A REASSESSMENT OF TECHNICAL EDUCATION IN MEXICO

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Abstract

Using propensity score matching, this paper re-evaluates the labor market performance of graduates of CONALEP, Mexico's largest technical education system. CONALEP serves students from a lower socio-economic status at the upper-secondary school level in Mexico. The manuscript shows that individuals in the control group find jobs faster than CONALEP graduates do, but a higher proportion of the CONALEP graduates work in the occupational category congruent with their field of specialization or training. CONALEP graduates earn between 20 to 28% higher wages than the control group. The results indicate that employers invest more in training CONALEP graduates than they invest in the control group. Finally, a cost-benefit analysis appears to show that CONALEP is an effective system.

Introduction

The period spanning from the second half of the 1980s until the late 1990s is important for the Mexican economy, as it encompasses a major structural change from a protected, public-sector driven economy to a globally integrated, private-sector led one. For all its merits, this change seems to have produced an increasingly unequal distribution of the fruits of economic growth. The World Bank Report "Earnings Inequality after Mexico's Economic and Educational Reforms" (2000) showed that the most plausible hypothesis for the worsening in earnings inequality in Mexico is the increased rate of skill-biased technological change brought about by trade liberalization. This World Bank Report also found that Mexico is experiencing increasing returns to higher education, and that the skill composition of employment in manufacturing and other export sectors has moved toward demanding a higher proportion of skilled workers, particularly in industries that are most open to international competition.

When rising demand for skills is not met by supply, the result is a persistent shortage of skilled labor and constrained growth. The excess demand also forces firms to pay above market-clearing wages in order to retain the workers they train. On the supply side, the roots of the shortage problem can be traced to three main factors (Maloney, 2000). The first is low educational attainment—particularly among the poor. The second is insufficient financial support to those students who are academically qualified but who are financially needy. The third is the persistence of antiquated and unresponsive training mechanisms—vocational and technical systems are

not providing new entrants with appropriate skills. Effective technical training is Mexico's primary tool for reaching an equilibrium in the market for skilled labor.

Several attempts have been made to evaluate technical education programs in Mexico (World Bank, 1997; Carnoy. et. al, 2000). Past evaluations have found that education in technical high schools increases earnings in the magnitude of 30 to 40% (Lane & Tan, 1996; Lee, 1998). However, these results must be taken with caution since they have some failures in the construction of the control group. Using a propensity score matching methods, this paper re-evaluates the performance of the College of Professional Technical Education (CONALEP) system. CONALEP is the backbone of Mexico's skills training structure and has become the most important government technical education system (Lopex-Acevedo, 2001).

This paper is organized as follows. Section two describes the Technical Education System in Mexico and the place of CONALEP within this system. Section three reviews CONALEP's past evaluations. Section four introduces the CONALEP graduate tracer survey, the National Employment Survey (ENE), and the National Employment, Training, and Salary Survey (ENECE) used in this study. It also discusses the methodology used to construct the control group. Section five discusses the CONALEP benefit results compared to a well-designed control group. Section six presents a cost-benefit analysis. Finally, section seven offers conclusions.

Education and Training

The structure of Mexico's educational system has the following main characteristics. Basic education is the Mexican government's highest priority. The basic education system consists of: (A) early childhood education (or pre-school), which is optional for children from 3 to 5 years old; (B) mandatory primary education, ideally for children aged 6 to 12, but due to late enrollment and grade repetition it is targeted at children aged 6 to 14, and (C) mandatory basic secondary school education, consisting of a 3-year cycle, and intended for children aged 12 to 16.

Upper-secondary education in Mexico is divided into (A) *bachillerato general* (general baccalaureate), (B) *bachillerato técnico* (technical baccalaureate) and (c) *bachillerato bivalente* (bivalent baccalaureate). The *bachillerato general* education system is administered by the Sub-secretariat for Tertiary Education and Scientific Research (SESIC), while the technical baccalaureate system is administered by the Sub-secretariat for Technological Education and Research (SEIT).

The *bachillerato técnico* training is provided through a range of institutions that include CONALEP, offering programs aimed at mid-level careers in the work force. Students graduate with the qualification of professional technician, technical professional, or base level technician, depending on the type of institution they attend and the program they undertake. CONALEP is unique in that it offers the opportunity for students to gain access to higher education as they can opt to take more courses per semester and to take a separate high school diploma exam.

In 1990-91, only 75% of those who finished basic education continued on to upper-secondary; in 1998-99, the proportion rose to 95% (Ministry of Education, SEP 1999a). Table 1 shows that of all the students who attended upper-secondary in 1999, 7.96% went to CONALEP, 0.76% attended schools offering the *bachillerato general*, and 21.19% attended schools offering the *bachillerato técnico*. Table 2 shows the main differences between these educational systems.

Table 1

Enrollment in Upper-secondary by Type of School

	1997	%	*1998*	%	*1999*	%
Federal (SEIT, SESIC)	1,015,636	38.97	1,032,059	38.03	1,035,960	36.93
General Upper-secondary (Bachillerato General)	20,781	0.80	20,373	0.75	21,375	0.76
Upper-secondary by cooperation	68,441	2.63	67,262	2.48	66,788	2.38
Upper-secondary (COBACH)	83,946	3.22	89,369	3.29	88,016	3.14
Technical Upper-secondary	597,416	22.92	594,762	21.92	594,581	21.19
Technician (CETIS and CBTIS)	45,073	1.73	38,947	1.44	40,154	1.43
Technician CONALEP	197,906	7.59	218,884	8.07	223,273	7.96
Technician (Others)	2,073	0.08	2,462	0.09	1,773	0.06
State	703,515	26.99	773,195	28.49	15,421	29.06
Autonomous (University)	374,201	14.36	369,992	13.63	367,960	13.12
Private	512,743	19.67	538,651	19.85	586,193	20.89
Total	2,606,095	100.00	2,713,897	100.00	2,805,534	100.00

Source: SEP, "Compendio Estadístico por Entidad Federativa 1999," DGPPP.

