COMPARING THE IMPACT OF TRADITIONAL AND COOPERATIVE APPRENTICESHIP PROGRAMS ON GRADUATES' INDUSTRY SUCCESS

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ABSTRACT

Calls for national educational reform over the past 2 decades have strongly criticized the ability of the current system to prepare students to be successful in our nations high tech workforce. A prudent approach to reform would require searching for successful models currently existing before undertaking a wholesale overhaul of the educational system. Evidence exists that the cooperative apprenticeship model that has been implemented nationally by the automotive industry over the past 15 years at over 500 sites produces improved outcomes worthy of emulation. This study compared the industry success of graduates from both traditional campus-based programs and cooperative apprenticeship programs 3 years after graduation. The results indicated that cooperative apprenticeship program participants had higher related employment rates, annual income, career advancement, and satisfaction with industry preparedness than graduates of traditional campus-based programs.

Calls for educational reform have resounded across our nation for more than two decades. Several national commissions have been convened to examine the current educational system and make recommendations for educational reform (e.g., Secretary's Commission on Achieving Necessary Skills, 1991; Secretary's Commission on Achieving Necessary Skills, 1992; Special Study Panel on Education Indicators, 1991). A common theme in their findings has been a concern with the educational system's inability to prepare students properly to meet the workforce needs for the future. Recent legislation (i.e., Goals 2000: Educate America Act, 1994; Carl D. Perkins Vocational and Applied Technology Education Amendments of 1998, 1998) has been enacted to encourage educational changes recommended by these studies to address the shortcomings of our educational system.

Numerous initiatives to overhaul the educational system have been proposed in response to the national concerns of the inadequacy of career preparation curricula. These analyses have strongly suggested that the current system is fundamentally inadequate and only a wholesale overhaul

of the system will yield the needed improvements in student outcomes. The cooperative apprenticeship model, implemented across the nation by the major automotive manufacturers and partner colleges since 1985, possesses several attributes that merit consideration. This curriculum has been nationally standardized and in use across a wide range of educational institutions by the automotive industry partners at over 500 sites (Cantor, 1991).

Problem Statement

Before undertaking the time consuming and extremely expensive reengineering of the educational system, information regarding educational program models that result in improved outcomes is needed. The cooperative apprenticeship model is one that is worthy of further investigation. This model, if proven successful, could provide a template for implementation across a broader range of technical programs. A limited number of studies have been conducted on cooperative apprenticeship programs in 2-year colleges. However, previous studies have been too few and too limited in size to permit any firm conclusions or generalizations (Bragg & Hamm, 1996; Stern, Finkelstein, Stone, Latting, & Dornsife, 1994).

Cooperative programs typically have been locally developed and differed greatly from institution to institution. One of the few exceptions is the manufacturer-sponsored automotive cooperative apprenticeship programs used across the United States since 1970 (Cantor, 1991). This cooperative apprenticeship model provides a unique opportunity to evaluate the educational method while reducing concerns of institutional or geographic limitations.

The automotive cooperative apprenticeship model has included the outcome criteria of placement, related placement, long-term persistence, annual income, and student satisfaction called for by recent federal legislation (McCaslin, 1990; McCaslin & Headley, 1993). However, the model has not been evaluated based on its ability to provide a significant increase in the workforce performance of its graduates. Applicability of this model has demanded evidence based on outcomes.

Purpose and Objectives

The purpose of this study was to compare the effectiveness of Ohio 1993-94 academic year graduates of cooperative apprenticeships and traditional on-campus automotive technical programs in terms of the industry success 3 years later (Rezin, 1998). The specific objectives of the study were to:

1. Determine the industry success of post-secondary automotive program graduates who participated in industry-sponsored cooperative apprenticeship and those of traditional programs as measured by employment, related placement, job title, and annual income.
2. Determine the student satisfaction of post-secondary automotive program graduates who participated in cooperative apprenticeship programs and those of participants in traditional programs.
3. Determine the relationship between student characteristics (age, prior related experience, prior related training, and high school grade point average) and industry success.
4. Isolate the unique contribution of program type (cooperative apprenticeship vs. traditional program) to the industry success and student satisfaction of program graduates when controlling for other factors.

Significance of the Study

Improvement in the career readiness of community college graduates for America's workforce has been a central focus in calls for educational reform over the past 15 years. Identification of a successful educational model would help to provide a useable template to address the career readiness of community college graduates. Broader implementation of this model could be done more rapidly and with considerably less expense than that required by a complete overhaul of the educational system.

