DOCUMENT RESUME

ED 074 223   VT 019 461

AUTHCR   Harris, Marshall A.
TITLE   Benefit-Cost Comparison of Vocational Education
                Programs. Statewide Evaluation of
                Vocational-Technical Education in Florida, Volume
                2.
INSTITUTION   Florida State Univ., Tallahassee. Dept. of
                Educational Administration.
SPONS AGENCY   Florida State Advisory Council on Vocational and
                Technical Education, Tallahassee.
PUB DATE   72
NOTE   118p.

EDRS PRICE   MF-$0.65 HC-$6.58
DESCRIPTORS   *Cost Effectiveness; Educational Accountability;
                Educational Development; Educational Finance;
                *Formative Evaluation; Mathematical Models; *Program
                Costs; Program Effectiveness; Program Planning;
                Resource Allocations; *Statewide Planning; Student
                Costs; *Vocational Education; Vocational High
                Schools
IDENTIFIERS   *Florida State Plan

ABSTRACT
                This statewide study achieved the following
objectives: (1) It developed a methodology for conducting a
benefit-cost analysis of vocational education programs in Florida;
(2) It examined, compared, and analyzed public and private costs and
benefits of four Florida vocational programs, (3) It compared public
and private benefits and costs for students enrolled in day high
school with students not enrolled in day high school, and (4) It
yielded mathematical formulas that resulted in the development of a
model for predicting public and private economic returns of
vocational programs. Current program cost data were incorporated with
data collected by means of student followup questionnaires. Positive
and significant rates of return were realized from public and student
investment in each of the four selected vocational programs, with
investments being recouped in less than two years. Of the four
programs, only the air conditioning program showed statistically
significant differences in rates of return on investments. Vocational
students had higher rates of return than regular secondary students,
although vocational student costs were greater. The methodology and
the benefit-cost planning model proved effective and could prove
useful in allocating resources to maximize public and student
benefits. Development of vocational programs in Florida, especially
in air conditioning, is recommended. This document is related to four
others, available in this issue as VT 019 460, and VT 019 462-VT 019
464. (AG)

ED 074223

RECEIVED

FEB 0 9 1973

FLORIDA EDUCATIONAL RESOURCES
INFORMATION CENTER (FERIC)
DEPARTMENT OF EDUCATION

BENEFIT-COST COMPARISON OF VOCATIONAL EDUCATION PROGRAMS
Marshall A. Harris

Statewide Evaluation of
Vocational—Technical Education
Richard H. P. Kraft, Project Director

THE FLORIDA STATE UNIVERSITY
DEPARTMENT OF EDUCATIONAL ADMINISTRATION
1972

ERIC

THE FLORIDA STATE UNIVERSITY

TALLAHASSEE 32306

DEPARTMENT OF EDUCATIONAL
ADMINISTRATION

COLLEGE OF EDUCATION

July 19, 1972

Mr. John H. Hinman, Chairman
Florida State Advisory Council
  on Vocational & Technical Education
Suite 752 - Tallahassee Bank & Trust
Tallahassee, Florida 32304

Dear Mr. Hinman:

The Study Group for Florida Statewide Evaluation of Vocational-
Technical Education submits to you the following evaluation reports
on Vocational-Technical Education in Florida for the school year
1971-72:

1. An Assessment of Goals and Priorities in Florida's State
   Plan for Vocational-Technical Education

2. Benefit-Cost Comparison of Vocational Education Programs

3. The Role of Florida Vocational-Technical Education in
   Providing Services for the Handicapped

4. Expectations and Satisfactions of Parents and Students
   with Vocational-Technical Education

5. Continued Evaluation of a Management Information System
   for Vocational-Technical Education

It is our hope that these reports will be helpful to all who are
concerned with strengthening the State's comprehensive system of
vocational-technical education.

Respectfully,

Richard H. P. Kraft
Associate Professor

RHPK/nm

VITA

Marshall Harris was born March 6, 1945, in West Palm Beach, Florida where he received his elementary and secondary education.

In June, 1967, he received a Bachelor's degree in Finance from the School of Business, The Florida State University, Tallahassee, Florida. Continuing his focus on finance, he graduated from the College of Education, The Florida State University, with a Master's degree in Educational Finance in August, 1968.

From September, 1968 through June, 1970, he was employed in positions related to educational finance with the State Department of Education of Florida and The Florida State University. From July, 1971 through August, 1972, he served as a Research Associate specializing in the economics of education in the Department of Educational Administration, The Florida State University. In August, 1972, he received his Ph.D. in the Economics of Education, The Florida State University.

Having published several papers related to the finance and economics of education, and to vocational education, he is presently employed as Coordinator of a Ford Foundation grant given to the Governor's Committee on

Education to study financial aspects of the public education
system of the State of Florida.

TABLE OF CONTENTS

        Statement of the Problem
        Purposes of the Study
        Assumptions
        Design of the Study
        Need for the Study
        Limitations of the Study
        Definition of Terms

        Regional Demarcations
        Selection of Programs
        Study Participants
        Time Period of the Study
        Data Collection
        Overview of Benefit-Cost Methodology
        Methodology for Determining Program Benefits
          Public benefits of vocational education
          Private benefits of vocational education
          Relatedness index
        Methodology for Determining Program Costs
          Public costs of vocational education
          Private costs of vocational education
        Methodology for Determining Benefit-Cost Ratios
        Statistical Techniques Employed

        Description of Sample
        Comparison and Analysis of Benefits
          Public benefits
          Private benefits
          Socio-demographic effects on benefits
          Relatedness index

vi

LIST OF FIGURES

INTRODUCTION

In 1969 the Division of Vocational, Technical and
Adult Education in the Florida State Department of Education
received, under contract, a cost-effectiveness study of
vocational education in Florida.[1] This pilot study advanced
several empirical, methodological, and theoretical findings
which encouraged and facilitated future evaluations which
utilized cost-effectiveness techniques. One important empir-
ical finding of this study revealed that vocational education
does, indeed, have an economic payoff, and therefore should
be considered a favorable medium for investing both public
and private (student) resources. One methodological finding,
however, warned of the difficulty of obtaining program cost
information in Florida due to a financial accounting system
which does not report cost data by programs.

Using similar techniques, another cost-effectiveness
evaluation was conducted in Florida in 1971.[2] In order to

---

[1]Richard H. P. Kraft, Cost-Effectiveness Analysis of
Vocational Technical Education Programs, Report to the Florida
State Department of Education, Tallahassee, Florida, June 30,
1969 (Tallahassee: The Florida State University, 1969).

[2]Marshall A. Harris, "Cost-Benefit Analysis of Occu-
pational Training Programs," in Perspectives on Progress:
Career Education in Florida, ed. by Richard H. P. Kraft, Re-
port to the Florida State Advisory Council on Vocational and
Technical Education, Tallahassee, Florida, June 1, 1' ¯.
(Tallahassee: The Florida State University, 1971).

1

overcome the obstacle of unavailability of cost data by pro-
grams, this study used estimated program cost data provided
by institutional administrators and instructors, and State
Department of Education estimated cost data prepared pur-
suant to legislation. An advancement of this study was that
it included twenty-one different programs, whereas the pilot
study included two programs. The findings of this later study
validated empirical findings of the early study relative to
the positive and significant economic value of vocational-
technical education in Florida.

The present study of the economic returns from voca-
tional education in Florida is larger in scope, more sophis-
ticated in methodology, and has a better data base than
either of the earlier studies. The effect of these advance-
ments over previous studies is to produce not only more
sound ex post evaluations, but also to facilitate ex ante
evaluations. In other words, the present study goes beyond
an assessment of what occurred in the past to provide pro-
cedures and data useful for planning for the future.

Statement of the Problem

Increasing public demands for educational account-
ability, and a persistent scarcity of resources, have encour-
aged administrators-economists to research and develop new
evaluation and planning methods in order to allocate scarce
resources to those programs which are most efficient. Since
vocational education programs are considerably more expensive
than conventional academic programs, the need for assessing

vocational education program costs and benefits becomes especially important.

Another dimension of educational accountability pertains to the n   to provide advance information about the costs and be efi   of vocational education programs to prospective students in order for them to make informed decisions relative to their vocational training choices, and thus their future occupations and primary source of income.

It is recognized that an important imperfection in estimating the returns to education is lack of information. In this connection, Renshaw says:

> . . . a potential . . . student (and society) really have no way of adequately appraising either the opportunity costs associated with various amounts and kinds of education or the prospective returns. At the margin, investment in . . . education is made pretty much on faith alone . . . .[1]

In view of the need to allocate scarce public and private resources the following questions were raised: (1) Do vocational education programs in Florida have positive benefit-cost relationships? (2) Do benefit-cost relationships between vocational education programs differ and do these relationships differ between individual students? and (3) Can the results of a benefit-cost analysis be used as an effective technique by educational planners and decision makers and by individuals anticipating enrolling in vocational education?

---

[1]E. F. Renshaw, "Estimating the Returns to Education," in Readings in the Economics of Education, ed. by Mary Jean Bowman (Paris: United Nations, Educational, Scientific, and Cultural Organization, 1968), p. 563.

Purposes of the Study

The purposes of this study were fourfold: first, it
developed a methodology for conducting a statewide benefit-
cost study of vocational education programs in Florida; sec-
o⁻¹ ¡t   ,nined, compared, and analyzed the public and
private benefit and cost aspects of four vocational education
programs in Florida; third, it compared the public and pri-
vate benefit and cost aspects of students who attended voca-
tional education programs while enrolled in day high school
and students not enrolled in day high school;[1] fourth, it
yielded formulae which resulted in the development of a model
for predicting public and private economic returns of voca-
tional education programs.

The study examined economic factors in the following
areas:

1. The public economic benefits and costs of vocational edu-
    cation.

2. The private or student economic benefits and costs.

3. The degree to which former vocational education students
    were employed.

4. The degree to which students were employed in occupations
    which were related to their vocational education programs.

5. The relationship between public costs and public benefits

---

[1]Students who attended vocational education programs
while enrolled in day high school were referred to as secon-
dary students throughout this study. Students who were not
enrolled in day school were referred to as nonsecondary stu-
dents.

and the relationship between private costs and private

benefits.

6. Predicting models for educational planners and decision

makers, and for students contemplating enrolling in voca-

tional education programs.

Assumptions

1. There is a causal relationship between formal vocational

education training and subsequent labor market perform-

ance of vocational education students.

2. Increases in wage rates and decreases in unemployment

rates are satisfactory measures of economic efficiency

benefits of vocational education.

3. An important objective of vocational education students

is to secure employment in the field for which they were

trained.

4. The number of persons moving in and out of vocational

education is too small to affect relative wage rates and

employment rates in respective occupations.

5. Analysis of cross-sectional and historical data provide

useful estimates for projecting trends into the future.