In December of 1978, the Mexican Government created CONALEP as a public decentralized body of the Ministry of Public Education (SEP). CONALEP was intended to provide a national network of upper-secondary schools that would prepare young people to become technicians at the upper-middle educational level. At this skill level 4 in the ISCED international classification (upper-secondary), there was a gap that was growing with the increasing demands for skilled labor. With the establishment of CONALEP, the Government also wanted to strengthen and rationalize the complex provision for technical secondary education in Mexico.

In 1979, the first ten CONALEP schools were opened, offering training in seven careers to 4,100 students. Not surprisingly, five of these careers focused on manufacturing, while the other two careers dealt with medical assistant and nursing professions. By 1982 the number of students enrolled in courses in CONALEP leading to technical qualifications increased to 72,000 and by 1989-1990 the total was 155,300. Since 1983, in addition to its career programs for technicians, CONALEP has also offered short courses for industry. This program was expanded in 1986 through the introduction of mobile training facilities. By 1990, the number of students enrolled in these courses had increased to 61,300.

The major growth in student numbers during this period was facilitated by a rapid growth in the number of CONALEP schools, from 10 in 1979 to 239 in 1986, by which date all 31 states in Mexico had CONALEP schools. However, the distribution of students by state was uneven, with about one-third of all students attending schools within the metropolitan zone of Mexico City.

Table 2

Institutions That Provide Upper-secondary Education in Mexico

General upper-secondary	**Technical professional education**	**Technological upper-secondary**
Bachilleres Colleges (CB)	College of Professional Technical Education (CONALEP)	Centers for Industrial and Services Technological Studies (CETIS)[2]
Preparatoria Schools	State Institutes for Work Training (ICATIS)[1]	Centers for Industrial and Services Technological *Bachillerato* (CBTIS)[2]
Science and Humanities Colleges (CCH)	State Colleges for Scientific and Technological Studies (CECyTE)[1]	Centers for Technical Industrial Studies (CETI)[4]
Incorporated *Bachillerato*	Centers for Industrial and Services Technological Studies (CETIS)[2]	Centers for Scientific and Technological Studies (CECyT)[5]
	Centers for Industrial and Services Technological Bachillerato (CBTIS)[2]	Centers for Technological Studies (CET)[5]
	Nursing and Obstetrics School (ESEO)[3]	State Colleges for Scientific and Technological Studies (CECyTE)[1]
		Centers for Ocean Technological Studies (CETMar)[6]
		Centers for Continental Water Studies (CETAC)[6]
		Centers for Farming and Agricultural Technological *Bachillerato* (CBTA)[7]
		Centers for Forestry Technological *Bachillerato* (CBTF)[7]

1. ICATIS and CECyTEs are operated by state Governments.
2. CETIS and CBTIS are coordinated by the General Directorate of Technological Industrial Education (DGETI).
3. ESEO is part of the National Polytechnic Institute (IPN). It is the only modality in which graduates are professional technicians.
4. CETI offers technical programs.
5. CECyT and CET are coordinated by IPN.
6. CETMar and CETAC are coordinated by Department of Scientific Education and Ocean Technology (UECyTM).
7. CBTA and CBTF are coordinated by the General Directorate of Farming and Agricultural Education (DGTA).

Source: Informe de Labores. Several years. SEP.

The size of the individual CONALEP schools was also uneven. The number of careers expanded substantially from the original seven to 146 by the beginning of the 1990s, although these careers were reduced to 29 between 1993 and the beginning of 1997. The rapid growth during the 1980s and the beginning of the 1990s coincided with a shift toward white-collar occupations in commerce, administration, computing, and accounting, which now comprise more than half of the students in CONALEP. The educational services at CONALEP schools were expanded in 1991-1992 by the introduction of the modular program, which was the forerunner of the competency-based education and training (CBET).

In 1994, as part of the Education Modernization Project (PMETyC), CONALEP introduced a competency-based model (CBET) for nine careers, to bring the CONALEP education program closer to the needs of industry. The initial pilot project to introduce competency-based education and training effectively in CONALEP demonstrated the challenges of this new way of teaching. This project helped the institution to understand the complexities of its significant role as a player in the forthcoming standards-based approach to education and training, and the need for major reforms to its administration and educational practices.

The CONALEP decision to move to CBET was a direct consequence of Mexico's decision to develop national competency standards as part of PMETyC, coordinated by the SEP and the Ministry of Labor (STPS). This new approach is run by the Council for Standardization and Certification of Labor Competencies (CONOCER), which is organized as a trust fund governed by a tripartite board of directors consisting of labor representatives, entrepreneurs, and government. The SEP budget finances the trust. Established in 1995, PMETyC is intended to strengthen the links between formal education, training, and the needs of the labor market. Different countries are coming to terms with the requirements of work-based training in different ways (Ahier, 1999). Learning can take place in a range of settings, including on the job, off the job, in a technological institution, and at home. The skills required for employment involve lifelong learning to upgrade skills, preparing people for higher levels of employment, or providing opportunities to develop life skills that make people more valuable as citizens. This last aim sparks much debate, and different countries weigh programs differently depending on local perspective. European countries have always placed considerable emphasis on the general education component of formal vocational courses; Mexico has done the same (Boud & Garrick 1999).

Countries such as the United Kingdom, Australia, and New Zealand have put much less emphasis on these broader considerations, concentrating more in their vocational courses on developing the technical skills needed in the workplace. There is now a move away from such an instrumental approach toward a more balanced curriculum. This new direction emphasizes more generic skills and seeks not to cut off the range of students' options too early, allowing them to move more easily to higher levels of learning in the same field or a new one (Hobart, 1999).

The importance of career programs that allow students to develop general skills alongside technical ones has been acknowledged in many countries (Frantz, 1998). These skills have different names in different countries—they are called key competencies in Australia, strategy for prosperity in Canada, process independent qualifications in Denmark, crossing or transferable skills in France, key qualifications in Germany, essential skills in New Zealand, core or common skills in the United Kingdom, and workplace know-how in the United States (Hobart, 1999).

In light of the increased need for more generic skills, Mexico has started to re-examine its own strategy, as specific technical skills can quickly become outdated.