Although many industry-education partnerships exist in post-secondary education using a cooperative apprenticeship curriculum design, little quantitative research has been done to identify the unique contribution that this design plays in graduate success. Though the program and geographic scope of this study were limited, the implications in both research design and findings could play an important role in providing directions for further research.

Methodology

This research examined Associate Degree Automotive Technology graduates 3 years after their graduation. The study was designed to compare the effectiveness of Associate Degree automotive programs (cooperative apprenticeship vs. traditional program) in terms of graduates' job placement, success in industry, and satisfaction with their educational program.

Type of Research

The research conducted was descriptive and correlational. "Descriptive research asks questions about the nature, incidence, or distribution of educational variables and/or the relationships among these variables" (Ary, Jacobs & Razavieh, 1990, p.45). Descriptive research does not attempt to manipulate variables but only to describe them and their relationships as they naturally occur (Ary et. al). "Correlational research attempts to investigate possible relationships among variables without trying to influence those variables" (Fraenkel & Wallen, 1993, p.286).

Population

The population for the study was graduates of Associate Degree Automotive Technology Programs offered at the 10 publicly funded-community and technical colleges in Ohio during the 1993-94 academic year. The population of institutions was identified in the Integrated Postsecondary Education Data System (IPEDS) report (National Center for Educational Statistics, 1994). The names and addresses of all graduates were then obtained directly from the colleges. Due to the small size of the population (N = 153), the entire population was included in the study which followed up these graduates in 1998.

Instrumentation

The outcomes measured chosen for the study (dependent variables) were selected from McCaslin's (1990) framework for evaluating vocational education. These variables included four dimensions of student success in industry (i.e., employment status, related employment, job title, and annual income) and student satisfaction. Success in industry was measured using items extracted from the Columbus State Community College Annual Graduate Follow-Up Survey (McCabe, 1997). Student satisfaction was measured using a 10-item instrument adapted from one developed by Franchak and Smith (1986). This instrument included items to identify satisfaction with program curriculum, delivery of instruction, and institutional support.

Program type chosen by graduates (cooperative apprenticeship or traditional) was the independent variable of primary interest in this study. Additional independent variables were selected to address concerns due to the influence of other factors (i.e., high school grade point average, age, years of prior related experience, and years of prior related training).

Validity

The survey instrument for the study was examined for face and content validity using a panel review including nine individuals. These individuals consisted of faculty from The Ohio State University, community college automotive instructors, and automotive service management personnel. Additionally, a pilot test with a group of 30 current automotive program students was conducted to determine problems with the instrument. No concerns requiring further modification of the instrument were identified. However, several recommendations were made to add an additional item to the student satisfaction index portion of the instrument to address the question of student satisfaction with adequate hands-on experience as a part of the program. An additional item was designed and added to the original instrument to reflect hands-on experience.

Reliability

Instrument reliability was determined by mailing the final survey instrument to a group of 30 Automotive Associate Degree Program graduates who were not included in the research population. This was done using a test-retest methodology in which respondents from the first mailing were sent a second copy of the same instrument 2 weeks after receipt of their initial response. The responses were then compared to find the reliability of their responses between the two mailings.

The first section of the instrument was evaluated for exact match between responses between the first and second iterations of the instrument. Almost 90% (87.7%) of the responses on the first nine items matched. Test-retest reliability on the 10th item (post-graduation training) achieved a very low correlation (27.8%) between the first and second responses. After further review of this item it was determined that respondents were unable to consistently report hours of training, and these results were excluded from the final instrument. The second section of the instrument, student satisfaction index, was evaluated for reliability using the consistency measure developed by Cronbach and Meehl (1955). The reliability test yielded an internal consistency coefficient (Cronbach's Alpha) of .83. Nunnally and Bernstein (1994) indicated that coefficients greater than .50 to .60 were acceptable indicators of reliability in early stages of research.

Data Collection

Data were collected using a mailed questionnaire to the entire population of Ohio automotive program graduates. Miller's (1994) recommended methodology to maximize responses to a mailed survey was followed. Forty-eight percent of the population responded to the mailed surveys. As a control for non-response error, a random sample of 20 of the non-respondents was contacted by telephone. Comparison of the responses from the two groups indicated that they did not differ. Therefore, the results were generalized to the population.