Design of the Study

This study was concerned with statewide benefits and

costs of vocational education programs in Florida. In order

to account for the influence of regional price variations and

regional labor market conditions and wage rates, the state

was divided into major geographical regions. Within each

region two institutions designated as area vocational centers

were randomly selected. Based upon stated criteria, four vocational education programs were included in the study.

Two methodologies for determining benefits and costs of vocational education programs were developed. One methodology was developed for determining public benefits and costs. A second methodology was developed for determining student benefits and costs. Both methodologies incorporated existing program cost data and data collected by means of follow-up questionnaires mailed to former vocational education students.

Benefit and cost data were collected and analyzed in two forms. In one form were the benefits received and the costs incurred by society (public benefits and costs). In another form were the benefits received and the costs incurred by students (private benefits and costs).

Using statistical techniques of simple correlation, analysis of variance, chi square, and multiple regression, separate analyses of benefits, costs, benefit-cost ratios, and the relationship between costs and benefits were performed.

As a result of the ex post evaluations, linear equation models for projecting returns on investment in vocational education were developed.

Need for the Study

1. As educational funding decisions move more toward the state level, it becomes increasingly important for legislators and state level educational administrators to make informed recommendations and decisions regarding educational appropriations. However, present fiscal accounting

and budgeting systems do not provide adequate information on education program benefits nor on program costs.

2. Presently the state funding formula for vocational education bears little relation to actual program costs. In 1971, legislation was passed in Florida requ' in that program cost data be collected on vocational education programs offered at area vocational centers in order that future funding may be based upon actual costs of programs.[1] Since vocational education program costs for the same unit of time vary greatly between different vocational education programs,[2] there is a need to link program benefits with program costs in order to make effective allocation decisions. This study provides an analytical approach toward providing current and future information on the benefits and costs of vocational education programs.

3. In 1970, the Vocational Subcommittee in the Florida House of Representatives recommended that:

. . . the State Board of education be directed to develop a uniform information system for all public education, emphasizing output information. Special emphasis should be placed on vocational education, and such a system should include occupational placement information by on-the-job studies of graduates and non-graduates, and an analysis of course and program productivity.

4. In order to meet the needs of vocational education or prospective vocational education students, Part I--

---

[1]Florida, Finance and Taxation: Schools, Statutes (1971), I, 1150.

[2]For example, a study of vocational education program costs submitted to the Division of Vocational, Technical and Adult Education reports costs ranging from $396 per FTE for a roofing course to $4,312 per FTE for a data processing course.

Continuing Administrative Provision of the Florida State

Plan for the Administration of Vocational Education

states:

> . . . the State Board and local educational agencies will
> establish and maintain vocational guidance and counseling
> services designed to (among others):
> 1. Provide persons with information needed for making
>   informed and meaningful occupational choices.
> 2. Determine the effectiveness of vocational instruction
>   and guidance through appropriate follow-up activities.[1]

5. In 1971, the Florida State Advisory Council on Vocational

   and Technical Education recommended that a cost-benefit

   analysis of vocational education programs at the secondary

   and post-secondary levels be performed. "One objective

   would be to contrast the economic efficiency of programs

   by level."[2]

Limitations of the Study

An economic study of vocational education programs

like a benefit-cost analysis captures only a portion of the

total benefits resulting from vocational education. Since

benefits of vocational education programs exist in both mone-

tary and non-monetary forms, a benefit-cost analysis which

considers only monetary benefits is necessarily only a par-

tial analysis of the total benefits of vocational education

programs.

In addition, monetary measures of benefits of

---

[1]Florida, Florida State Plan for the Administration
of Vocational Education, Part I (1971), p. 36.

[2]Annual Report of the Florida State Advisory Council
on Vocational, Technical Education (Tallahassee, Flor ...
author, 1971), p. 2.

vocational education programs are dependent upon the operation of labor market mechan..sms to provide data. Any imperfections in the labor market will also appear in the monetary measures of benefits. The amount of increases in monetary measures of benefits that accrue to persons after vocational training is difficult to determine, since normal maturation processes and shifts in individual wants and desires occur from the time a person enters vocational training until his monetary benefits are measured.

Definition of Terms

Since definition of words sometimes have unique disciplinary connotations which directly affect the contextual interpretation of a study, the following definitions are used uniformly in this study.

Benefits.--The economic benefits of vocational education are defined as the change in economic welfare of society (public benefits) and the individual student (private benefits) caused by vocational education. Another measure of benefits used in this study was the relationship of post-vocational employment to the vocational education program.

Benefit-Cost Analysis.--An analytical, economic approach for evaluating and projecting the economic returns of students who attended vocational education programs is a benefit-cost analysis.

Costs.--Economic costs of vocational education are incurred either by society (public costs) or by students (private costs). Economic costs include both direct costs

(tax support by society and costs for tuition, books, supplies, uniforms, and special equipment incurred by students), and indirect costs (opportunity costs of foregone benefits on alternative investments).

Economic Returns.--Returns on investment in vocational education as measured by a benefit-cost ratio are designated economic returns. This also refers to the economic efficiency of vocational education programs in achieving employment objectives.

Full-Time-Equivalent (FTE).--Eight hundred ten student hours of attendance comprise one FTE. This is based on five hours of attendance per day times 180 days, less a 10 per cent absentee and withdrawal factor or: (5 x 180) - 90 = 810.

Dependent Variables.--Seven dependent variables were used in this study. They were: (1) public benefits, (2) private benefits, (3) public costs, (4) private costs, (5) public benefit-cost ratios, (6) private benefit-cost ratios, and (7) relatedness index (relationship of post-vocational employment to vocational program attended). Involuntary unemployment was also a dependent variables, but since it entered into the calculation of benefits, it was not considered separately.

Independent Variables.--Independent variables are the socio-demographic characteristics of students which include: region where trained and employed; working experience; relatedness index; additional training; race; secondary student; fathers lived with family for majority of student's elementary and secondary school years; marital stuatus; father's

income and education; mother's education; hours of attendance in program; involuntary unemployment; age; number of children; high school level completed; and high school grade point average. In the regression analyses, relatedness index and involuntary unemployment were used as independent variables.

Private.--Private is defined as being synonymous with student, and these terms are used interchangeably. For example, private benefits or student benefits.

Public.--Public is defined as being synonymous with society, and these terms are used interchangeably. For example, public benefits or social benefits.

CHAPTER II

RESEARCH METHODOLOGY

This chapter presents the research methodology used
in the study in terms of: (1) regional demarcations; (2)
selection of vocational education programs; (3) study parti-
cipants; (4) time period of the study; (5) data collection;
(6) an overview of the benefit-cost methodology; (7) method-
ology for determining benefits; (8) methodology for deter-
mining the relationship of employment to vocational education
training; (9) methodology for determining costs; (10) method-
ology for determining benefit-cost ratios; and (11) statis-
tical techniques employed in the study.

Regional Demarcations

The procedure for selecting the programs which were
included in the study was based upon the notion that dif-
ferent geographical regions in Florida have varying price
levels which directly affect the cost (public and private)
of given vocational education programs. Additionally, dif-
ferent geographical regions have different labor market con-
ditions which affect wage and employment rates of persons in
the labor force who took vocational training.

Therefore, delineation of Florida into major geo-
graphical regions was the first procedural step. The state

12

was divided according to major economic and population cen-
ters which resulted in the four geographic regions delineated
in Figure 1. Demarcation of geographic regions were as fol-
lows: northwest and north Florida; central Florida; south-
west Florida; and southeast Florida.

Selection of Programs

Determination of the kind of programs to be selected
for study was the next procedural step. Five criteria were
developed for this purpose. (1) Only programs offered in
institutions designated as area vocational centers in Florida
would be included. (2) A minimum of fifteen full-time-
equivalent (FTE) enrollment for the years 1968 through 1971.[1]
(3) A mix of programs to include both males and females would
be selected. (4) Programs must have served both secondary
and nonsecondary students. (5) All area vocational centers
must offer at least two of the programs selected.

Using statewide vocational education program data
collected by the Florida Division of Vocational, Technical
and Adult Education, five programs were selected which met
the stated criteria. They were: electronics, auto mechanics,
air conditioning and refrigeration, cosmetology, and licensed
practical nursing. While the electronics program was in-
cluded initially, it was later excluded from the study

---

[1]Two reasons for limiting the follow-up period to
three years were: (1) the longer persons have been out of
school, the more difficult it is to locate them, and (2) the
specific effects of vocational training tend to decrease over
time relative to the actual effectiveness of vocational train-
ing on benefits.

FIGURE I

REGIONAL DEMARCATIONS OF FLORIDA

Northwest and North

Central

Southwest

Southeast
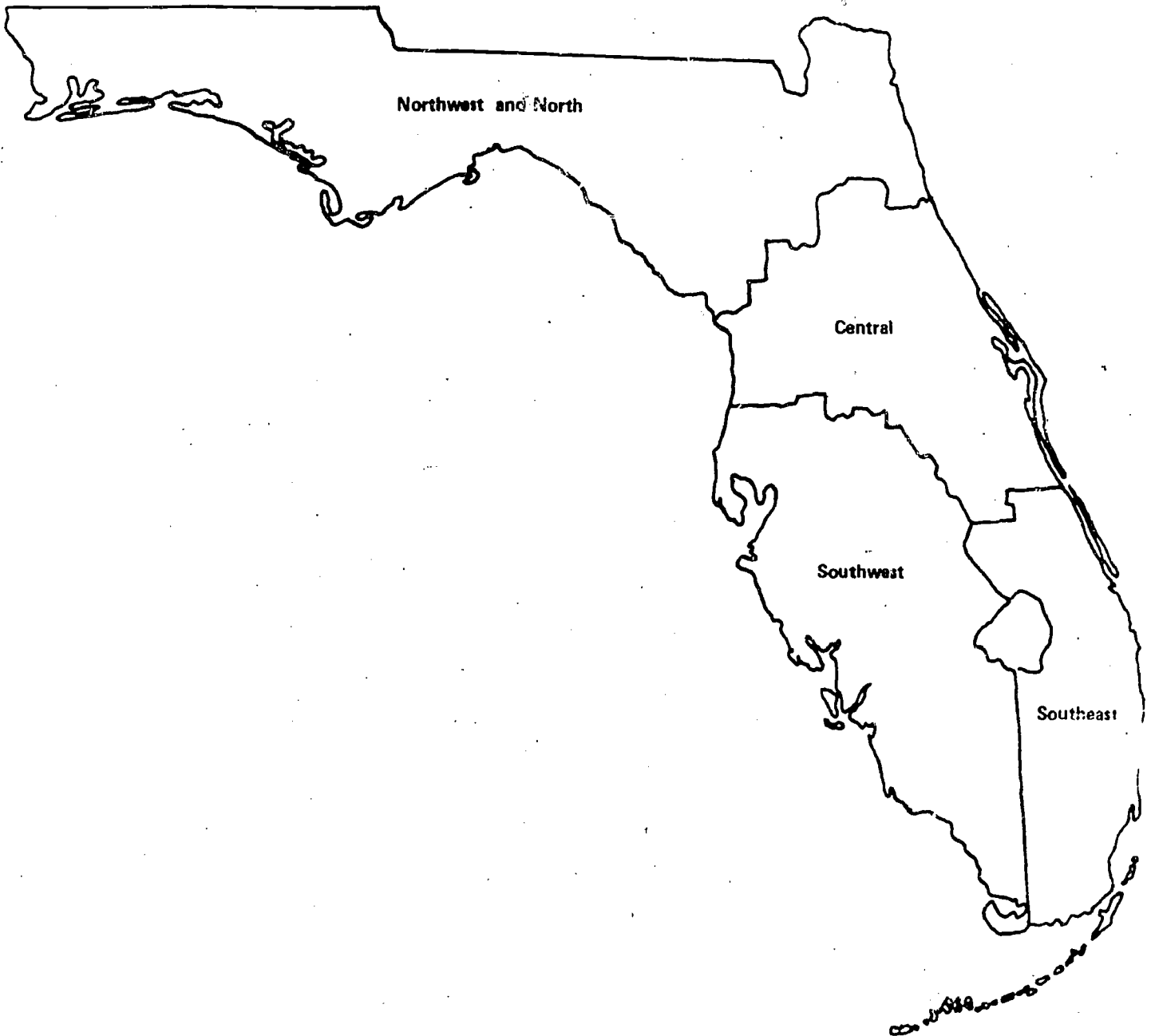
because the return of usable questionnaires was very low

