2,437,564	\$357,152,638
2	\$14,316,865	\$21,502,851	\$96,442,384	\$204,717,220	\$2,315,685	\$339,295,006
3	\$13,601,022	\$20,427,708	\$91,620,264	\$194,481,359	\$2,199,901	\$322,330,256
4	\$12,920,971	\$19,406,323	\$87,039,251	\$184,757,291	\$2,089,906	\$306,213,743
5	\$12,274,923	\$18,436,007	\$82,687,289	\$175,519,427	\$1,985,411	\$290,903,056
6	\$11,661,176	\$17,514,206	\$78,552,924	\$166,743,456	\$1,886,140	\$276,357,903
7	\$11,078,118	\$16,638,496	\$74,625,278	\$158,406,283	\$1,791,833	\$262,540,008
8	\$10,524,212	\$15,806,571	\$70,894,014	\$150,485,969	\$1,702,242	\$249,413,007
9	\$9,998,001	\$15,016,243	\$67,349,313	\$142,961,670	\$1,617,130	\$236,942,357
10	\$9,498,101	\$14,265,431	\$63,981,848	\$135,813,587	\$0	\$223,558,966
11	\$9,023,196	\$13,552,159	\$60,782,755	\$129,022,907	\$0	\$212,381,018
12	\$8,572,036	\$12,874,551	\$57,743,618	\$0	\$0	\$79,190,205
Total	\$138,539,006	\$208,075,126	\$933,237,237	\$1,858,400,981	\$18,025,812	\$3,156,278,161

* Earnings are adjusted for migration loss, labor force participation, and unemployment

Estimated earnings gains adjusted for migration, labor force participation, and unemployment total more than \$3.7 billion over the life-of-training.

Individual earnings gains are reported in Table 5 as the differential between average high school earnings and average earnings at each educational attainment level. Direct annual gains for doctoral graduates average \$43,576, professional degree gains average \$40,924, master's degree gains average \$28,392, bachelor's degree gains average \$18,408 and associate's degree gains average \$6,032.

Table 5. Life-of-Training Estimated Earnings Gains

	Doctoral	Professional	Master's	Bachelor's	Associate
Number of Completers	413	650	4,026	12,105	300
Average Number of Completers Remaining in Kansas During Life-of-Training	394	620	3,841	11,751	303
Direct Annual Earnings Gain*	\$43,576	\$40,924	\$28,392	\$18,408	\$6,032
Total Adjusted Direct Earnings	\$165,748,292	\$248,941,419	\$1,116,526,549	\$2,195,280,989	\$20,747,351
Average Life-of-Training Gains of Program Completer Remaining In-State	\$420,665	\$401,441	\$290,692	\$186,823	\$68,504
Life-of-Training, Years	12	12	12	11	9

* Post-training earnings less high-school graduate earnings = direct annual earnings gain

Over the life-of-training, doctoral degrees add \$420,665 to the earnings stream of the average program completer remaining in-state, professional degrees add \$401,441 to the earning stream of the average program completer remaining in-state, master's degrees add \$290,692 to the earnings stream of the average program completer, bachelor's degrees add \$186,823 to the earnings stream of the average program completer, and associate's degrees add \$68,504 to the earnings stream of the average program completer. This estimate, however, describes the "average" outcome for those receiving training, including those students not entering the competitive job market, and is not intended to predict the outcome of any individual student or program.

Economic Impact of Direct Earnings Gains⁵

The benefits of training not only provide direct wage gains to students, but also increase the income level in the state economy. The estimated wage gains from training produce multiplier, or ripple effects. Fiscal modeling can be used to estimate increased income and sales tax collections as a consequence of the new economic activity.

In estimating the economic impact, the added earnings of program completers are deemed the "direct" effect, which in turn generates what are referred to as "indirect" and "induced" effects. The indirect effect is the statewide inter-industry economic activity resulting from the direct impact, while induced effects reflect the economic activity resulting from new household spending out of employee compensation received as part of the direct and indirect effects.

⁵ The analysis focuses on the economic impact of wage gains on the state economy and does not consider the direct cost or opportunity cost of an individual student's decision to enroll in a training program, or the economic impact of the training program's operations.

The CEDBR's state-level fiscal model was used to estimate the multiplier effects over the expected life of the training. The economic impact multiplier used was the average multiplier value from RIMS II Industry Aggregation for Kansas.

