AN INVESTMENT ANALYSIS OF VOCATIONAL PROGRAMS OFFERED IN MISSOURI JUNIOR COLLEGES*

Donald D. Osburn and W.B. Richardson, Jr.

Administrators of the public junior colleges in Missouri are faced with two major problems. First, there is an increasing number of students demanding post-secondary education. Second, apathy of voters and legislators toward financial support of our educational institutions is increasing. A study entitled *Missouri Public Junior Colleges: A Report to the People* [3] revealed that in 1960 there were approximately 600,000 students enrolled in two-year institutions of higher education in the United States. The report further stated that in 1971 the enrollments would climb to 2,000,000 and that by 1980 the projected enrollments would approximate 4.4 million. This predicted growth pattern has been observed in Missouri with the enrollments increasing by approximately 20 percent per year.

The report cited above also confirms the second major problem as state aid for Missouri junior colleges has been decreasing over the past few years. Voter apathy, although more evident in secondary schools, is a force that can affect the junior college as programs are expanded to meet the increasing student demand.

The combination of these two factors has placed the junior college administrator in a precarious situation of allocating scarce resources (funds) among several educational alternatives. Budgetary priorities require rational thinking based on sound criteria in order to allocate properly these scarce funds among competing programs to achieve the greatest return to society's dollar.

The junior college administrator is hard pressed to find the appropriate criteria for decision making as he attempts to allocate financial resources. Furthermore, more specific data and better evaluative techniques are critically needed in decision making to justify specific expenditures among the educational alternatives.

OBJECTIVES

The evaluation model designed for use in this study is aimed at determining the relative desirability of educational programs based on costs and benefits of those programs. The major thrust of the study was centered on cost-benefit analyses of the vocational programs in Missouri public junior colleges.

COSTS

Treatment of the Cost Data.

A wide variety of accounting procedures were found in the districts studied which necessitated the development of a cost rationale for the treatment of cost data. Two cost categories were used: current costs and equipment costs. Current costs consist of administrative, instructional, operational and maintenance costs. Equipment costs consist of annual depreciated value of equipment outlays. Enrollment data for each school were converted to a full-time equivalent (FTE) basis so as to standardize for variances in part-time students among schools. Costs of each individual vocational program were summarized as: average annual current costs per FTE per vocational program, and annual average total costs per FTE per vocational program. Estimates of building costs were not obtained. Hence, total costs presented in Table 1 exclude costs for buildings.

Costs Among Programs

There were seven vocational program areas in the eight junior college districts that had sufficient scope to warrant their inclusion in this investigation. Table 1 presents a summary of average current and

Donald D. Osburn is associate professor agricultural economics at the University of Missouri and W. B. Richardson, Jr., is assistant professor of agricultural economics at Purdue University.

*Missouri Agricultural Experiment Station Journal Series No. 6620.

Table 1. AVERAGE ANNUAL CURRENT COST, TOTAL COST, AND PROGRAM COSTS PER STUDENT, BY PROGRAM AREA, OF OPERATING VOCATIONAL-TECHNICAL EDUCATION PROGRAMS IN MISSOURI 1969-70 AND 1970-71

Program Area	Total FTE	Average Annual Current Cost	Average Annual Total Cost	Two Year Program Costs
Agribusiness and Industry	112	$ 983	$1007	$2014
Business and Office Occupations	383	712	749	1498
Data Processing	195	931	939	1878
Distributive Education	218	700	722	1444
Health Occupations*	214	1804	1854	2239
Public Service Related Occupations	124	554	574	1148
Trade and Industrial Occupations	519	841	904	1808
Weighted Average	1765	911	950	1815

[a]The $2239 is a weighted average of 169 graduates from the one year licensed practical nursing program and 45 graduates of the two year associate degree program.

estimated total cost of operating curricula within each of these seven program areas.

Estimated total costs were obtained by weighted averages. Within each program area, a weighted average of available equipment costs were computed. This weighted average was used to compute total costs for those programs not having adequate equipment data.

BENEFITS

This investigation sought to obtain a net monetary benefit relating directly to post-secondary training. Research by Kaufman [2] and Carroll and Ihnen [1] revealed that there are several variables that influence monetary benefits of students in vocational-technical education programs at secondary and post-secondary levels (earnings of graduates minus expected earnings had they not attended post-secondary training institutions). Thus, it was necessary to control, statistically, for these variables that were thought to influence earnings of individuals who completed junior college vocational technical education programs. Multiple regression techniques were employed to control for these variables.

The dependent variable used in the regression analysis was monthly earnings of individuals who completed junior college vocational-technical education programs. It provided one index of labor market performance of these individuals. Table 2 shows the results of earnings regressed on selected independent variables.

Estimates of earnings, controlled for the independent variables, were generated using the coefficients estimated by the regression equation. To provide standard comparisons, the following assumptions were made:

1. A mean age of 24 years was used.
2. A mean educational level of the father was 11 years.
3. It was assumed that none of the individuals belong to a labor union.
4. All persons were males.
5. All individuals completed their vocational training in 1970.