(less than 10%). The remaining four programs--auto

mechanics, air conditioning and refrigeration, cosmetology,

and licensed practical nursing--comprised the sample of the

study.

Since not all area vocational centers offered all

four of the selected programs, two area vocational centers

from each of the four geographic regions were randomly

selected.[1] Figure 2 shows the total population of the

thirty-five area vocational centers in Florida by the geo-

graphic regions delineated in this study.

Study Participants

A previous cost-benefit study conducted in Florida

revealed that many vocational education students did not re-

main in vocational training for the length of time scheduled

for completion of the program. For example, in one graphic

arts program, the scheduled number of contact hours for

course length completion was 1080 hours. However, the actual

average training length of all students was only 700 hours.[2]

---

[1] One area vocational center in central Florida which
was selected chose not to participate in the study. There-
fore, this school was removed from the total schools avail-
able for selection in central Florida.

[2] Marshall A. Harris, "Cost-Benefit Analysis of Occu-
pational Training Programs," in Perspectives on Progress:
Career Education in Florida, ed. by Richard H. P. Kraft
(report to the Florida State Advisory Council on Vocational
and Technical Education, Tallahassee, Florida, June 1, 1971;
Tallahassee, Florida: The Florida State University, 1971),
p. 72.

FIGURE 2

FLORIDA AREA VOCATIONAL - TECHNICAL CENTERS ━━━
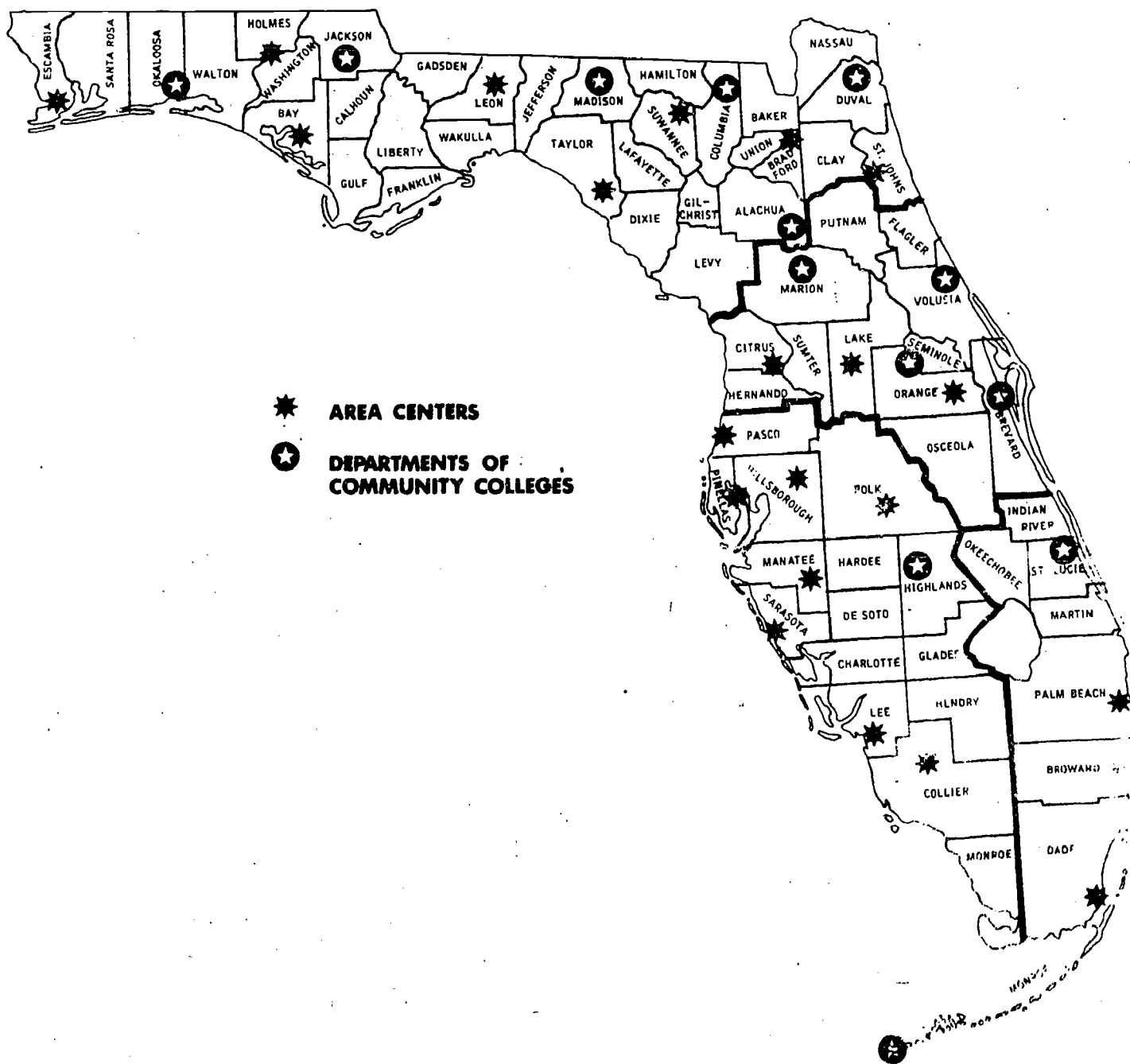
✱ AREA CENTERS

✪ DEPARTMENTS OF COMMUNITY COLLEGES

Not needing the entire number of hours to fulfill
their employment objectives, these early leavers (some of
which are taking parts of the program for retraining pur-
poses) very often enter gainful employment utilizing those
skills acquired from the vocational training program.[1] Erro-
neously, these students have sometimes been categorized as
"dropouts" while the fact may be that they are minimizing
their training time and thus their costs, and yet still
achieving their employment objectives.

Since these early leavers were found to have derived
benefits from vocational education,[2] they were included in
the sample of this study. The decision to include these
types of persons as well as graduates required special con-
sideration in the time period of the study.

Time Period of the Study

In order to follow up early leavers as well as grad-
uates of vocational education programs, persons who either
completed training or left early during the period from
August, 1968 through September, 1971, were included in the
study.

The common method of following a single cohort (for
example, persons who either left the program early or who
graduated in June, 1969) was rejected because (1) early
leavers drop out at various times during the year, and (2)
the number of persons completing training at area vocational

---

[1]Ibid., p. 94.   [2]Ibid.

centers at any given time was small compared to the number
who graduate at various times during the year and the number
who leave early during the year.

Instead of using a single cohort, a sample of all
students who either graduated from or left the vocational
education programs early during the period from August, 1968
through September, 1971 was used.

Since the time period of the study during which re-
spondents could have participated in the labor force was
August, 1968 through December, 1971, the longest possible
time one could have participated in the labor force was
thirty-eight months, and the shortest possible time was four
months.

Data Collection

The main source of data for this study was follow-up
questionnaires sent to former vocational education students.
The questionnaire which appears in Appendix A was constructed
by the author in order to obtain necessary information on the
socio-demographic characteristics and labor market perform-
ance of former vocational education students.[1]

The questionnaire was pre-tested in Leon County,
Florida, in September, 1971, using two faculty members at
The Florida State University, one vocational education

---

[1]The follow-up questionnaire in Kaufman, et al., "A
Cost-Effectiveness Study of Vocational Education," pp. 239-46,
was consulted for development of the questionnaire for this
study. A few items from that questionnaire were adapted ver-
batim, while some others were modified for the purposes of
this study.

instructor, five former vocational education students, five
high school graduates, and three high school dropouts. As a
result of their feedback, certain changes were made in the
questionnaire.

Names and last known addresses of all graduates and
early leavers of the selected vocational education programs
from August, 1968 through September, 1971, were provided by
administrators at each of the selected area vocational cen-
ters. A random sample was made of the names and addresses
provided and questionnaires, attached to the cover letter
appearing in Appendix B, were mailed on December 27, 1971.
Four weeks were allowed for return of questionnaires.

Table 1 shows, according to vocational program at-
tended, the number of questionnaires mailed, the number re-
turned, the number discarded because of (1) incomplete
information, and/or (2) attendance at a community college,
four-year college or university; the number of questionnaires
discarded because respondents had no training related jobs;
the number of usable questionnaires from respondents enrolled
in secondary school; usable questionnaires from nonsecondary
students; and total usable questionnaires.[1]

The electronics program had twenty-two returns which
could have been used in the study. Representing less than

---

[1]Persons who attended college after vocational train-
ing were excluded from the study since the effects of voca-
tional education could not have been isolated from the
effects of college attendance. Persons who did not have any
training related jobs were excluded since employment effects
were probably not causally related to their vocational educa-
tion.

TABLE 1

RETURN OF QUESTIONNAIRES BY PROGRAMS

	Mailed	Returned	Incomplete Data or Attended College	No Training Related Job	Usable Secondary	Usable Nonsecondary	Total Usable
Auto Mechanics	190	85	23	19	37	25	62
Air Conditioning & Refrigeration	150	72	26	22	16	30	46
Practical Nursing	200	113	14	5	9	90	99
Cosmetology	280	140	39	29	45	56	101
Electronics	238	37	15	12	6	18	22

10 per cent of the questionnaires mailed out, the electronics program was excluded from the study.[1]

Overview of Benefit-Cost Methodology

Like alternative objects of public or private spending, vocational education programs involve both benefits (advantages) and costs (disadvantages). In order to evaluate such programs (or any program) it is important to take into account the costs of producing benefits. The essence of explicitly linking costs to benefits as an overall evaluation design arises because it is conceivable to attain any objective if unlimited funds are available. However, limited funds or a scarcity of resources, a basic economic concept, are always a constraint.