The Evaluation of the CONALEP System: Students and Graduates

The socioeconomic and academic level of CONALEP students varies according to location. Data from the National Evaluation Center (*Centro Nacional de Evaluación*, CENEVAL) suggests that CONALEP most frequently serves students from a lower socioeconomic status at the upper-secondary school level in Mexico City. The results of a random sample of those who took the entrance examination to upper-secondary school in the metropolitan area of Mexico City in 1999 suggest that CONALEP students come from families with the lowest average income and the lowest parental education (Table 3). The parents of an average CONALEP student have about two years less formal education than the parents of a student attending a *Colegio de Bachilleres*, and three years less formal education than the parents of a student attending the high schools of the *Instituto Politécnico Nacional*.

Students attending CONALEP do not necessarily do poorly on the entrance test, nor do they all come from low educated or low-income parents. About 20% of CONALEP students in this sample scored higher than the average student attending the *Colegio de Bachilleres*.

Approximately 35 to 40% of the parents of CONALEP students have higher levels of education than the parents of an average student at the *Colegio de Bachilleres*. Nonetheless, on average, CONALEP students come from the lower socioeconomic categories and generally have lower scores in the CENEVAL examination than students in the other streams of upper-secondary education. Only students attending other technical-professional schools (DGETI) are comparably low on these indicators.

CONALEP's Past Evaluations

The CONALEP system has been evaluated several times in the past. The first evaluation was done by CONALEP (1994) and CONALEP (1999) using graduate tracer surveys. These data sets are described in the next section. The other evaluations were done by Lane and Tan (1996) and by Lee (1998). CONALEP also hired international consultants (Carnoy and others 2000) to assess the evolution of the CONALEP system. For this purpose the consultants used a different data set as is explained below.

The CONALEP (1994) and (1999) tracer studies had several problems, one of the most important being the lack of a well defined control group. A control group was expected to be added later, using data from the National Urban Employment Survey (ENEU). However, the studies neither include in-depth information on how the analysis was performed nor do they provide useful information on how CONALEP graduates perform relative to a control group.

Lane and Tan (1996) also encountered several problems in their evaluation. The first was the construction of a non-arbitrary control group. The ENEU sample is representative of metropolitan areas while the CONALEP graduate tracer survey is representative nationally. The difference in geographical coverage of the two groups makes comparison difficult. Second, the control groups were constructed ad hoc. The control groups included individuals between the ages of 17 and 30: (A) those who have completed lower-secondary education; (B) those

Table 3

CONALEP Students Compared to Students from Selected Institutions[6]

All Institutions	Option[1] Numbers	Global[2] Test Score	Family[3] Income	GPA in[4] Lower Secondary	Mother's Schooling (years)	Father's Schooling (years)	Private Lower Sec=1
CONALEP							
Mean	2.27	54.2	2271.2	7.627	7.1	8.2	8.70E-03
N	460	460	460	460	460	460	460
SD	2.13	15.3	2269	.6992	4.8	5.2	9.29E-02
Colegio de Bachilleres							
Mean	3.05	66.4	3132	7.658	9.0	10.0	3.33E-02
N	421	421	421	421	421	421	421
SD	2.28	13.2	2845	.75722	5.2	5.1	.18
Estado de México							
Mean	2.41	64.6	2721	7.931	8.452	9.9	1.76E-02
N	1192	1192	1192	1192	1192	1192	1192
SD	2.09	16.56	2436	.7600	4.9	5.2	.13
DGETI							
Mean	2.71	59.6	2610	7.7205	7.700	9.2	2.20E-02
N	682	682	682	682	682	682	682
SD	2.32	15.6	2488	.7271	5.0	5.4	.15
IPN							
Mean	1.97	80.7	3315	8.1865	9.8	11.3	5.81E-02
N	430	430	430	430	430	430	430
SD	1.61	13.9	2552	.7871	4.7	5.0	.23
UNAM							
Mean	1.46	88.1	3967	8.3935	9.8	11.4	9.41E-02
N	510	510	510	510	510	510	510
SD	.83	11.6	3385	.7864	5.212	5.0	.29
Other							
Mean	1.38	82.9	3896	8.5417	11.969	12.9	8.33E-02
N	48	48	48	48	48	48	48
SD	.96	15.8	3164	.8124	3.676	4.2	.28
TOTAL							
Mean	2.33	67.9	2945	7.9248	8.6	10.0	3.50E-02
N	3743	3743	3743	3743	3743	3742	3743
SD	2.03	18.5	2693	.7982	5.1	5.2	.18

Note: 1. This is the average preference number toward each institution from students who applied and got in.

2. Out of 128 questions.

3. In net pesos per month.

4. Grades go from 5 (fail) to 10.

5. Years of schooling.

who have completed non-professional, elementary vocational training (CECATI), and (C) those who have completed one to three years of general academic (non-vocational) high school. Some doubts remain with respect to the second group, since the ENEU survey does not distinguish between formal and informal training/technical courses.

Lee (1998) compares the individuals from the *Encuesta de Egresados* 1994 (the treatment group) with two other groups. One group comprises all 1991 graduates from upper-secondary diversified technical education programs; this group's labor force participation and employment performance in January 1994 was compared with that of CONALEP graduates of 1991, and of 1991-93 combined. The first comparison group was created from a mail survey of all graduates, with a 45% response rate, and therefore is likely to be biased toward those who were either employed, studying, or had a higher level of earnings. The second comparison group was made up of employed workers aged 20 to 24, as reported in the aggregates of the ENEU of January 1994.

The results of these evaluations concluded that CONALEP graduates actively participated in the labor market at a much higher rate than the similar age cohort of the general population, and at a much higher rate than graduates from traditional technical high schools. On average, CONALEP graduates found jobs faster than control individuals, and about two-thirds of CONALEP graduates worked in jobs related to the specialization they had studied. Using cross-cohort comparison, these evaluations also suggested that CONALEP graduates' earnings increased rapidly within the first two to three years of employment.

These conclusions are as expected, although the magnitudes of the participation rate and the increase in earnings in comparison to the magnitudes in traditional technical high schools and the general population are surprising—30% in Lane and Tan, and 40% in Lee. The results should be considered with caution, since these studies failed to control for possible self-selection bias that could account for different labor market outcomes between the CONALEP group and the comparison groups. In addition, some of these evaluations do not fully explain how the control groups were constructed.