Data Analysis

Data analysis involved the use of descriptive and inferential statistics. Frequencies, percentages, and measures of central tendency (i.e., means, modes, and standard deviations) were used to describe graduates in terms of the variables selected for the study. Correlations were used to determine the strength of the relationships using the Davis (1971) Convention. Relationships of ±.30 were said to be moderate. Two inferential statistical methods were used to explain the relationship between the independent variables and graduate industry success and satisfaction. Logistic regression was used to evaluate the ability of the independent variables to explain the three ordinal-level graduate success measures (employment status, related employment, and job title). Hair, Anderson, Tatham & Black (1995) indicated that logistic regression was appropriate for use in analyzing non-metric dependent variables. Logistic regression does not require strict adherence to the assumptions of multivariate normality and equal variance.

Multiple regression was used to explain the amount of variance in the two interval-level dependent variables (annual income and student satisfaction index). Hair et.al. (1995) stated that multiple regression is used to analyze the relationship between a single metric dependent variable and several independent variables. Both methods of regression analyses were implemented in a two-step method to isolate the unique contribution of program type to student success and satisfaction. Multiple and logistic regression commonly have been used as inferential statistics in hypothesis testing. In this instance, they were used as descriptive statistics to explain differences in the population.

Findings

This section reports the results of the study. The results are presented for the industry success of the graduates, graduates' satisfaction with their educational program, the relationship of other graduate characteristics to industry success, and the unique contribution of type of program to industry success.

Industry Success of Graduates

Although nearly 95% of all graduates were employed full-time, graduates from cooperative apprenticeship programs outperformed traditional program graduates in several areas (Table 1). Nearly 87% (86.8%) of cooperative apprenticeship program graduates reported current employment in jobs directly related to their college program compared to 53.1% of the traditional program graduates.

More than 18 (18.4%) of the cooperative apprenticeship program graduates had moved up into automotive management or supervisory positions with an additional 57.9% employed as automotive technicians. Only 3.1% of the traditional program graduates were employed in automotive management or supervisory positions with an additional 46.9% employed as automotive technicians. More than 28% (28.1%) of the traditional program graduates reported that they were currently employed outside of the automotive industry compared to only 7.9% of the cooperative apprenticeship program graduates.

Annual income of the graduates is presented in Table 2. Cooperative apprenticeship program graduates reported a 15.8% higher 1997 annual income ($38,868) than their traditional program counterparts ($33,573). This amounted to a pay differential of nearly $5,300. Additionally, cooperative apprenticeship graduates had higher minimum and maximum salaries.

Table 1

Employment Status by Program Type

Employment Status	Traditional f	Traditional %	Cooperative Apprenticeship f	Cooperative Apprenticeship %
Employment Status				
Not Employed	2	5.9	1	2.6
Employed Part-Time	0	0	1	2.6
Employed Full-Time	32	94.1	37	94.9
Total	34	100	39	100
Related Employment				
Not Related	8	25	3	7.9
Somewhat Related	7	21.9	2	5.3
Directly Related	17	53.1	33	86.8
Total	32	100	38	100
Job Title				
Automotive Service Mgmt.	1	3.1	1	2.6
Shop Foreman / Supervisor	0	0	6	15.8
Automotive Technician	15	46.9	22	57.9
Other Automotive Position	7	21.9	6	15.8
Non-Automotive Position	9	28.1	3	7.9
Total	32	100	38	100

Table 2

1997 Annual Gross Income of Graduates from Automotive-Related Employment

Annual Income	Traditional f	Traditional %	Cooperative Apprenticeship f	Cooperative Apprenticeship %
$11,001 - $20,000	3	12.5	0	0
$20,001 - $30,000	7	29.2	8	25.8
$30,001 - $40,000	4	16.7	13	41.9
$40,001 - $50,000	5	20.8	7	22.6

Table continues

$50,001 - $60,000	5	20.8	1	3.2
$60,001 - $70,000	-	-	1	3.2
$70,001 - $80,000	-	-	-	-
$80,001 - $90,000	-	-	1	3.2
Total	24	100.0	31	100.0
Mean =	$33,573		$38,868	
SD =	$11,832		$13,552	
Range =	$40,500		$62,300	
Minimum =	$14,500		$21,700	
Maximum =	$55,000		$84,000	

Graduates' Satisfaction with Their Educational Program

Responses of all graduates' satisfaction with their programs are reported in Table 3. Graduates from both program types indicated that they were satisfied with the program's ability to prepare them for the automotive industry. However, satisfaction of cooperative apprenticeship program graduates was higher (strongly agree) than that of their traditional program counterparts on 9 of the 10 items. Cooperative apprenticeship program graduates expressed stronger agreement with the program's ability to increase confidence in their professional ability, their preparedness for a higher-level position, and their instructor's ability to help them achieve their learning objectives. They also indicated a stronger interest in encouraging their friends and co-workers to enroll in the program.