There are two major classifications of benefits which are of concern when determining benefits. These are: (1) public benefits which accrue to society as a result of providing vocational education programs, and (2) private benefits which accrue directly to individual students who have taken vocational education.

Like benefits, there are two major classifications of costs which are of concern when calculating costs. These are: (1) the public costs incurred by society as a result of

---

[1]One possible reason for the low return rate from electronics students may have been due to adverse economic and labor conditions in the electronics industry during the time of this study, thus forcing these people to geographically migrate.

offering given vocational programs, and (2) the private costs incurred by students taking vocational education.

Separating the benefit-cost methodology into public and private components emphasizes the need to investigate the benefits and costs of vocational education programs associated with the two primary investors and benefactors, namely, society at large (public benefits and costs), and individual students (private benefits and costs). Table 2 displays an overview of the benefit-cost methodology used in this study.

<u>Methodology for Determining</u>
<u>Program Benefits</u>

Assuming a person wants to enter the labor market, the options available to him are as follows:

Work (u)

0

Vocational Training $\longrightarrow$ Work (s)
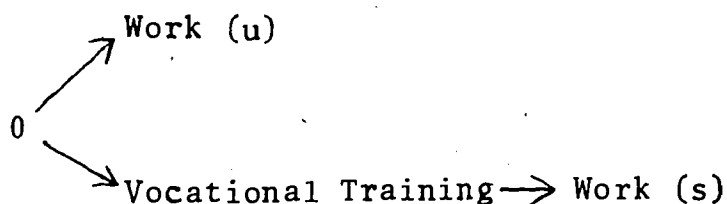
In this study it was assumed that persons who took vocational training before going to work entered the work force as skilled workers (s), and therefore had different wage rates and unemployment rates than unskilled workers (u).

Benefits resulting from vocational education programs used in this study were measures of the extent to which the employment objectives of vocational education programs were achieved. Thus, post-vocational education labor market experiences of former students were examined. Two measures of

TABLE 2

OVERVIEW OF BENEFIT-COST METHODOLOGY

Public	Private
Benefits	**Benefits**
Definition: Economic welfare gained by society as a result of vocational training.	Definition: Economic welfare gained by the student as a result of vocational training.

Elements	Elements
1. Student's marginal before tax wage rates attributable to vocational training.	1. Student's marginal after tax wage rates attributable to vocational training.
2. Reduced unemployment rates attributable to vocational training.	2. Reduced unemployment rates attributable to vocational training.

Costs	**Costs**
Definition: Costs incurred either directly or indirectly by the public sector (federal, state, and local governmental agencies) to support formal vocational training.	Definition: Costs incurred either directly or indirectly by students for formal vocational training.

Elements	Elements
1. Operating and capital funds expended to support a vocational program.	1. Direct expenses incurred by students due to attending school (e.g., tuition, books, supplies, etc.).
2. Opportunity costs of not expending funds on alternative public programs.	2. Foregone earnings or opportunity costs (indirect expenses) incurred by students as a result of attending school rather than being gainfully employed.

post-vocational education labor market performance were utilized: (1) measurement of wage rates, and (2) measurement of unemployment rates.

The wage rate was an average wage rate weighted according to the amount of time a person worked on jobs either related or very related to his vocational education program.[1] The formula for calculating weighted average wage rates follows:

$$(1) \quad W_i = \left(\frac{\Sigma_v L \frac{S}{H}}{\Sigma L_v} \right)_i$$

where:

W = weighted average wage rate;

i = individual student;

v = job either "related" or "very related" to vocational education program; v = 1,2;

L = length of time on job (in months);

S = midpoint of weekly salary;

H = number of hours worked per week.

Unemployment rates were converted to employment rates which were calculated as follows:

$$(2) \quad R_i = 1 - \left(\frac{I}{T - M} \right)_i$$

---

[1]As previously noted, persons without any training related jobs were excluded from the study entirely. Similarly, when persons had several jobs, some related and some unrelated to vocational training, unrelated jobs were excluded from the calculation of wage rates.

where:

> R = employment rate;
>
> i = individual student;
>
> I = involuntary unemployment (in months);
>
> T = time from completion of vocational education program (in months);
>
> M = time in military service (in months).

Following national income accounting procedures, the employment rate (R) in algorithm (2) above was based only on involuntary unemployment. Voluntary employment did not enter into the calculation of the employment rate. Thus, productive activities apart from the market sector, such as production in the household sector, were not measured in the benefits of vocational education. Kaufman asserts the following regarding not counting involuntary unemployment as an economic output.

> The bias due to the national income account measure of benefits . . . which excludes household production from being included in gross national product should not lead one to conclude that household production is trivial in its impact on the economy or that efficiency in household production is not just as necessary as efficiency in market production.[1]

Wage rates and employment rates were combined into a net wage rate which served as a monetary index of labor

---

[1]Kaufman, et al., "A Cost-Effectiveness Study of Vocational Education," p. 150.

market performance of skilled workers as follows:[1]

$$(3) \quad E_{s,i} = (W_{s,i}) (R_{s,i})$$

where:

E = net wage rate;

s = skilled worker;

i = individual student;

W = weighted average wage rate;

R = employment rate.

Since this study was concerned with differences in wage rates and unemployment rates between persons who enter the labor market as unskilled workers and those who enter the labor market as skilled workers, after-training wage rates and employment rates [$(E_{s,i})$ in algorithm (3)], had to be reduced by factors that represented wage rates and employment rates for unskilled workers in Florida.

Wage rates for unskilled workers vary according to the region in Florida where a person works. Regional differences in wage rates were explicitly incorporated into the calculation of a monetary index for unskilled workers in

---

[1] While wage rates and unemployment rates reflect an important part of the monetary benefits of vocational education, there are certain qualifications which should be recognized. First, wage rates and employment rates may not necessarily indicate the increased productivity of workers. Second, labor supply and demand conditions for particular labor skills affect wage rates and employment rates. Thus, changes in wage rates and employment rates may not be due only to vocational education programs.

Florida.[1] Additionally, employment rates for unskilled
workers were imputed into the monetary index.[2] The algorithm
for calculating the net wage rate which served as a monetary
index for unskilled workers in Florida follows:

$$(4) \quad E_{u,j} = (W_{u,j})\ (R)$$

where:

E = net wage rate;

u = unskilled workers;

j = region of Florida; r = 1, ..., 4;

W = wage rate;

R = employment rate (100% minus unemployment rate).

The differences between the net wage rates for
skilled workers and the net wage rates for unskilled workers
represented the net benefits resulting from vocational edu-
cation programs. When these net benefits were converted to
an annual earnings figure, this figure represented the annual
benefits of vocational education programs.[3]

The algorithm for calculating the annual benefits of
vocational education follows:

---

[1]The average of the midpoints of wage rates for each
region was used (see Appendix C).

[2]The unemployment rate figure used was 7.1 per cent,
the average unemployment rate for "operatives" in Florida for
1968-1971. Source: U.S. Department of Labor, Manpower Re-
port of the President (Washington, D.C.: Government Printing
Office, 1972), p. 216.

[3]The net marginal wage rate was converted to an an-
naul earnings figure by multiplying it by 2080 hours, the
normal number of work hours per year.

$$(5) \quad B_i = [(E_{s,i}) - (E_{u,j})] \ K$$

where:

    B = annual benefits;

    i = individual student;

    E = net wage rate;

    s = skilled worker;

    u = unskilled worker;

    j = region; $j = 1, \ldots, 4$;

    K = 2080 hours.

Public benefits of vocational education

This study followed national income accounting pro-
cedures for measurement of public benefits. That is, the
annual benefits before federal income tax deductions [(B_i) in
algorithm (5) above] were considered as the public benefits
of vocational education programs, since these earnings repre-
sented an increase in national income.

Private benefits of voca-tional education

National income accounting procedures also were used
for the measurement of private benefits. Annual benefits
after deduction of federal income taxes were considered as
private or individual student benefits since these earnings
represented an increase in personal disposable income.

The algorithm for calculating the annual private
benefits of vocational education follows:

$$(6) \quad PB_i = [(E_{s,i})\,(K)] - (T_{s,1})_i - [(E_{u,j})\,(K)] - T_u$$

where:

  PB = private benefits;

  i = individual student;

  E = net wage rate;

  s = skilled worker;

  K = 2080 hours;

  T = federal income tax on earnings;[1]

  1 = year;

  u = unskilled worker;

  j = region of Florida; j = 1, ..., 4.

Relatedness index

Since the relationship of after training employment to vocational education programs did not enter into the calculation of monetary benefits, except to the extent that jobs completely unrelated to training were excluded from the calculation of benefits, a third measure of benefits of vocational education was developed.

Since those persons who found employment which was "most" related to their vocational trainings probably realized benefits in addition to economic benefits,[2] the

---

[1]Federal income tax was based on the number of dependents reported by each person. Tax on earnings for unskilled workers was based on the same number of dependents as for skilled workers.

[2]Examples of such additional benefits would include psychic effects of utilizing training and effects of achieving a goal.

relatedness index which was developed measured the relation-
ship between vocational education program and subsequent jobs.
Weighted according to the time on a given job, a value of
"1" was assigned to jobs "related" to vocational training and
a value of "2" assigned to jobs "very related" to vocational
training. Thus, the closer the index was to "2" the more re-
lated employment was to the vocational education programs,
and the higher the additional benefits.

The algorithm for deriving the relatedness index fol-
lows:

$$(7) \qquad RI_i = \frac{\Sigma_{rm} L_m}{\Sigma L_m}$$

where:

RI = relatedness index;

i = individual student;

r = relatedness value for job m; $r = 1,2$;

m = "related" or "very related" job;

L = length of time on job m (in months).

Methodology for Determining Program Costs

Public costs of vocational education

Current operating and capital costs incurred either
directly or indirectly (opportunity costs) by the public sec-
tor (federal, state, and local governmental agencies) com-
prised the public costs of vocational education programs. In
order to calculate the public cost of vocational education
for a given student, two factors must be considered: (1) the

quantity of time that a student spends in a given vocational

education program, and (2) the value or cost per unit of time

of the services he received as measured in terms of dollars.

The quantity of time students spent in a vocational

education program was measured in terms of hours of attend-

ance which were obtained from the follow-up questionnaires.