A fourth evaluation, aimed at understanding the background experience and goals of CONALEP students, conducted a survey with 5% of the senior students (ready to graduate) and freshmen students, the control group. The sample was 4,930 third year students and 725 first year students who, on the basis of their responses, were then divided into three groups using a socioeconomic status indicator. The results confirm the assumption that close to one-third of the students from CONALEP come from a low socioeconomic background. Another 40% come from a middle socioeconomic range. About 18% have parents with basic secondary school or more, own their own home with four or more rooms and have either a car, a phone, or both. The average entry test scores for the sample show several important trends in social class, gender, and cohort, as described below.

Girls in both cohorts enter CONALEP with slightly lower scores than boys. The first year (1999) cohort entered with higher scores than the third year (1997) cohort. Thus, we could conclude that CONALEP student entry scores have actually risen more than suggested by the data. In the third-year cohort, entry scores positively correlated with rising socioeconomic indicators for both boys and girls. However, there seems to be little relationship between socioeconomic status and entry score in the 1999 cohort, except for higher-class girls.

In sum, CONALEP students tend to come from relatively low socioeconomic backgrounds and tend to score at the lower passing end of the higher secondary school entry test. About half have general basic secondary education, with another third coming from basic technical secondary schools. Somewhat less than half of the third year students indicate that the CONALEP option was their first choice of higher secondary school, and somewhat more than half of the first year cohort say it was their first choice.

A second questionnaire was given to firms that hired CONALEP graduates from regular courses or training courses. In general, the interviewed firms who hire students from CONALEP and use its training services think highly of the organization. Approximately 72% of firms (public lower, private higher) think that the academic level attained by CONALEP students is high or very high. About 55 to 60% of companies said that the technological level of a CONALEP education is high or very high, with large public companies giving the lowest ranking (46%).

Data and Methodology

The CONALEP Graduate Tracer Surveys

This paper re-evaluates CONALEP's effectiveness using the CONALEP graduate tracer surveys conducted in 1994 and 1998.[7] The first CONALEP graduate tracer survey was conducted in February 1994 (CONALEP, 1994) on the basis of a random sample of 1500 former CONALEP students who graduated between June 1991 and June 1993. The surveyed graduates were selected to represent the profile of the graduates in each of the three years in terms of all 13 major occupational groups of careers and the six geographical regions of the country. However, the sample is dominated by 1992 graduates who comprise 50% of the sample; 1991 and 1993 graduates each represent 25% (Table 4 and 5). The sample selection is probabilistic and statistically representative of the universe of graduates in each cohort. For each graduate (M), three substitutes were chosen from the same career and school (S, T and Z).

The second CONALEP Graduate Tracer Study (CONALEP 1999) was conducted between May and June of 1998 on the basis of a random sample of individuals who graduated between June 1993 and June 1997. The sample is representative of geographical regions, all 29 careers and all cohorts. The difference between the actual sample of 5,574 individuals and the planned sample of 10,000 was due to exogenous factors such as changes in address (3,590 cases); addresses that belonged to different states (651 cases); differences between the number of graduates officially registered and those found in the administrative records (229 cases), and technical careers that had never been offered (7 cases). CONALEP (1998) extensively reviews the sample frame of the second CONALEP Graduate Survey as described by LEVANTA, the consultant firm which designed the sample process. The distribution of the 1998 CONALEP survey was as follows. Table 6 shows that the response rate is high.

Table 4

Distribution of the 1994 Sample by Cohort

Graduation Year Cohort	Planned Selection	%	Actual Selection	%
1991	375	25	346	24.7
1992	750	50	704	50.3
1993	375	25	349	24.9
Total	1500	100	1399	100

Source: CONALEP (1994).

Table 5

Actual Sample Selection (original and substitutes by cohort)

	Selected		Substitutes		Total	% vs. 1,500
Graduation Year Cohort	M	S	T	Z		
1991	268	53	20	5	346	23.1
1992	560	96	42	6	704	49.9
1993	286	46	15	2	349	23.3
Total	1,114	195	77	13	1,399	93.3
Cumulative percentage	74.3%	87.3%	92.4%	93.3%	93.3%	

Source: CONALEP (1999).

Table 6

Distribution of the 1998 Sample by Cohort

Cohort	Interviewed Graduates		% Completed
	Number	%	Interviews
90-93	779	14.0	59.0
91-94	951	17.1	72.0
92-95	1,127	20.2	85.4
93-96	1,268	22.7	96.1
94-97	1,449	26.0	109.8[1]
Total	5,574	100.0	84.5

Source: LEVANTA C.

Note: [1] This value, as listed in CONALEP data sets, appears to exceed 100% because the number of responding graduates exceeded the goal number.

The ENE98 and ENECE99 Surveys

Two other surveys are used in this paper, The National Employment Survey (ENE) and the National Employment, Schooling, and Training Survey (ENECE). The first is representative at a national level and by urban and rural areas. It has rich information on individual labor market characteristics. The ENE98 has a sample size of nearly 200,000 individuals. The second survey is a module of the National Employment Survey. The 1999 sample size was 164,550 individuals. The ENECE is also representative at the national level and has useful additional information on the professional profile of the individuals and the training status, such as type of training received, training time, date of training, place of training, etc.

Propensity Score Matching

In order to compare CONALEP graduates to a control group, this paper examines labor force participation, employment status, earnings, training and hours worked for both the CONALEP group and the control group. To construct the control group, this paper uses the statistical approach of propensity score matching. As discussed by Ravallion (1999) and Todd (1999), the idea behind matching is to find a comparison group that is as similar as possible to the treatment group in terms of the relevant observable characteristics such as age, sex, education, region of residence, as summarized by the propensity score. In calculating the propensity scores, we followed Ravallion's methodology (1999) and Gill and Dar (1995).

First, we chose two representative sample surveys of eligible non-participants as well as one of the participants. The two surveys of eligible non-participants are The National Employment Survey of 1998 (ENE98) and the National Education, Training, and Employment Survey of 1999 (ENECE99). Both surveys have the advantage of a large number of eligible non-participant respondents, which ensures good matching. The participant survey used is the 1998 CONALEP graduate tracer study. Although the participant and non-participant data come from different surveys, the surveys are comparable since some of the questions are identical, all are from similar survey periods, and all are nationally representative.