The results in Table 6 suggest that the added wage gains to completers result in indirect and induced earnings at the state level equal to \$4.1 billion over the life-of-training. The total earnings impact (including direct, indirect and induced effects) exceeds \$7.8 billion. In other words, each dollar of direct earnings gained by completers supports an estimated \$1.10 of additional indirect and induced income by other workers in the state economy.⁶

⁶ The overall multiplier effect equates to 2.1 - - the average RIMS II Aggregate Industry multiplier for Kansas.

Table 6. Multiplier Effects

Year	Doctoral	Professional	Master's	Bachelor's	Associate
Adjusted Direct Earnings Gains					
1	\$15,522,496	\$23,313,617	\$104,563,848	\$221,956,565	\$2,510,691
2	\$15,188,763	\$22,812,374	\$102,315,725	\$217,184,499	\$2,456,711
3	\$14,862,204	\$22,321,908	\$100,115,937	\$212,515,032	\$2,403,891
4	\$14,542,667	\$21,841,987	\$97,963,444	\$207,945,959	\$2,352,208
5	\$14,229,999	\$21,372,385	\$95,857,230	\$203,475,121	\$2,301,635
6	\$13,924,054	\$20,912,878	\$93,796,300	\$199,100,406	\$2,252,150
7	\$13,624,687	\$20,463,252	\$91,779,679	\$194,819,747	\$2,203,729
8	\$13,331,756	\$20,023,292	\$89,806,416	\$190,631,123	\$2,156,349
9	\$13,045,124	\$19,592,791	\$87,875,578	\$186,532,554	\$2,109,987
10	\$12,764,654	\$19,171,546	\$85,986,253	\$182,522,104	\$0
11	\$12,490,214	\$18,759,358	\$84,137,549	\$178,597,878	\$0
12	\$12,221,674	\$18,356,031	\$82,328,591	\$0	\$0
Total	\$165,748,292	\$248,941,419	\$1,116,526,549	\$2,195,280,989	\$20,747,351
Total Direct Earnings Gains, All Training					\$3,747,244,601
Indirect and Induced Earnings Gains					
1	\$17,074,746	\$25,644,979	\$115,020,232	\$244,152,222	\$2,761,760
2	\$16,707,639	\$25,093,612	\$112,547,297	\$238,902,949	\$2,702,382
3	\$16,348,425	\$24,554,099	\$110,127,530	\$233,766,536	\$2,644,281
4	\$15,996,933	\$24,026,186	\$107,759,788	\$228,740,555	\$2,587,429
5	\$15,652,999	\$23,509,623	\$105,442,953	\$223,822,633	\$2,531,799
6	\$15,316,460	\$23,004,166	\$103,175,930	\$219,010,447	\$2,477,365
7	\$14,987,156	\$22,509,577	\$100,957,647	\$214,301,722	\$2,424,102
8	\$14,664,932	\$22,025,621	\$98,787,058	\$209,694,235	\$2,371,984
9	\$14,349,636	\$21,552,070	\$96,663,136	\$205,185,809	\$2,320,986
10	\$14,041,119	\$21,088,700	\$94,584,878	\$200,774,314	\$0
11	\$13,739,235	\$20,635,293	\$92,551,304	\$196,457,666	\$0
12	\$13,443,841	\$20,191,635	\$90,561,451	\$0	\$0
Total	\$182,323,121	\$273,835,561	\$1,228,179,204	\$2,414,809,088	\$22,822,086
Total Indirect and Induced Earnings Gains, All Training					\$4,121,969,061
Total Earnings Gains					
1	\$32,597,242	\$48,958,596	\$219,584,080	\$466,108,787	\$5,272,450
2	\$31,896,401	\$47,905,986	\$214,863,022	\$456,087,448	\$5,159,092
3	\$31,210,629	\$46,876,008	\$210,243,467	\$446,281,568	\$5,048,172
4	\$30,539,600	\$45,868,174	\$205,723,233	\$436,686,514	\$4,939,636
5	\$29,882,999	\$44,882,008	\$201,300,183	\$427,297,754	\$4,833,434
6	\$29,240,514	\$43,917,045	\$196,972,229	\$418,110,853	\$4,729,515
7	\$28,611,843	\$42,972,828	\$192,737,326	\$409,121,469	\$4,627,831
8	\$27,996,689	\$42,048,912	\$188,593,474	\$400,325,358	\$4,528,332
9	\$27,394,760	\$41,144,861	\$184,538,714	\$391,718,363	\$4,430,973
10	\$26,805,772	\$40,260,246	\$180,571,132	\$383,296,418	\$0
11	\$26,229,448	\$39,394,651	\$176,688,852	\$375,055,545	\$0
12	\$25,665,515	\$38,547,666	\$172,890,042	\$0	\$0
Total	\$348,071,413	\$522,776,981	\$2,344,705,754	\$4,610,090,078	\$43,569,436
Total Earnings Gain, All Training					\$7,869,213,661