Value of services or unit costs were based upon vocational

education costs which were generated by a study conducted

for the Florida Division of Vocational, Technical and Adult

Education.[1] This study included an analysis of the following

expenditures of area vocational/technical centers:

1. An amount allocated from expenditures for system-
   wide administration.
2. An amount allocated from the expenditures made for
   the county-wide administration and supervision of
   vocational, technical and adult education.
3. An amount determined to have been expended for cur-
   rent operations for instruction in the vocational/
   technical programs provided in the center, including:
   a. salaries for certified personnel,
   b. salaries for non-certified personnel,
   c. free textbooks,
   d. library services,
   e. instructional supplies,
   f. other expenses for instructors, and
   g. contracted services for instruction.
4. An amount determined to have been expended for the
   operation of the physical plant of the Area Center
   (or an amount allocated from district-wide expendi-
   tures for plant operations).
5. An amount determined to have been expended for the
   maintenance of the physical plant of the Area Center
   (or an amount allocated from district-wide expendi-
   tures for plant maintenance).
6. An amount determined to have been expended for auxil-
   iary services, including transportation.

_____

[1]Associated Consultants in Education, Inc., Current
Operating Costs, 1970-71, Florida Area Vocational/Technical
Centers (Tallahassee: Author, 1972).

7. An amount allocated from district-wide fixed charge expenditures.
8. Charges for depreciation of movable equipment calculated at one tenth of the original value of the equipment.
9. An amount expended for current operations of the Center from its internal accounts (from non-tax soucres).[1]

The objective in analyzing these expenditures was to provide a statement "in dollar terms of the cost of providing instruction for one student contact hour in each of the vocational/technical courses given during the year . . . "[2] In order to obtain the dollar cost per full-time-equivalent (FTE)[3] for each course, "the total cost per hour of student attendance is (was) multiplied by 810."[4] The costs per FTE by program and region which were used in this study appear in Appendix D.

The algorithm for calculating the public costs of vocational education for each student was as follows:

$$(8) \quad C^P_{i,z,j,1} = \left[(F)_{z,j,1} \left(\frac{N_{i,z}}{810} \right) \right] 1.06$$

where:

C = cost;

p = public;

i = individual student

---

[1]Ibid., p. 23.   [2]Ibid., p. 1.

[3]One full-time-equivalent equals 810 student hours of attendance.

[4]Associated Consultants in Education, Current Operating Costs, p. 15.

i = programs;

j = region; $j = 1, \ldots, 4$;

l = year; l = 1968-69, 1969-70, 1970-71;

F = public cost per full-time-equivalent (FTE) student;

N = number of hours of vocational training;

.06 = social opportunity cost.[1]

Private costs of vocational education

The most important element of private costs of vocational education are indirect costs incurred by students. These are the opportunity costs of foregone benefits which students could have realized if they had been employed in the labor market rather than attending vocational training. Schultz has estimated that indirect cost of this nature represents about 60 per cent of the total cost of education and is greater than the contribution from tax sources (public costs).

Private indirect costs are a function of two factors:

---

[1] Costs can be viewed as opportunity costs since they represent the foregone benefits of alternative opportunities which cannot be pursued due to following a given activity. Therefore, assessment of costs of vocational education programs should impute foregone benefits. The public opportunity cost of the foregone benefits on alternative social investments was assumed to be 6 per cent. For an exposition of the theoretical rationale for public opportunity costs see Otto Eckstein, "A Survey of the Theory of Public Expenditure Criteria," in Public Finance: Needs, Services and Utilization: A Conference of the Universities (Princeton, New Jersey: Princeton University Press, 1961).

[2] Theodore W. Schultz, The Economic Value of Education (New York: Columbia University Press, 1963), p. 2.

(1) the quantity of time that a student spends in a given vocational education program, and (2) the value or price of time as measured by earnings foregone.

As stated previously, the quantity of time one spends in a vocational education program in Florida is measured in terms of student hours of attendance. Value or price of time was based upon prevailing wage rates for unskilled workers in the geographic region where a student took his vocational training. These values were the same as those used when wage rates were calculated except here they were adjusted by the amount of the implicit price deflator used in the calculation of real GNP according to the year in which a person took his vocational training.

A second element of private costs of vocational education are the direct costs incurred by the student. These are the costs paid by the student for tuition, books, supplies, uniforms, special equipment, and transportation.[1] Appearing in Appendix E are the private direct costs which, when adjusted for time of attendance in the vocational education program, were the data used in the study.

The algorithm for calculating the total private costs of vocational education for each student was as follows:

$$(9) \quad PC_{i,z,j,1} = (W_{u,j}) N_{i,z} + D_{i,z,j,1}$$

----

[1] It was assumed that private direct costs of transportation to training centers were the same as if the student were working. Therefore, transportation costs were not relevant.

where:

PC = cost;

i = individual student;

z = programs;

j = regions; j = 1, ..., 4;

l = year; l = 1968, 1969, 1970, 1971;

W_u = adjusted wage rate of unskilled worker;

N = number of hours of attendance in program;

D = direct costs for tuition, books, supplies,
    equipment, and uniforms.

Methodology for Determining Benefit-Cost Ratios

Although benefit and cost methodologies were dis-
cussed separately in the previous sections, no conclusions as
to the economic efficiency of the four vocational education
programs can be made until the relationship of benefits to
costs is considered. The explicit linking of benefits to
costs is achieved by means of the benefit-cost ratio which is
a measure of economic efficiency.

The choice of the benefit-cost ratio as the proper
investment criterion for linking benefits to costs is sum-
marized by Kaufman as follows:

> . . . when there is capital rationing (and this is prob-
> ably a common situation for an individual contemplating
> investment in himself), the benefit-cost ratio is the
> proper criterion for investment decision-making, since by
> choosing the set of investments with the highest ratios
> he thereby maximizes net present value.[1]

---

[1]Kaufman, et al., A Cost-Effectiveness Study of
Vocational Education," p. 59.

Benefits in the form of earnings are realized over many years of post-vocational education employment, while costs, including opportunity costs, are incurred in the period of the vocational education program (normally one year or less). Since money has a time value, money (benefits) which is realized in future years must be discounted to the present value of that money.[1] Discounting is effected using an appropriate interest rate. Since no theoretically correct interest rate exists, it is useful to select one near the top of the range suggested by theoretical considerations, thereby making the benefit-cost ratio a conservative index. Weisbrod has suggested a discount rate of 10 per cent for this purpose and this rate was used in this study.[2]

It was assumed that costs (both public and private) were incurred in a present value time period. Therefore, no discounting of costs was needed.

When discounted benefits are linked to present value costs in the form of a benefit-cost ratio, the resultant figure is useful for comparison of a program's economic efficiency over previous years, limited to monetary aspects,

---

[1]Discounting is a term which refers to finding the present value of money received in the future. For example, $100 earned five years from now is worth considerably less than $100 earned today. At a 10 per cent discount rate $100 five years from now has a present value of $62. Conversely, $62 invested today at 10 per cent simple interest will be worth $100 five years from today.

[2]Burton A. Weisbrod, "Conceptual Issues in Evaluating Training Programs," Monthly Labor Review, LXXXIX (October, 1966), 1099.

with other programs. This ratio number is also the percent-
age rate of return per year on investment in vocational edu-
cation programs. The reciprocal of this ratio number is
equivalent to the number of years it will take a person (or
society) to receive a "total return" on his (its) investment.

The formula for calculating public and private
benefit-cost ratios is as follows:

$$B_0 \Big/ C_0 = \frac{\dfrac{b_0}{(1 + i)^0} + \dfrac{b_1}{(1 + i)^1} + \cdots \dfrac{b_t}{(1 + i)^t}}{\dfrac{c_0}{(1 + i)^0}}$$

where:

B/C = benefit-cost ratio;

b = benefits;

t = time period; t = 0; . ., 2;

c = costs;

i = discount rate of interest; i = 10%.

Statistical Techniques Employed

Three primary statistical techniques were employed
in this study--analysis of variance, chi square, and multiple
regression analysis.

Analysis of variance was used to make comparisons of
quantitative data between programs while chi square was used
to compare qualitative data.

Multiple regression analysis was employed in order to
assess the effects of student socio-demographic characteris-
tics on benefits and costs. This was done because the

benefits acc

evenly distr

Furt

mizing effic

fits and cos

costs of voc

cific to the

Therefore,

programs is

education p

which traine

of the recip

Add:

formulae use

cators of v

specific cha

generated by

---

[1]Wa

ment on Incc

Groups," The

ional education students are not

ll students.'

etermination of a pattern of maxi-

dent upon the distribution of bene-

magnitude of the benefits and

ion is, to a certain extent, spe-

phic characteristics of students.

uation of vocational education

not only the type of vocational

o the labor market conditions into

r and the personal characteristics

onal education.

iple regression analysis yields

ng purposes. Benefit most indi-

tion programs for students with

an be predicted using formulae

ression analysis.

e Effect of Low Educational Attain-
rative Study of Selected Ethnic
man Resources, I (Fall, 1966), 23.

CHAPTER III

PRESENTATION AND ANALYSIS OF DATA

In Chapter II, the methodology for deriving benefits, costs, and benefit-cost ratios was presented. This chapter describes the sample data and presents a comparison and analysis of persons who attended each of the four vocational education programs in terms of (1) benefits, (2) costs, (3) relationship of employment to vocational education program (relatedness index), and (4) benefit-cost ratios.

Description of Sample

Of the total respondents the average respondent was 26.7 years old, white (88% of sample), married (55% of sample), if he had children (45% of the sample had children) he had 2.4 children, completed high school (92% of sample), had a high school grade point average of 2.53;[1] and on the average he attended vocational education for 1173 hours. After completing vocational education the average respondent did not serve in the military for three months or longer (4% did serve in the military).

During the majority of his elementary and secondary school years his father lived with his family (80% of sample);

_____

[1]Grade point average was measured on a 4.0 scale.

his father finished 10.6 years of school[1] and earned $6640 per year.[2]   His mother completed 10.8 years of sch ol.

Fifty-one per cent of the total respondents were employed either part time or full time while attending voca- tional training, although a majority of the total respondents (57%) did not have related working experience prior to com- pleting their vocational training.   Only 12 per cent of the total respondents took additional related training after com- pleting their vocational education programs.   Secondary stu- dents who attended vocational education comprised 35 per cent of the total respondents (65% were nonsecondary students).

Of the total 308 respondents 33 per cent attended the nursing program, 32 per cent attended the cosmetology pro- gram, 20 per cent attended the auto mechanics program, and 15 per cent attended the air conditioning program.   All the respondents from the auto mechanics program and air condi- tioning program were males (35% of the total), while all the respondents from the nursing and cosmetology programs were females (65% of the total).   By geographic regions 34 per cent of the respondents were from southeast Florida, 25 per

---

[1]Fathers who did not live with the respondents' fam- ilies during the majority of the respondents' elementary and secondary school years are not included in the average fathers' education figures.   As such, 19 per cent of the total respondents were excluded from the average father's education figure.

[2]Respondents' fathers who were either retired or de- ceased were not included in the father's income figure.   As such, 33 per cent of the total respondents were excluded from the father's income figure.

cent were from central Florida, 24 per cent were from south-
west Florida, and 16 per cent were from north Florida.