Next, the two samples were pooled and a logit model of CONALEP participation as a function of the variables that are likely to determine participation was estimated. The variables included were age, sex, education, region of residence, and the location where training was under taken. The predicted values of the probability of participation were created from the logit regression —the propensity scores. There was a propensity score for every sampled participant and non-participant.[1] The models consistently classified correctly 99% of the non participant group cases and 72% of the participant group cases. The overall percentage of correctly predicted cases is 98%. Then we calculated propensity scores of the three and five nearest neighbors. This means that for each individual in the CONALEP group, the three and five observations in the non participant sample that have the closest propensity score were found, as measured by the absolute differences in scores. Alternatively, another transformation was used, the lag-odds ratio $log\ [p/(1-p)]$, where p is the propensity score for matching. Heckman and others (1998) have proposed an alternative method for the nearest neighbor. Instead of relying on the nearest neighbor, they use all the non-participants as potential matches but weigh each according to its proximity.

The mean values of the outcome indicators for the three and five nearest neighbors were computed using labor market status, hourly earnings, earnings, economic sector, and training. The difference between the mean and the actual value for the treated observation is the estimate of the gain due to the program for that observation. The mean of these individual gains was computed to obtain the average overall gain.

Results

In order to reassess CONALEP's effectiveness, we examine CONALEP graduates versus the control group in terms of labor force participation, status in the labor market, sector, further training at work, wages, and hours worked. Interpretation and tabular data of each area are presented in the following subsections.

Labor Force Participation

Irrespective of distance criteria or nearest neighbors, the proportion of individuals seeking employment in the CONALEP group is higher than in the control group (Figure 1). It is unclear whether labor force participation of the CONALEP group has declined with respect to the control group over time. Additionally, the percent of individuals who are searching for a job is higher in the CONALEP group than in the control group. It is difficult to interpret why this proportion increased substantially for the cohort graduating in 1996, a crisis recovery year.

The labor force participation rate of CONALEP graduates is shown in Table 7 and 8. Contrary to previous studies, the results indicate that the share of CONALEP graduates in the working population is lower than the control group. Moreover, the CONALEP job search share is higher compared to the control group. Further analysis might be needed to explain the greater percent of CONALEP graduates who are searching for a job. Results also suggest that between 2 and 3.5% more control individuals worked without pay than CONALEP graduates did. Although between 3.9 and 5.6% more control individuals are employed than CONALEP individuals are, CONALEP individuals earn between 20 and 27.5% more per hour than control individuals do. It appears, then, that the lack of employment of CONALEP graduates relative to the control group does not translate into a lack of income.

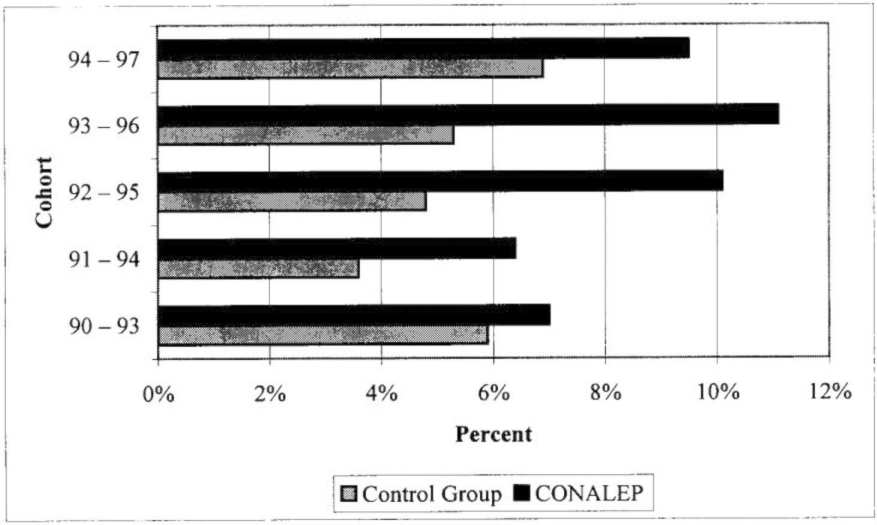

Figure 1. Share of Individuals Seeking Jobs (ENE98 control group).

Table 7

Labor Force Participation by Cohort
Matching group: Age 17-65. Three nearest neighbors based on propensity scores

	Working people			Searching for a job		
Cohort	Ctrl. Group	CONALEP	Difference	Ctrl. Group	CONALEP	Difference
90 – 93	94.1	93.0	-1.0	5.9	7.0	1.0
91 – 94	96.4	93.6	-2.8	3.6	6.4	2.8
92 – 95	95.2	89.9	-5.3	4.8	10.1	5.3
93 – 96	94.7	88.9	-5.8	5.3	11.1	5.8
94 – 97	93.1	90.5	-2.6	6.9	9.5	2.6
Total[1]	94.8	91.2	-3.6	5.2	8.8	3.6
ENE 98[2]	97.5			2.5		
ENE 98, LS[3]	94.5			5.5		
ENE 98, US[4]	95.7			4.3		

1. Sample: Workers in the matching group.
2. Sample: All workers.
3. Sample: Workers with lower-secondary complete and 3 years of experience (18 and 19 years old).
4. Sample: Workers with upper-secondary complete and 1-5 years of experience (22-26 years old).
Note: ENE98 control group.

Table 8

Labor Force by Cohort
Matching group: Age 17-65. Three nearest neighbors based on propensity scores

	Working people			Searching for a job		
Cohort	Ctrl. Group	CONALEP	Difference	Ctrl. Group	CONALEP	Difference
90 – 93	97.0	94.5	-2.5	3.0	5.5	2.5
91 – 94	95.7	93.1	-2.7	4.3	6.9	2.7
92 – 95	96.3	88.3	-8.0	3.7	11.7	8.0
93 – 96	94.7	88.8	-5.9	5.3	11.2	5.9
94 – 97	95.7	87.9	-7.8	4.3	12.1	7.8
Total[1]	95.9	90.8	-5.1	4.1	9.2	5.1
ENECE 99[2]	98.1			1.9		
ENECE 99, LS[3]	95.7			4.3		
ENECE 99, US[4]	98.4			1.6		

1. Sample: Workers in the matching group.
2. Sample: All workers.
3. Sample: Workers with lower-secondary complete and 3 years of experience (18 and 19 years old).
4. Sample: Workers with upper-secondary complete and 1-5 years of experience (22-26 years old).*Note:* ENECE99 control group.