The greatest difference between the two groups was in their satisfaction with adequate hands-on experience during the program. More than 82% (82.1%) of the cooperative apprenticeship program graduates agreed that hands-on experience was adequate; only 55.9% of the traditional program graduates agreed with the statement.

Relationship of Other Graduates' Characteristics to Industry Success

In addition to investigating the relationship of program type to industry success, the study also investigated the relationship that pre-existing factors (age, prior related experience, prior related training, and high school grade point average) had to industry success (employment status, related placement, job title, and annual income). Overall, these factors were found to be poor predictors of industry success.

A low to negligible relationship was found between age and all four of the industry success factors as illustrated in Table 4. Graduate age was found to have a negligible negative relationship to employment status (tau = -.02), and to related employment (tau = -.14) and a low negative relationship to job title (tau = -.24). The relationship of age to annual income was also found to be low yielding a Pearson product-moment correlation coefficient of only .14.

Table 3

Graduates' Satisfaction (in percent) with their Program

Statement	Traditional Program SD	D	A	SA	Cooperative Apprenticeship SD	D	A	SA
1) The automotive technology program motivated me to learn new skills related to my job.	2.9	11.8	64.7	20.6	0.0	10.3	53.8	5.9
2) I have gained additional confidence in my professional capabilities as a result of the automotive technology program.	0.0	2.9	64.7	32.4	0.0	7.7	41.0	51.3
3) I feel that the automotive technology program has helped to prepare me for a higher-level position.	0.0	8.8	70.6	20.6	2.6	10.3	46.2	41.0
4) The process of setting up learning objectives as the basis for evaluation of the automotive technology program is appropriate.	0.0	8.8	76.5	14.7	0.0	7.7	66.7	25.6
5) My instructor was competent in helping me to achieve my learning objectives.	0.0	5.9	55.9	38.2	5.1	2.6	46.2	46.2
6) The grading procedure in the automotive technology program was fair.	0.0	0.0	85.3	14.7	0.0	5.1	64.1	30.8
7) If I had the opportunity, I would enroll in the automotive technology program again.	8.8	20.6	50.0	20.6	12.8	12.8	35.9	38.5
8) The automotive technology program is the best preparation available to prepare someone for a career as an automotive technician.	2.9	14.7	58.8	23.5	0.0	7.7	51.3	41.0
9) I would encourage friends/co-workers to enroll in the automotive technology program.	8.8	17.6	55.9	17.6	7.7	15.4	38.5	38.5
10) Adequate time was devoted to hands-on experience in the automotive technology program to properly prepare me for a career in automotive repair	14.7	29.4	32.4	23.5	7.7	10.3	41.0	41.0

Note: SD = Strongly Disagree, D = Disagree, A = Agree, SA = Strongly Agree.

Table 4

Relationship of Age to Employment Status, Related Employment, and Job Title

	Age							
Current Employment	24 to 27	28 to 31	32 to 35	36 to 39	40 to 43	44 to 47	48 to 51	52 to 55
Employment Status								
Not Employed	1	1	0	0	1	0	0	0
Employed Part-Time	0	1	0	0	0	0	0	0
Employed Full-Time	29	18	10	3	5	3	0	1
Kendall's tau-c = - .02								
Related Employment								
Not Related	4	2	2	0	1	1	0	1
Somewhat Related	2	4	1	0	1	1	0	0
Directly Related	23	13	7	3	3	1	0	0
Kendall's tau-c = - .14								
Job Title								
Automotive Service Mgmt.	3	4	2	0	1	1	0	1
Shop Foreman / Supervisor	3	3	2	1	2	2	0	0
Automotive Technician	18	10	5	2	2	0	0	0
Other Automotive Position	5	0	1	0	0	0	0	0
Non-Automotive Position	0	2	0	0	0	0	0	0
Kendall's tau-c = -.24								

Note. Pearson Correlation = .14

All of the relationships of prior-related experience and prior-related training to employment status, related employment, and job title were found to be negligible. The strongest relationship of these factors to the industry success measures was to annual income. Prior-related experience had a low positive association (r = .24) and prior-related training had a low negative association (r = -.25) to annual income.

Overall, high school grade point average was found to have little relationship to the industry success of automotive graduates. The relationship of high school grade point average to each of the following dependent variables were negligible (a) employment status (tau = .03), (b) related employment (tau = .02), (c) job title (tau = .17), and (d) annual income (rho = .08).