An analysis of the total respondents in terms of the
dependent variables of public and private benefits, public
and private costs, public and private benefit-cost ratios,
and relatedness index appears in Table 3.[1] This table shows
the relationship between measures of the dependent variables
and selected independent variables.

The data in Table 3 indicates a profile of character-
istics of persons who had the highest returns on investment
in vocational education as measured by benefit-cost ratios.
On the average, these persons: attended vocational educa-
tion for less than 600 hours; had related working experience
prior to entering the labor market; were employed during
training; took additional training after entering the labor
market; and were married white persons over thirty years old
who finished four years of high school with a grade point
average above 2.60.[2]

In addition to economic returns, Table 3 also indi-
cates a profile of characteristics of persons whose jobs were
most related to their vocational education program as mea-
sured by the relatedness index. On the average, these per-
sons: attended vocational education for 1051 hours; were not

---

[1]These data show gross relationships. After control
ling for the influence of other socio-demographic variables
and specific program effects, the net relations for these
variables may change.

[2]Grade point average was measured on a 4.0 scale.

TABLE 3

BENEFITS, COSTS, BENEFIT-COST RATIOS, AND RELATEDNESS INDEX AS A FUNCTION OF
SELECTED SOCIO-DEMOGRAPHIC VARIABLES FOR TOTAL SAMPLE IN ALL PROGRAMS

Independent Variables	Dependent Variables						
	Public Benefit	Private Benefit	Public Cost	Private Cost	Public Benefit-Cost Ratio	Private Benefit-Cost Ratio	Relatedness Index
Hours of Attendance							
Up to 600 (N=27)	$ 957	$ 791	$ 571	$ 866	2.38	1.38	1.47
601-1050 (N=23)	2161	1809	1212	1913	1.66	.89	1.70
1051 or Above (N=258)	1050	885	1881	2617	.51	.31	1.88
Related Working Experience							
Yes (N=134)	1283	1071	1687	2381	.84	.49	1.82
No (N=174)	1004	850	1738	2433	.72	.41	1.84
Employed During Training							
Yes (N=149)	1263	1062	1609	2200	1.04	.62	1.79
No (N=158)	991	833	1814	2610	.50	.29	1.87
Additional Training							
Yes (N=47)	1651	1389	1745	2379	1.39	.81	1.73
No (N=261)	1031	866	1711	2416	.65	.39	1.85
Marital Status							
Single (N=113)	854	703	1489	2221	.63	.34	1.74
Married (N=169)	1287	1090	1834	2512	.90	.54	1.92
Separated, Widowed or Divorced (N=26)	1255	1063	1938	2539	.49	.33	1.88
Race							
White (N=272)	1156	971	1709	2407	.79	.46	1.85
Nonwhite (N=36)	891	753	1769	2437	.60	.38	1.69
Age							
Up to 20 (N=102)	787	651	1468	2223	.50	.27	1.77
21-25 (N=104)	908	752	1905	2508	.55	.33	1.87
26-30 (N=22)	1448	1206	1751	2419	.60	.41	1.85
30 or Above (N=80)	1751	1501	1778	2521	1.42	.84	1.86
High School Level Completed							
1-3 Years (N=26)	378	1064	1592	2195	-.03	.03	1.75
4 Years (N=282)	1194	1202	1728	2430	.84	.4.	1.84
High School Grade Pt. Ave.							
Up to 2.30 (N=118)	800	669	1661	2308	.66	.4.	1.80
2.31 - 2.59 (N=74)	1183	993	1732	2418	.71	.44	1.81
2.60 or Above (N=116)	1419	1198	1762	2510	.91	.51	1.88
Mean of the Dependent Variable	$1125	$ 946	$2215	$2411	.45	.76	1.83

employed during training; did not take additional training after entering the labor market; and were married nite persons over twenty-one years old who finished four years of high school with a grade point average above 2.60.

Before analyzing monetary benefits, relatedness index, costs, and benefit-cost ratios between vocational education programs, it is in order to look at differences and similarities in student socio-demographic variables between each of the four programs.

Between programs there were significant differences in some student characteristics.[1] On the average, the ages of respondents who attended the nursing program (33.3 years) and the air conditioning program (29.4 years) was significantly ($p < .001$)[2] higher than the average ages of respondents who attended either the cosmetology program (22.4 years) or the auto mechanics program (21.1 years) The only significant difference in race composition between programs was in the nursing program. The percentage of nonwhite respondents who attended the nursing program (18.2%) was significantly ($p < .10$) higher than for either the auto mechanics program (11.3%), the air conditioning program (8.7%) or the cosmetology program (6.9%). Mothers of respondents who attended the auto mechanics program had, on the average,

---

[1]Analysis of variance of quantitative variables appears in Appendix F and a chi square analysis of qualitative variables appears in Appendix G.

[2]All statistics were tested against four levels of significance: $p < .001$; $p < .01$; $p < .05$; and $p < .10$.

significantly (p <.01) more education (11.8 years) than did mothers of respondents who attended the nursing p ogram (10.2 years).

The percentage of secondary students who attende the auto mechanics program (60.7%) was significantly (p <.001) higher than either the percentage of secondary students who attended the air conditioning program (34.8%), the n r_ing program (9.1%), or the cosmetology program (44.6%).

Some student characteristics did not differ signifi-cantly between programs. There were no significant differ-ences between programs in the average number of children respondents had, nor was there a significant difference in the number of years of high school completed. Likewise, there were no significant differences between programs in either father's annual income, fathe. 's education, or re-spondents' grade point average in high school. ..ere were no significant differences in mother's education between respondents who attended either the air conditioning program (10.6 years), the nursing program (10.2 years), or the cos-metology program (10.8 years).

Comparison and Analysis of Benefits

There were two major classifications of benefits which were considered in this study: (1) public or social benefits, and (2) private or student benefits. A third mea-sure of benefits--relatedness index--gauged the rela ions p of employment to vocational education program atten e

Presented in this section are compariso s

analyses of benefits between each of the four vocational education programs, and comparisons between secondary and nonsecondary students in all programs. Included are comparisons and analyses of (1) public benefits, (2) private benefits, (3) socio-demographic effects on benefits, and (4) relatedness index.

Public benefits

Calculation of public benefits per student was based on wage rates and employment rates (a monetary index) before deduction of federal income taxes.

The average public benefit per student for each program and for secondary and nonsecondary students in all programs appears in Table 4. Based upon the statistical technique of analysis of variance, comparisons and analyses of public benefits per student between programs and between secondary and nonsecondary students in all programs follow.[1]

The average public benefit for persons who attended the air conditioning program[2] ($2646) was significantly (p < .001) higher than for persons who attended either the nursing program ($1252), the auto mechanics program ($927), or the cosmetology program ($393). Contributing to the higher public benefit for the air conditioning program was a

---

[1] See Appendixes F and H for analyses of variance.

[2] Neither institution selected in north Florida had an air conditioning and refrigeration program. Therefore, north Florida is not represented in the air conditioning program data.

TABLE 4

AVERAGE PUBLIC BENEFITS BY PROGRAMS AND BY SECONDARY AND NONSECONDARY STUDENTS IN ALL PROGRAMS (PER STUDENT)
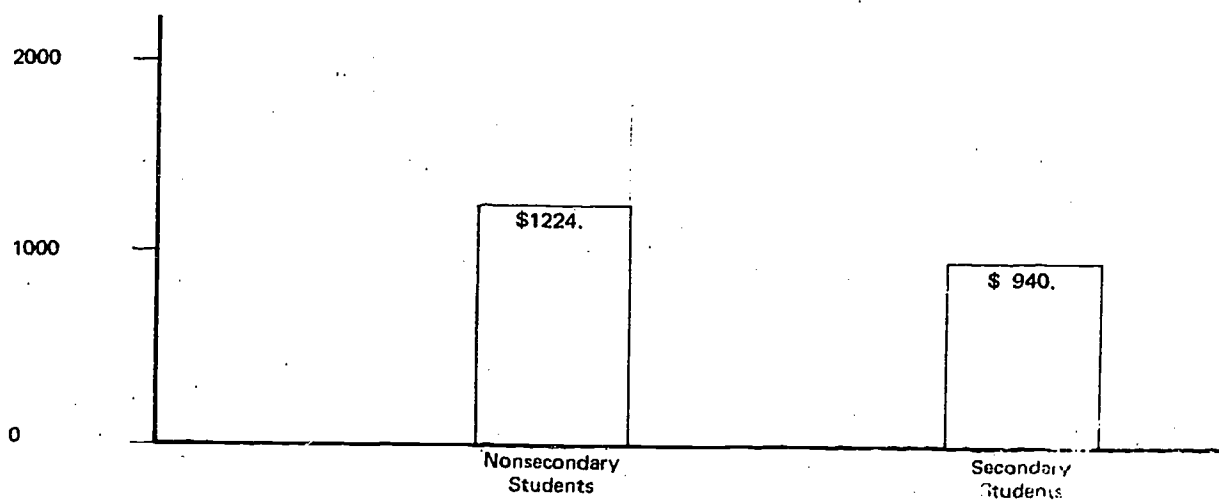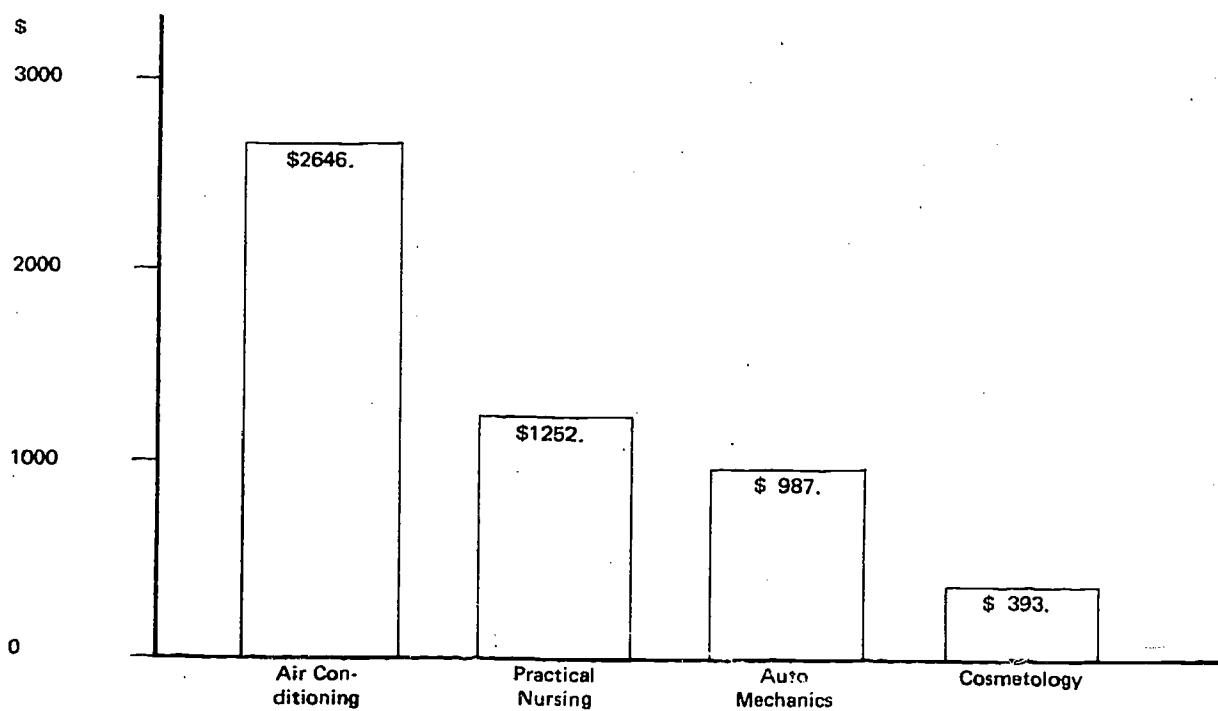
comparatively low rate of involuntary unemployment (.17 months per year) experienced by persons who attended the air conditioning program as compared to the involuntary unemployment rates experienced by persons who attended either the nursing program (.87 months per year), the auto mechanics program (.58 months per year), or the cosmetology program (.26 months per year).