In a parallel study (López-Acevedo, 2001) evaluates the benefits of the 1991-1992 CONALEP reforms. Results indicate that graduates from the pre-reformed program (94 Survey) search longer for a job compared to those of the post-reformed program (98 Survey). Moreover, graduates from the post-reformed program have 45% more probability of finding a job than those from the pre-reformed program. Furthermore, the 94 Survey cohorts earned higher hourly earnings than the 98 Survey cohorts. A plausible explanation is that since 1994, real wages have decreased in Mexico by almost 40%. It also performs a cost-benefit analysis. It finds that CONALEP's present value is always positive.

Employment Status

In general, there are not substantial differences between the employment status of CONALEP graduates compared to the control groups using either ENE98 or ENECE99 (Figure 2). A large proportion of both CONALEP graduates and the control group individuals are employees. Albeit, the proportion of CONALEP graduates that are employees or wage earners (84.3% and 83.8%) is less than in the control groups (86.5% and 84.6%). The proportion of self-employed is higher among CONALEP graduates (9.8%) than it is in the ENE98 control group (7.5%). A plausible explanation for this is that CONALEP graduates are generally employed in the services sector. This sector has not been the engine of the Mexican economy in the last decade. Therefore, it is likely that CONALEP graduates join the informal sector through self-employment. There is also no clear pattern of this proportion through time. Interestingly, the proportion of self-employed in the 1991-1994 cohort (5.3%) is higher compared to the self-employed in the 1993-1996 cohort (2.6%). This might indicate that self-employment increases as graduates gain more work.
experience.[1]

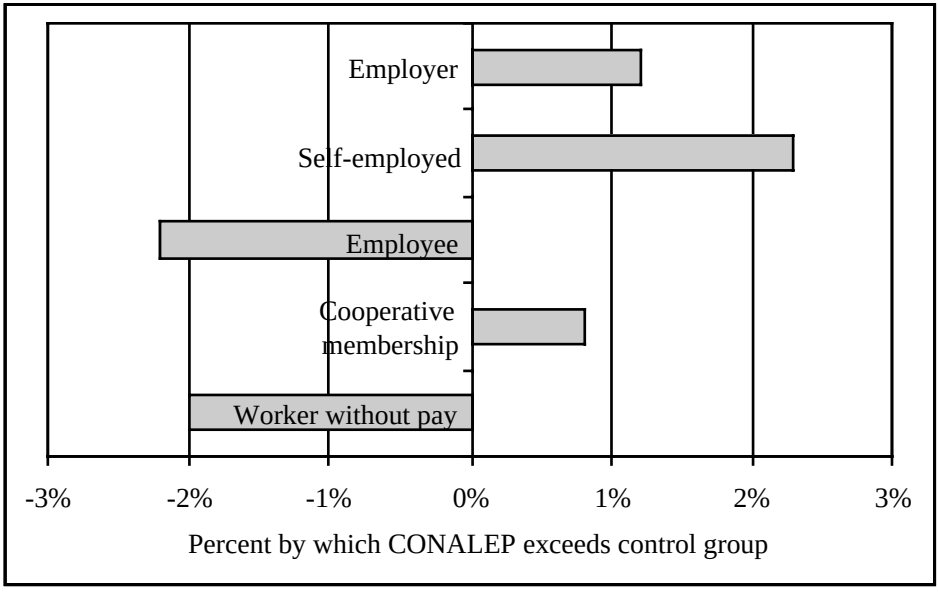

Figure 2. Employment Status, CONALEP vs. Control group (ENE98).

In relation to employment sectors, commerce, restaurants, hotels, personnel, communications, and government have the highest percent of CONALEP graduates (33.8%, 24.1% and 31.9% respectively). Unsurprisingly, these sectors also employ the largest share of individuals in the control groups. In Mexico, both manufacturing and services employ close to 80% of the labor force. Few CONALEP graduates work in the primary sector, the extraction (mining) sector or the electricity and gas sectors. With respect to overall patterns of employment, considering both sector and labor market status, the results for the CONALEP group are very similar to those obtained for the control groups. An important feature, however, is that CONALEP offers careers that are demanded in the manufacturing and service sectors. Due to the ENE98 limitations, it is not possible to assess in detail the type of job obtained by the individual. However, the CONALEP graduate tracer survey allows us to infer whether there is congruency in the CONALEP graduate professional profile. Among the employed CONALEP graduates, more than half reported that they were working in the occupational category congruent with their field of specialization. Close to 70% of employed graduates consistently reported that CONALEP training or specialization was "very useful" or "useful" in their current occupation. This high rate of congruency might be comparable to the high rate among apprentices in Germany, but it is significantly higher than in other developed countries (Organisation for Economic Co-operation and Development, OECD 1997).

Further Training

About 39% of CONALEP workers receive further training at work, a significantly higher level than the 37.2% of control group individuals that do (Figure 3). It appears that government investment in CONALEP training for an individual leads to additional investment by firms in training for the same individual.

Moreover, a significant proportion of CONALEP graduates (89.7%) report that their training was related to their current employment or work activity (Figure 4). Although the 1994-1997 cohort shows a considerable increase in the proportion of CONALEP graduates receiving training related to work, a lower proportion of this cohort reported receiving further training than older cohorts did.[1]

In response to a question asking the purpose of further training, nearly 60% of CONALEP graduates said that they received training in order to update their technical knowledge. Compared to the ENECE99 control group rate (near 32%), the CONALEP rate is quite high. This could indicate that employers invest more in training CONALEP graduates than they do in the control group because investment in the CONALEP group is more profitable. Compared to the 1994-1997 cohort, the rate of further training is slightly higher for the 1991-1994 cohort and much higher for the 1990-1993 cohort, which could mean that individuals in older cohorts need to update their skills in order to work efficiently. The proportion of CONALEP graduates who undergo training because it is a job prerequisite increases over time. This suggests two possible explanations: (A) employers' expectations of CONALEP graduates rise as they become more familiar with them, and (B) the technical complexity of jobs held by CONALEP graduates increases over time.