Unique Contribution of Type of Program to Industry Success

The intercorrelation between the independent variables is reported in Table 5. High correlation between independent variables reduces the predictive power of the variables (Hair et al., 1995). This sharing of predictive power of the independent variables can result in multicollinearity and violates the assumption of independence necessary for using multiple regression. A moderate association was found between the independent variables prior- related experience and prior-related training (r = .39). A low association was found between all of the other independent variables. Program type had a low association with each of the other predictor variables (r = .05 to -.11). Warmbrod (1996) indicated multicollinearity is not generally a problem if the correlation coefficients are =.80. Thus, the independent variables demonstrated their ability to act as independent predictors of results.

Table 5

Relationship Between Independent Variables

Independent Variables	Program Type	High School GPA	Current Age	Prior-Related Experience	Prior-Related Training
Program Type	1.00				
High School GPA	-0.09	1.00			
Current Age	-0.11	-0.02	1.00		
Years of Related Experience	0.05	-0.01	0.39	1.00	
Years of Related Training	0.03	-0.03	0.02	0.27	1.00

Logistic regression found no significant relationship between program type and graduate employment status. These findings were expected since almost all of the graduates from both programs (95.9%) were employed.

The relationship of related placement to the independent variables is reported in Table 6. Program type (using logistic regression) was found to be the only significant predictor of related employment (directly related or somewhat related) of graduates. The results indicated that the odds were 3.2 to 1 that a graduate who chose the cooperative apprenticeship program would be employed in a related job 3 years after graduation. Even stronger evidence was found for the relationship of cooperative apprenticeship to directly-related employment. Graduates of cooperative apprenticeship programs were 5.7 times more likely to be employed in directly-related jobs than graduates of traditional programs.

Although a moderate positive relationship was found between program type and current job title, none of these relationships were significant. The results did indicate that high school grade point average was the best predictor of graduate employment in an automotive management position. Age had a negative relationship with employment as a shop foreman/supervisor. Each year of age dropped the likelihood by 2 to 1 that a graduate would be employed as a shop foreman/supervisor. Prior-related experience had a negative impact on current employment as an automotive technician.

Table 6

Relationship of Related Placement (Directly Related and Somewhat Related) to Independent Variables

Related Placement
-2 Log Likelihood (Step 0) 60.54

Variables entered in step 1: GPA, Age, Experience, Training

-2 Log Likelihood 57.11 Classification: 85.5% correct
Goodness of Fit 72.35

	Chi-Square	df	Sig.
Model	3.43	4	0.49
Block	3.43	4	0.49
Step	3.43	4	0.49

Variables entered in step 2: Program Type

-2 Log Likelihood 54.44 Classification: 85.5% correct
Goodness of Fit 73.52

	Chi-Square	df	Sig.
Model	6.10	5	0.30
Block	2.67	1	0.10
Step	2.67	1	0.10

Variable	B	S.E.	Wald	df	Sig.	R	Exp (B)
GPA	-0.23	0.43	0.30	1	0.59	0.00	0.79
AGE	-0.07	0.05	1.77	1	0.18	0.00	0.93
EXPERIENCE	0.06	0.08	0.50	1	0.48	0.00	1.06
TRAINING	-0.17	0.34	0.24	1	0.63	0.00	0.85
PROGRAM TYPE	1.17	0.75	2.46	1	0.11	0.09	3.23
Constant	3.83	2.01	3.63	1	0.06		

The relationship of directly-related placement to the independent variables is reported in Table 7. The results indicated that a graduate of a cooperative apprenticeship was almost 6 times more likely (exp b = 5.7) to be employed in a job directly related to the automotive program (sig. = .01) than a graduate from a traditional program.

Using multiple regression, the other factors (high school grade point average, age, years of prior-related training, and years of prior-related experience) explained 13% of the variance in income. Participation in a cooperative apprenticeship program was able to explain an additional 5% of the variance when the influence of all other variables was controlled.