The average public benefit for the nursing program ($1252) was significantly (p <.001) higher than the average public benefit for the cosmetology program ($333). Since the average amount of involuntary unemployment for persons who attended the nursing program (.87 months per year) was significantly (p <.10) higher than for persons who attended the cosmetology program (.26 months per year), the difference in public benefits between the two programs was due largely to differences in wage rates rather than employment rates.

There was no significant difference in public benefits between persons who attended the nursing program ($1252) and persons who attended the auto mechanics program ($987), but the average public benefit for persons who attended the auto mechanics program ($987) was significantly (p <.10) higher than the average public benefit for persons who attended the cosmetology program ($333).

Over all programs, the average public benefit for secondary students ($940) was significantly (p <.05) lower

than the average public benefit for nonsecondary students
($1224).[1]

Private benefits

Calculation of private benefits per student was based
on wage rates and employment rates (a monetary index) after
deduction of federal income taxes.

The average private benefit per student for each pro-
gram and for secondary and nonsecondary students in all pro-
grams appears in Table 5. Based upon the statistical
technique of analysis of variance, comparisons and analyses
of private benefits per student between programs and between
secondary and nonsecondary students in all programs follow.[2]

The average private benefit for persons who attended
the air conditioning program ($2230) was significantly
(p <.001) higher than for persons who attended either the
nursing program ($1056), the auto mechanics program ($316),
or the cosmetology program ($333). Contributing to the
higher private benefit for persons who attended the air con-
ditioning program was the comparatively low rate of involun-
tary unemployment (.17 months per year) these persons experi-
enced.

The average private benefit for persons who attended
the nursing program ($1056) was significantly (p <.001)

---

[1]There were significant differences in public bene-
fits between programs for secondary and nonsecondary students.
These differences are reported in Appendix H.

[2]See Appendixes F and H for analyses of variance.

TABLE 5

AVERAGE PRIVATE OR STUDENT BENEFITS BY PROGRAMS
AND BY SECONDARY AND NONSECONDARY STUDENTS
IN ALL PROGRAMS (PER STUDENT)

$
3000

2000

1000

0

$2230.

$1056.

$ 816.

$ 333.

Air Con-
ditioning

Practical
Nursing

Auto
Mechanics

Cosmetology

2000

1000

0

$1037.

$ 774.

Nonsecondary
Students

Secondary
Student
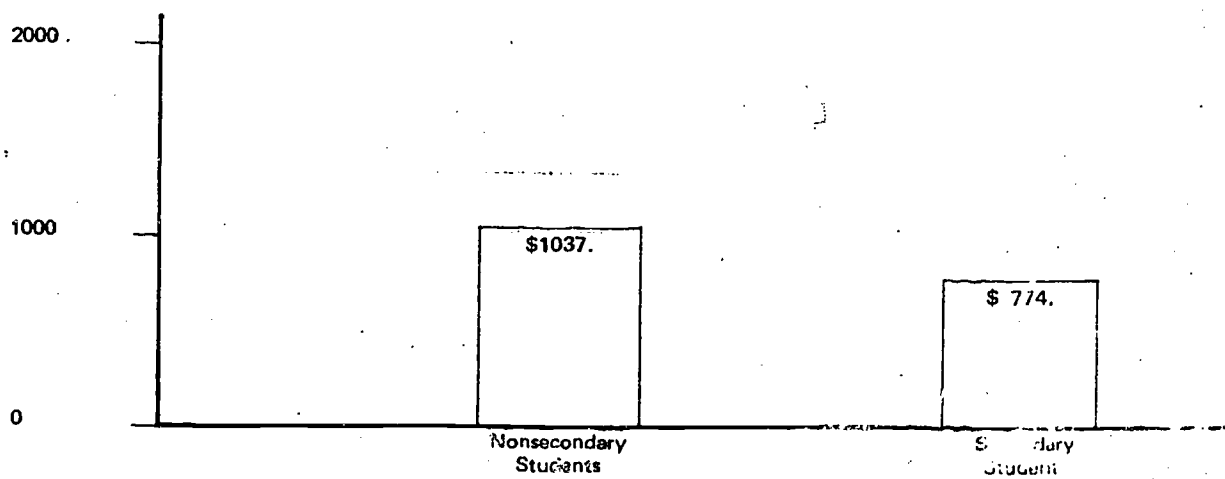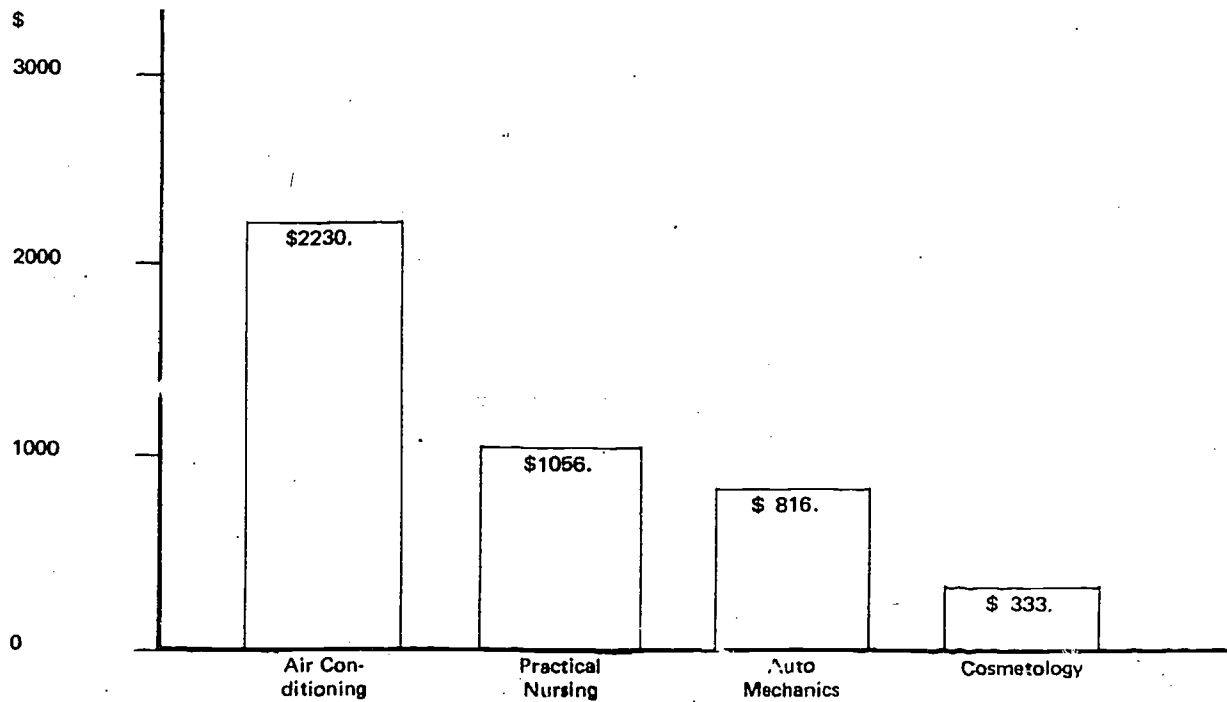
higher than the average private benefit for persons who attended the cosmetology program ($333). There was no significant difference between the average private benefits for persons who attended either the nursing program or the auto mechanics program ($816), nor was there a significant difference in the average private benefit between persons who attended the auto mechanics program or the cosmetology program ($333).

Over all programs the average private benefit for secondary students ($774) was significantly (p <.05) lower than the average private benefit for nonsecondary students ($1037).[1]

Socio-demographic effects on benefits

In order to analyze the effects of student socio-demographic characteristics on public and private benefits for each program, multiple regression analysis was employed. The multiple regression analyzed the relationship between student socio-demographic characteristics and (1) public benefits, and (2) private benefits. Since public benefits differed from private benefits only by the amount of federal income taxes, multiple regression analyses for public and private benefits were very similar. The complete regressions for both public and private benefits appear in Appendixes I

---

[1] There were differences in private benefits for secondary and nonsecondary students between programs and these differences are reported in Appendix H.

and J, respectively, while a summary table of the statistically significant socio-demographic variables for private benefits appears in Table 6. A discussion of summary Table 6 follows.

Even after controlling for regional differences in wage rates, the region of employment was significantly related to private benefits for persons who attended the air conditioning program and for persons who attended the nursing program. Persons who attended the air conditioning program and were employed in southwest Florida earned, on net (that is, holding the effects of all other variables constant), $980 (earnings are net of federal income taxes) less per year than if these persons had worked in southeast Florida. There were no significant differences in private benefits between the other regions for persons who attended the air conditioning program.

Similarly, persons who attended the nursing program and were employed in southwest Florida earned, on net, $807 less per year than if these persons had worked in southeast Florida. There were no significant differences in private benefits between the other regions for persons who attended the nursing program.

The relatedness index was significantly related to private benefits for persons who attended the air conditioning program. For a one point increase in the relatedness index (for example, from related jobs to very related jobs), persons who took the air conditioning program had, on net, a

TABLE 6

SUMMARY OF MULTIPLE REGRESSION ANALYSIS OF
SOCIO-DEMOGRAPHIC EFFECTS ON PRIVATE
BENEFITS FOR EACH PROGRAM

Socio-Demographic Variables	Programs			
	Auto Mechanics	Air Conditioning	Licensed Practical Nursing	Cosmetology
Region	NSR	SR^c	SR^a	NSR
Relatedness Index	NSR	SR^d	NSR	SR^d
Additional Related Training	NSR	NSR	NSR	SR^c
Race	SR^a	SR^b	NSR	NSR
Secondary Student	NSR	NSR	NSR	SR^d
Marital Status	NSR	NSR	NSR	SR^d
Father's Annual Income	SR^b	NSR	NSR	NSR
Hours of Attendance	SR^a	NSR	SR^d	NSR
Age	NSR	NSR	SR^c	SR^a
High School Grade Point Average	NSR	SR^a	NSR	NSR

SR = Significantly Related

NSR = Not Significantly Related

[a] Significant at .001 level.