Table 2. **REGRESSION RESULTS WHEN MONTHLY EARNINGS OF MISSOURI JUNIOR COLLEGE GRADUATES WERE REGRESSED ON SELECTED INDEPENDENT VARIABLES, 1968-69, 1969-70 AND 1970-71**

Variable	b	s	t
Program Area			
Agribusiness	-115	34	-3.42**
Business	- 46	43	-1.08
Data Processing	- 16	45	-0.37
Distributive Education	- 17	30	-0.57
Health Occupations	37	47	-0.79
Public Service	221	63	3.50**
Trade and Industrial #			
Sex	123	63	3.28**
Father's Education	1	2	0.49
Labor Union	61	32	1.89
Hours Worked	4	2	2.16*
Age	6	1	3.79**
Year of Graduation			
1969	68	28	2.41*
1970	31	20	1.53
1971#			

Number of observations = 289
b = regression coefficient
s = standard error of regression coefficient
t = computed t value
Multiple correlation coefficient = .5706
Coefficient of determination = .3256
Intercept (A value) = 89.57
f value = 10.21
*Significant at the .05 level
**Significant at the.01 level
#These variable subsets were entered into the intercept. Therefore, the other subsets in each variable set can be interpreted as deviations from this subset.

Table 3 summarizes the results of the application of the regression coefficients taking the assumptions into account. The agribusiness program area had the lowest estimated net monthly earnings. An agribusiness graduate, male, 24 years of age, who is not a member of a labor union, whose father completed 11 years of schooling, who completed his vocational training during 1970 and worked 40 hours a week had estimated monthly earnings of $444 or $5328 annually.

Public service related occupations with the same assumptions had the highest estimated net earnings. Public service workers estimated net earnings were $780 per month or $9360 annually. This was based on a small number of programs found exclusively in the urban areas of the state. Also, there was a small sample size in this subset. Therefore, inferences

Table 3. **ESTIMATED[a] MONTHLY EARNINGS AND UNADJUSTED EARNINGS BY PROGRAM AREA OF INDIVIDUALS COMPLETING MISSOURI JUNIOR COLLEGE VOCATIONAL-TECHNICAL EDUCATION PROGRAMS, 1968-69, 1969-70, AND 1970-71**

Program Area	Adjusted Earnings Monthly	Adjusted Earnings Annual	Unadjusted Earnings Monthly	Unadjusted Earnings Annual
Agribusiness and Industry	$444	$5328	$434 (140)	$5208
Business and Office Occupations	513	6156	372 (107)	4464
Data Processing	542	6504	472 (128)	5664
Distributive Education	542	6504	484 (203)	5808
Health Occupations	596	7152	485 (146)	5820
Public Service Related Occupations	780	9360	473 (295)	5676
Trade and Industrial Occupations	559	6708	542 (150)	6504
Average	568	6816	466	5592
Weighted Average	549	5688	471	5657

NOTES: [a]Assuming 11 years of education for father, 24 years of age, 40 hours worked per week, male, and 1970 year of completion. The figures are based on the regression results found in Table 2. Numbers in parenthesis are the standard deviations.

concerning this program area must be made with caution.

The raw mean earning differences among program areas, in terms of cost rankings among programs, were relatively consistent with the earnings difference estimated by the regression equation (Table 3).

Graduates of health and public service occupations, rather than earning less than trade and industrial graduates, as indicated by the raw mean, actually earned more than trade and industrial graduates when regression results were used to adjust for characteristics of the graduate. Still another important difference was that relative earnings of business and office graduates increased dramatically over unadjusted earnings estimate. This was likely due to the fact that 93 percent of business and office graduates were female. Hence, one may conclude that the unadjusted earnings reflect in large part sex or labor market role discrimination rather than program characteristics. Both adjusted and unadjusted means were used when costs and benefits were combined for the investment analysis.

INVESTMENT ANALYSIS

An investment analysis was made of the seven program areas being operated by the vocational departments in eight selected Missouri public junior colleges. Two investment criteria were selected for use: (1) benefit-cost ratio, and (2) the internal rate of return. The analysis was made under three alternative earning levels of high school graduates due to problems encountered in estimating the earnings of high school graduates during the 1970 work year. The three projections for those who received no additional formal training were:

1. Projection 1 -- $5,000, 2. Projection II – $6,000, and 3. Projection III – $7,000

Table 4. INVESTMENT ANALYSIS PERTAINING TO GRADUATES OF VOCATIONAL PROGRAMS OFFERED IN MISSOURI JUNIOR COLLEGES, UNDER ALTERNATIVE EARNINGS OF $5,000, $6,000 AND $7,000 BY HIGH SCHOOL GRADUATES, ACADEMIC YEARS 1968-69, 1969-70, AND 1970-71