Table 7

Relationship of Directly-Related Placement to Independent Variables

Directly-Related Placement
-2 Log Likelihood (Step 0) 83.08

Variables entered in step 1: GPA, Age, Experience, Training

-2 Log Likelihood 79.69 Classification: 73.9% correct
Goodness of Fit 68.68

	Chi-Square	df	Sig.
Model	3.387	4	0.50
Block	3.387	4	0.50
Step	3.387	4	0.50

Variables entered in step 2: Program Type

-2 Log Likelihood 70.85 Classification: 78.3% correct
Goodness of Fit 71.08

	Chi-Square	df	Sig.
Model	12.23	5	0.03
Block	8.84	1	0.00
Step	8.84	1	0.00

Variable	B	S.E.	Wald	df	Sig.	R	Exp (B)
GPA	0.29	0.37	0.63	1	0.43	0.00	1.34
AGE	-0.06	0.05	1.56	1	0.21	0.00	0.94
EXPERIENCE	0.01	0.07	0.01	1	0.93	0.00	1.01
TRAINING	-0.1	0.29	0.12	1	0.73	0.00	0.91
PROGRAM TYPE	1.74	0.63	7.75	1	0.01	0.27	5.72
Constant	1.28	1.72	0.55	1	0.46		

The correlation of the student satisfaction index to the independent variables is presented in Table 8. The overall ability of the five factors (high school grade point average, age, years of prior-related experience, years of prior-related training, and program type) to explain student satisfaction was low. Program type was the only variable that showed a significant relationship to student satisfaction. However, program type only had a low association (partial correlation = .20) with student satisfaction and only explained 4% of the variance in student satisfaction.

Table 8

Correlation of Student Satisfaction Index to Independent Variables

Model	Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardied Coefficients Beta	t	Sig.	Correlations Zero order	Correlations Partial	Correlations Part
1 Satisfaction	19.57	3.70		5.29	0.00			
High School GPA	0.00	0.75	0.00	-0.01	1.00	0.00	0.00	0.00
Current Age	0.05	0.10	0.07	0.53	0.60	0.09	0.07	0.07
Related Experience	0.07	0.16	0.06	0.42	0.68	0.08	0.05	0.05
Related Training	-0.19	0.65	-0.04	-0.29	0.78	-0.02	-0.04	-0.04
r^2 chg.= .12								
2 Satisfaction	17.60	3.84		4.59	0.00			
High School GPA	0.10	0.74	0.02	0.14	0.89	0.00	0.02	0.02
Current Age	0.08	0.10	0.10	0.75	0.46	0.09	0.09	0.09
Related Experience	0.04	0.16	0.04	0.27	0.79	0.08	0.03	0.03
Related Training	-0.22	0.64	-0.04	-0.34	0.73	-0.02	-0.04	-0.04
Program Type	2.09	1.25	0.20	1.67	0.10	0.19	0.20	0.20
r^2 chg.=.04								

Conclusions and Recommendations

This study compared the outcomes of cooperative apprenticeship program graduates with those of traditional programs. The objective was to identify learning gains that justified the continued investment in these programs, expansion of this model within automotive programs, and consideration of this model in other college programs. Finally, evidence that cooperative apprenticeship programs provided improved outcomes would support recent studies and legislation that strongly recommend education/industry partnerships as a method to improve educational outcomes.

The improvements to student success and satisfaction through use of the cooperative apprenticeship model were measurable. A 34% increase in directly-related employment, a 15% improvement in promotion to management, and a 16% increase in annual income. Student satisfaction scores of cooperative apprenticeship program graduates were also higher than their traditional program counterparts.

The income advantage found in this study supports the findings of Mosbacker (1973); Gore (1972); Brown (1976); Brock, Larson, Rogers, and Stull (1984); and Kysor (1994). However, the findings are in contrast with those of Appelt (1991) who found no significant difference in earnings. The improvement in student satisfaction supports the prior research of Stern, Stone, Hopkins, McMillion, and Cagampang (1992), and Emenike (1994).

The improvements in all of the key indicators of employability resulting from participation in cooperative apprenticeships have marked implications for practitioners in career and technical programs. Instructors and administrators of career and technical programs should carefully consider the use of this instructional model to improve the outcomes of their programs. Where this model already exists, the evidence encourages expansion of the use of cooperative apprenticeships. Further, the impact of this model in producing better-prepared workers sends an important message to private sector employers of graduates. The improved employability outcomes should encourage employers to increase their involvement with career and technical programs to build cooperative apprenticeship partnerships to address their shortage of technical workers and improve the quality of their entry-level workforce.

Although the results were strong, the nature and scope of the study were limited. It only evaluated one program (automotive) in one state (Ohio) during one year (1993-94) with a total population of 153 graduates. Due to these factors, the results can only be generalized to this population. However, the results indicated that the benefits derived from this model of cooperative education warrant further research across broader geographic areas and a wider range of programs.

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