Tax Revenues

Both the direct increase in the earnings of trainees and the indirect and induced earnings supported by the multiplier effects generate income and sales tax revenue at the state and local levels. Table 7 provides a summary of the estimated tax revenue generated both directly and indirectly by completers of the training. The retail sales tax estimates assume that 50 percent of income gains are spent within the state on taxable goods and services, with applicable sales tax rate of 5.3 percent. State income tax revenues were estimated using the Kansas income tax schedule applied to the direct income gains. State income tax revenues for indirect and induced income gains were estimated using the tax rate for the median household income for Kansas residents in 2005.

	Doctoral	Professional	Master's	Bachelor's	Associate
Table 7. Estimated Tax Revenue*					
Direct Effects of Training, Tax Revenue					
Estimated Earnings Gains	\$165,748,292	\$248,941,419	\$1,116,526,549	\$2,195,280,989	\$20,747,351
Estimated Tax Revenue					
Retail Sales	\$3,399,201	\$5,105,344	\$22,897,965	\$48,605,267	\$549,805
State Income	\$7,461,571	\$11,263,641	\$46,816,783	\$89,625,023	\$809,147
Total Direct Tax Revenue	\$10,860,772	\$16,368,984	\$69,714,748	\$138,230,290	\$1,358,951
Total Direct Tax Revenue, All Training					\$236,533,746
Indirect and Induced Effects of Training, Tax Revenue					
Estimated Earnings Gains	\$182,323,121	\$273,835,561	\$1,228,179,204	\$2,414,809,088	\$22,822,086
Estimated Tax Revenue					
Retail Sales	\$4,831,563	\$7,256,642	\$32,546,749	\$63,992,441	\$604,785
State Income	\$4,390,739	\$6,537,634	\$33,023,669	\$79,851,454	\$1,107,909
Total Indirect Tax Revenue	\$9,222,302	\$13,794,276	\$65,570,418	\$143,843,895	\$1,712,694
Total Indirect and Induced Tax Revenue, All Training					\$234,143,585
Total Effects of Training, Tax Revenue					
Estimated Earnings Gains	\$348,071,413	\$522,776,981	\$2,344,705,754	\$4,610,090,078	\$43,569,436
Estimated Tax Revenue					
Retail Sales	\$8,230,764	\$12,361,986	\$55,444,714	\$112,597,708	\$1,154,590
State Income**	\$11,852,310	\$17,801,274	\$79,840,452	\$169,476,477	\$1,917,055
Total Tax Revenue	\$20,083,074	\$30,163,261	\$135,285,166	\$282,074,185	\$3,071,645
Total Tax Revenue, All Training					\$470,677,330

*Additional tax revenues are affected by these gains but they are beyond the scope of this study (e.g. property tax, gasoline tax, etc.)

** Tax rate of 4.4% applied. Income tax rate for 2005 Kansas median household income of \$42,027.

Estimated direct income tax and sales tax revenue paid by program completers totals \$236.5 million with an additional \$234.1 million realized through indirect and induced multiplier effects. Total tax revenue estimates following training suggest total future tax

payments to state and local government of \$470.7 million. Estimates of tax revenue gains following training per completer are listed in Table 8.

Table 8. Estimated Tax Revenue Per Completer*					
	Doctoral	Professional	Master's	Bachelor's	Associate
Total Tax Revenue	\$20,083,074	\$30,163,261	\$135,285,166	\$282,074,185	\$3,071,645
Completers of Kansas Programs	413	650	4,026	12,105	300
Total Tax Revenue Per Completer of Kansas Programs	\$48,627	\$46,405	\$33,603	\$23,302	\$10,239

*Additional tax revenues are affected by these gains but they are beyond the scope of this study (e.g. property tax, gasoline tax, etc.)

While the primary benefit to those receiving training is a higher wage rate, many other documented benefits can accrue to program completers. For example, training provides faster entry into the labor force, potentially faster income gains, and an increased likelihood of becoming a professional or manager relative to those with no training beyond high school.

Higher labor force participation rates and lower unemployment rates indicated added efficiencies of human capital utilization for completers of post high school programs.

The analysis does not include any potential socioeconomic benefits resulting from reduced reliance on public services (e.g. unemployment compensation and welfare benefits), improved health benefits, reduced absenteeism, or other benefits of education beyond high school.