Vocational Program	Benefit-Cost With $5,000 Earnings		Internal Rate of Return	Benefit-Cost With $6,000 Earnings		Internal Rate of Return	Benefit-Cost With $7,000 Earnings		Internal Rate of Return
	Discount Rate 6%	Discount Rate 10%		Discount Rate 6%	Discount Rate 10%		Discount Rate 6%	Discount Rate 10%	
Agribusiness and Industry	2.5	1.6	17%	----	----	----	----	----	----
Business and Office	12.2	7.9	*	1.65	1.07	11%	----	----	----
Data Processing and Computer Science	12.2	7.9	*	4.07	2.65	27%	----	----	----
Distributive Education	15.9	10.3	*	5.31	3.5	35%	----	----	----
Health Occupations	8.97	4.8	*	4.8	3.1	30%	1.07	.70	6%
Public Service Occupations	57.4	38.5	*	44.7	29.7	*	32.0	20.8	*
Trade and Industrial	15.3	9.7	*	6.3	3.5	42%	----	----	----

*Greater than 50 percent

[a]—Benefit-cost ratios less than 1.

Graduates were expected to work until an age of 65. Hence, benefits were assumed to accrue for a period of 41 years. Benefits (graduate earnings minus earnings of students who received no formal post-secondary training) were assumed to remain constant over the working life of the graduates.

Two discount rates were utilized to determine the present value of future earnings differences of junior college students over students who did not attend post-secondary training institutions. Also, the investment analysis results of Table 4 were those obtained by using the total current costs presented in Table 1.

Table 4 shows the results of the investment analysis using different earnings levels of high school graduates and discount rates. A recent unpublished survey supports the $5,000 earnings level as the most plausible. Therefore, reporting of the investment analysis is limited to the $5,000 earnings level.

Benefit-cost ratios, associated with the six percent discount rate, ranged from 57.4 for public services to 2.5 for agribusiness program areas. With the exception of the agribusiness program area, all programs had internal rates of return in excess of 50 percent. Agribusiness has an internal rate of 20 percent.

Full Costing Analysis

The preceding benefit-cost analysis focused on evaluation with current and equipment costs considered in the investment analysis. The cost analysis was later expanded to capital outlay and student foregone earnings. Cost data regarding physical plants and associated capital outlay, with few exceptions, were not available. As a proxy for and to provide the basis for an estimate of capital outlays, the findings of Osburn and Goishi [4] that annual capital outlays per student for vocational training in area schools were on the order of about $100 were used. Therefore, capital outlays of $200 per student could be expected for a two-year vocational program.

Table 1 shows weighted average total costs (current expenditures and equipment costs) for all programs and schools to be $1,815. Adding foregone earnings (assumed annual $5,000 earnings level of high school graduates and assuming part-time earnings of $2,000 over a two year period), a total cost figure of $10,015 results.

Adjusted and unadjusted earnings were $6,588 and $5,657, respectively, for graduates among all program areas. Assuming a $5,000 earnings level had students not attended junior college, benefits of $1,588 and $657 were expected to accrue to graduates. Applying the $10,015 full cost to the benefits resulted in benefit-cost ratios of 2.45 and 1.02. These were estimated from adjusted and unadjusted graduate earning levels.

SUMMARY

Total program costs (exclusive of foregone earnings and building depreciation) ranged from $1,148 for public service related occupations to $2,239 for health occupations. Weighted average costs for operating vocational-technical education programs were $1,815.

Annual earnings ranged from $5,328 for agribusiness and industry graduates to $9,360 for public service related occupations. The weighted average was $6,588. When costs and benefits were compared to ascertain investment profitability, all program areas showed that, on the average, benefits exceeded costs under the assumption that students without additional post-secondary training earned $5,000 annually. Benefit-cost ratios ranged from 1.6 for agribusiness programs to 38.5 for public service occupations.

A total program cost of $10,015 was estimated when foregone earnings of $5,000 was considered and part-time employment earnings of $2,000 was assumed. Benefit-cost ratios with this full cost model were 2.45 and 1.02, and were computed when annual benefits of $1,588 and $657 were specified from using the adjusted and unadjusted earnings respectively.

Considerable variations in program costs and benefits were observed among as well as within programs. Additional efforts to explain such variation appears warranted, and would provide educational planners with information for increased program efficiency and effectiveness.

REFERENCES

[1] Carroll, A. B. and L. A. Ihnen, "Cost and Returns for Two Years of Post-Secondary Technical Schooling: A Pilot Study." *Journal of Political Economy,* Vol. 6, 1967.

[2] Kaufman, Jacob L., and others, "A Cost-Effectiveness Study of Vocational Education." A paper prepared for the Institute for Research on Human Resources, University Park, Pennsylvania, 1969.

[3] *Missouri Public Junior Colleges, A Report to the People,* A report prepared by the legislature committee, Missouri Association of Junior Colleges, 1970.

[4] Osburn, D. D., and F. H. Goishi, "Some Aspects of Scale Economies Among Missouri Area Vocational Schools." *American Journal of Agricultural Economics,* Vol. 53, No. 5, 1971.