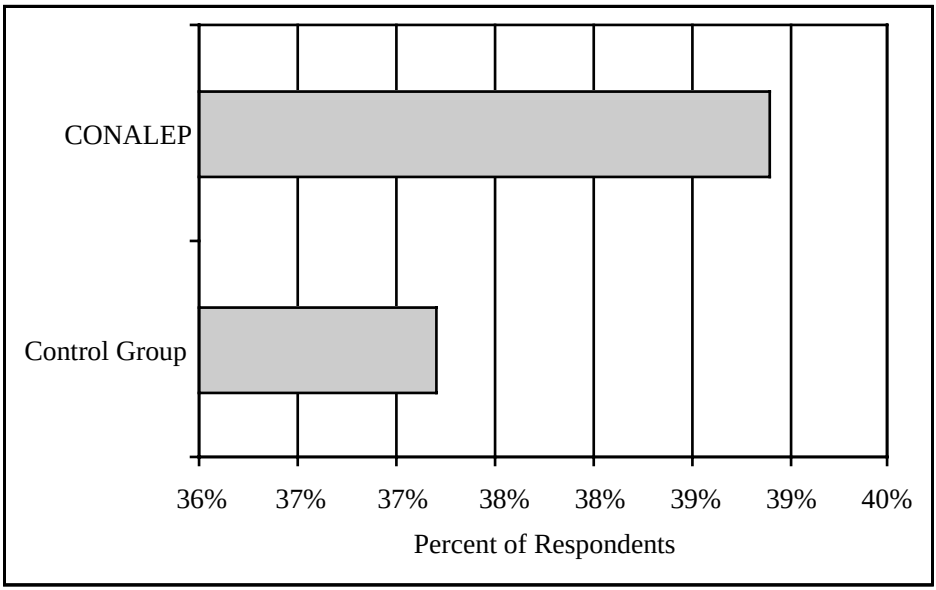

Figure 3. Training Received at Work (ENECE99 control group).

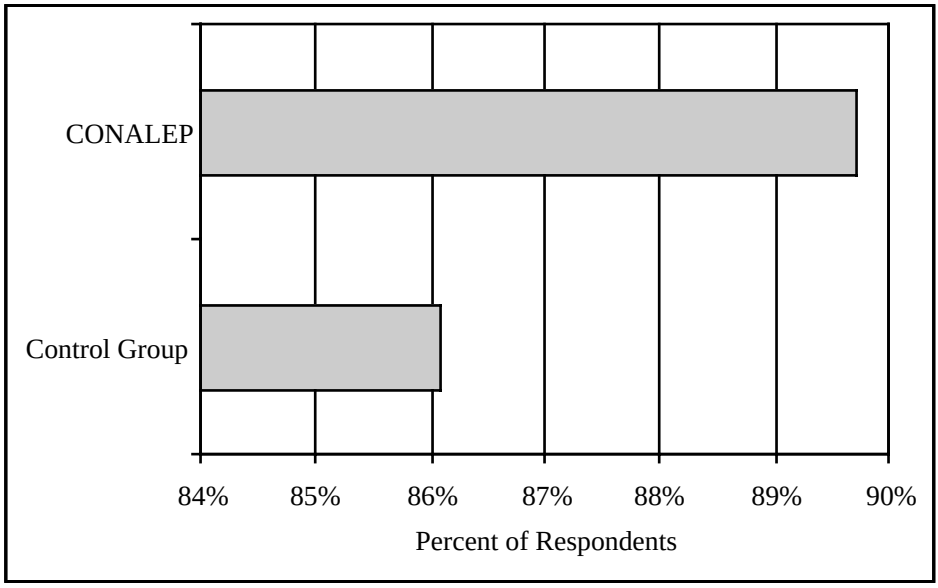

Figure 4. Training Related to Work (ENECE99 control group).

Earnings and Hours Worked

On average, CONALEP graduates earned 17% more than the ENE98 control group and 22% more than the ENECE99 control (Figure5 and 6). Controlling for hours worked, CONALEP graduates earn close to 20% more than the ENE98 control group and 27.5% more than the ENECE99 control group.

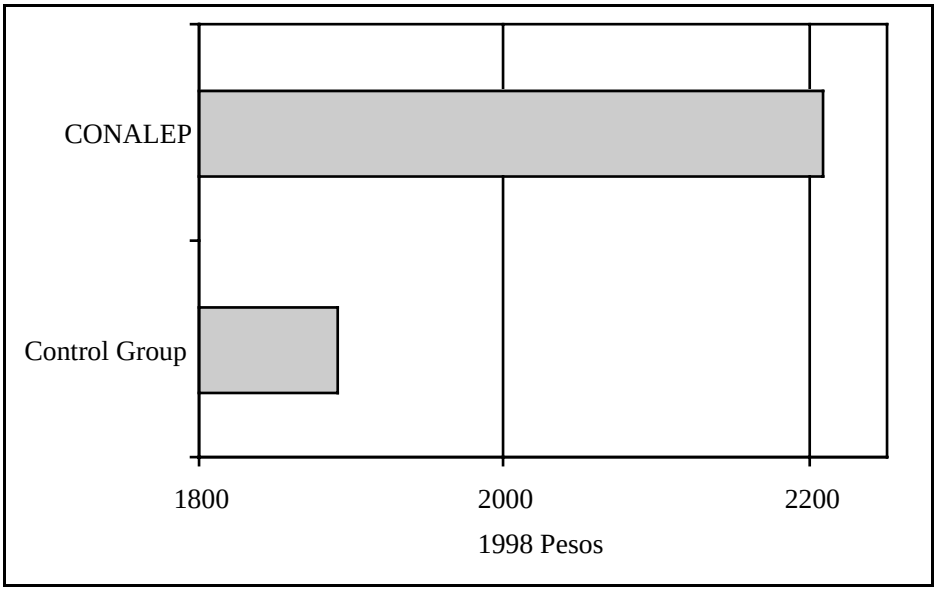

Figure 5. Earnings per month (ENE98 control group).

Even after the 1994 crisis, CONALEP graduates obtained higher earnings than individuals in the control group did. This might indicate that CONALEP has been a good alternative for low income individuals seeking a lasting job. Furthermore, it seems that in downturns such as in the 1994 crisis, CONALEP served as an alternative to other programs. The 1994-1997 cohort's results are surprising, but as anomalous data this cohort may be treated as an outlier (Table 9).

Table 8

Average Earnings, Earnings per Hour, and Hours Worked by Sample Group
Matching group: Age 17-65. Three nearest neighbors based on propensity (1998 pesos)

	Earnings			Earnings per hour			Hours worked per week		
Cohort	Control Group	CONALEP	Difference	Control Group	CONALEP	Difference	Control Group	CONALEP	Difference
90 - 93	1910.5	2660.0	749.5	10.6	14.3	3.7	44.5	46.4	1.9
91 - 94	1851.1	2170.4	319.4	11.0	12.4	1.3	43.8	45.6	1.8
92 - 95	1883.6	2262.3	378.7	10.7	14.9	4.2	43.5	46.0	2.4
93 - 96	1980.1	2288.8	308.8	10.7	12.3	1.6	45.3	46.9	1.6
94 - 97	1826.9	1655.1	-171.9	10.1	9.6	-0.5	44.3	45.0	0.7
Total[1]	1890.4	2208.7	318.3	10.6	12.7	2.1	44.3	46.0	1.7
ENE 98[2]	2046.0			11.6			*43.5*		
ENE 98, LS[3]	1266.3			6.6			44.8		
ENE 98, US[4]	2088.5			11.2			45.8		

1. Sample: Workers in the matching group.
2. Sample: All workers.
3. Sample: Workers with lower-secondary complete and 3 years of experience (18 and 19 years old).
4. Sample: Workers with upper-secondary complete and 1-5 years of experience (22-26 years old).*Note:* ENE98 control group.

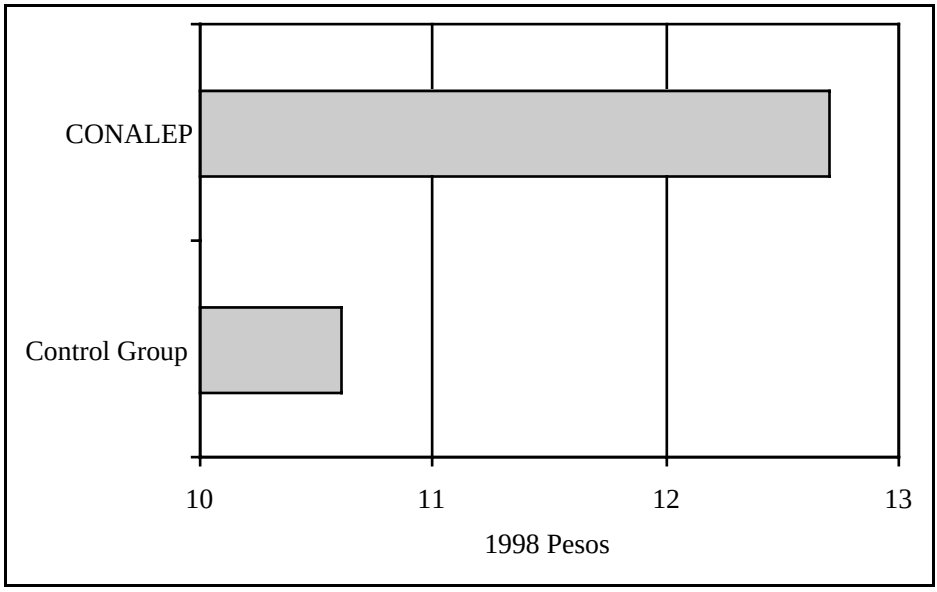

Figure 6. Earnings per hour (ENE98 control group).

Cost-Benefit Analysis

Campos (2001) and Carnoy and others (2000) provide a very detailed discussion on the unit costs of CONALEP, the *general bachillerato*, and the *media superior* schools. Unit cost data are provided for 1992, 1994, 1995, and 1998. Cost items are divided into two classes: investment in infrastructure and equipment, and operational expenses. Operational expenses include, among other things, salaries of teachers and administrators, security services, and utilities (electricity, telephone, water, etc.). The cost data refer to the three year program. The control group's unit cost per year is $11,512.90, or 7.4 percent higher than CONALEP's unit cost of $10,719.98 (in 1998 pesos). As shown in the previous section, the control group's average earnings are lower than CONALEP's average earnings ($26,504.40 vs. $22,684.8, 1998 pesos). It follows that CONALEP's present value is always positive. An alternative scenario was estimated assuming that the control group's unit cost is unknown, that there is a discount rate of 5 percent, and that earnings differences remain constant over the next 30 years. The breakeven year, when the discounted present value of accumulated benefits equals costs, is 12 years in the alternative scenario. If opportunity costs are added, the breakeven year is 18 years.

Conclusions

The Mexican government introduced CONALEP as an alternative technical education system to the traditional upper-secondary education. This paper re-examines CONALEP's performance compared to a well-designed control group. Contrary to previous evaluations, this paper shows that CONALEP graduates search longer for a job but that job congruency is higher compared to the control group. It is also shown that CONALEP graduates receive more training than those in the control group. In agreement with previous evaluations, this paper shows that CONALEP increases graduates' earnings. However, the order of magnitude of earnings increase differs greatly from previous studies. This paper finds that on average, CONALEP increases graduates earnings by 22% —not the 30 or 40% found in other studies— compared to a control group.

The results indicate that CONALEP is a cost-effective program. In addition, as mentioned by other authors, CONALEP has had spillover effects on the rest of the technical education system by stimulating other educational institutions to be more efficient and to adapt to a changing economic and social situation (Carnoy and others 2000).

It is difficult to discern the relative contribution of the different factors responsible for the good overall performance of CONALEP, but it is safe to conclude that the special features of CONALEP as a whole have made it possible. These are as follows: autonomous national organizational structure, decentralized operation, strong link to industry, industry-experienced instructors, and modular courses. However, further challenges remain, notably curriculum adjustment to changing market circumstances and improvement of external and internal efficiency.

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