[b] Significant at .01 level.

[c] Significant at .05 level.

[d] Significant at .10 level.

$705 per year increase in their private benefits. Similarly, persons who took the cosmetology program had, on net, a $812 per year increase in their private benefits for a one point increase in their relatedness index. Thus, as employment for persons who attended these programs was more related to their vocational training, they not only enjoyed benefits beyond economic returns, but also had additional economic returns.

Persons who attended the cosmetology program and who had additional training related to cosmetology earned, on net, $341 less per year than similar persons who did not take additional training. Since this study examined a limited time in the labor force, it apparently did not capture the effects of additional training on private benefits. It is likely that reduced income in the short-run will be more than recouped in the long-run as a result of additional training.

Race was significantly related to private benefits for persons who attended the auto mechanics program and for persons who attended the air conditioning program. White persons who attended the auto mechanics program earned, on net, $1209 more per year than similar nonwhite persons. Likewise, white persons who attended the air conditioning program earned, on net, $2014 more per year than similar non-white persons.

Attending vocational education as a secondary student was significantly associated with private benefits in one program. Secondary student who attended the cosmetology

program earned, on net, $416 less per year than similar non-secondary students who attended the cosmetology program.

Marital status was significantly related to private benefits for persons who attended the cosmetology program. Married persons who attended the cosmetology program earned, on net, $416 more per year than did similar persons who were either separated, widowed, or divorced. There was no significant difference in private benefits between single persons and separated, widowed, or divorced persons in the cosmetology program.

Students' fathers' annual incomes were significantly related to private benefits for persons who attended the auto mechanics program and for persons who attended the cosmetology program. For persons who attended the auto mechanics program, higher categories of fathers' annual income ($8001-$9000 and $10,001 or above) were associated with higher private benefits ($657 and $1029 more per year, respectively) as compared to similar persons whose fathers' annual incomes were in the lowest category (up to $4000). Likewise, persons who attended the cosmetology program whose fathers' annual incomes were in the higher categories ($8001 - $9000 and $9001-$10,000) earned, on net, $773 and $541 more per year, respectively, than did similar persons whose fathers' annual incomes were in the lowest category (up to $4000).

Hours of attendance in the auto mechanics program and the nursing program were significantly related to private benefits. Persons who attended the auto mechanics program

realized an increase in their private benefits, on net, of $1.40 per year for each additional hour they attended the auto mechanics program. Similarly, persons who attended the nursing program realized an increase in their private benefits, on net, of $.60 per year for each additional hour they attended the nursing program.

Age was significantly related to private benefits for persons who attended the nursing program. Private benefits increased, on net, $18 per year for each one year increase in a person's age.

High school grade point average was significantly related to private benefits for persons who attended the air conditioning program. Two students with the same socio-demographic characteristics, except for a one point difference in high school grade point average, had a difference of $1448 per year in their private benefits, with higher private benefits going to the person with the higher grade point average.[1]

In sum, the multiple regression analysis showed that a student's socio-demographic characteristics significantly affected his private benefits.

Relatedness index

As an additional indicator of the benefits of

---

[1] Grade point average was measured on a 4.0 scale.

vocational education the relatedness index[1] measured the
relationship between vocational education program attended
and subsequent employment.

On the average, the relatedness index for the nursing
program (1.92) was significantly greater than for either the
auto mechanics program (1.60) or the air conditioning pro-
gram (1.68). The relatedness index for the cosmetology
program (1.95) was, on the average, also greater than either
the auto mechanics program (1.60) or the air conditioning
program (1.68). There was no significant difference in the
index between the nursing program and the cosmetology pro-
gram.[2]

While the monetary benefits for the cosmetology pro-
gram were comparatively low, persons who attended cosmetology
training had jobs which were more related to their training
than did persons who attended either the auto mechanics pro-
gram or the air conditioning program. Likewise, nursing
students had lower monetary benefits than air conditioning
students, but nursing students had jobs which were more re-
lated to their training than did air conditioning students.

Over all programs, on the average, the relatedness
index for nonsecondary students (1.86) was significantly

---

[1]The range of the relatedness index is 1-2. The
closer the index approaches 2, the more related were a per-
son's jobs to his vocational education program.

[2]For an analysis of variance of the relatedness in-
dex between programs, see Appendix F.

(p <.01) higher than the relatedness index for secondary students (1.77). This indicated that nonsecondary students, as compared to secondary, enjoyed benefits in addition to those measured by the monetary index.

Comparison and Analysis of Costs

There were two major classifications of costs which were considered in this study: (1) public or social costs, and (2) private or student costs.

Presented in this section are comparisons and analyses of costs between each of the four vocational education programs, and between secondary and nonsecondary students in all programs. Included are comparisons and analyses of (1) public costs, (2) private costs, and (3) socio-demographic effects on costs.

Public costs

Calculation of public costs for each program was based on two factors: (1) the quantity of time that a student spent in a given program, and (2) the value of cost per unit of time for vocational education.

The average public cost per student for each program, and for secondary and nonsecondary students in all programs, appears in Table 7. Since public costs were a function of the quantity of time spent in a program, hours of attendance for each program and for secondary and nonsecondary students in all programs are portrayed in Table 4.

Based upon the statistical technique of anal sis of

TABLE 7

AVERAGE PUBLIC COSTS BY PROGRAMS AND BY SECONDARY AND NONSECONDARY STUDENTS IN ALL PROGRAMS (PER STUDENT)
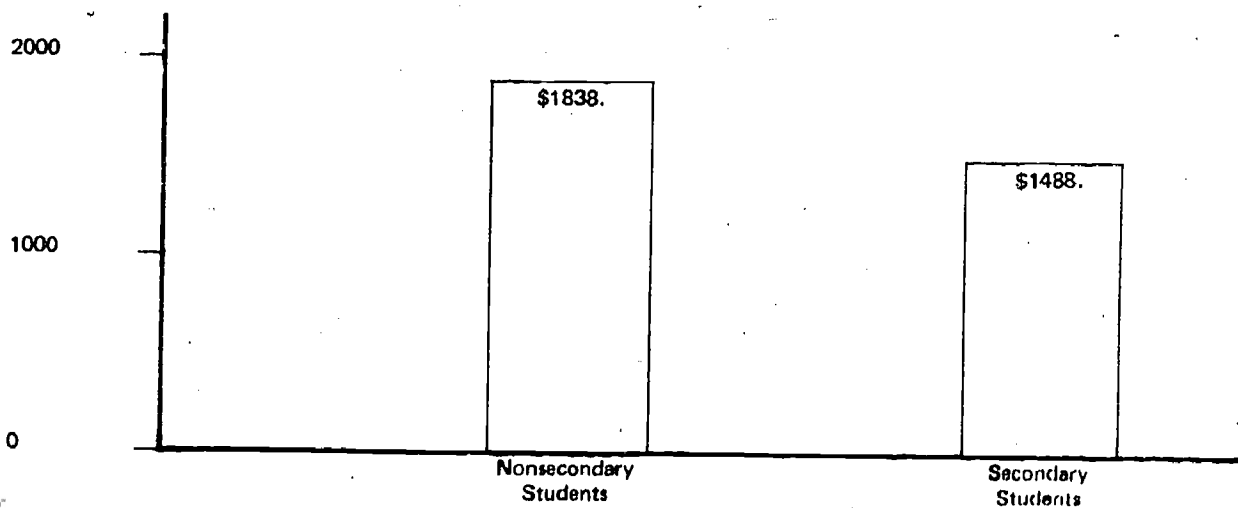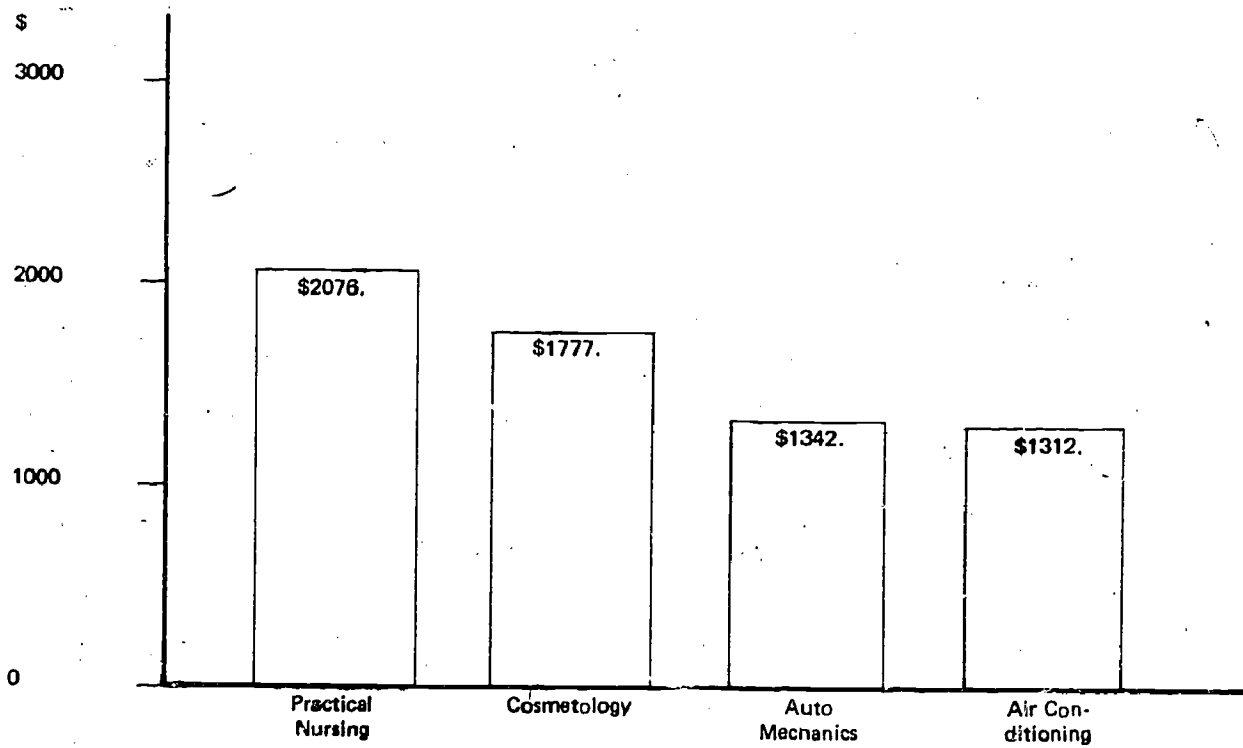
TABLE 8

AVERAGE NUMBER OF HOURS OF ATTENDANCE BY PROGRAM
AND BY SECONDARY AND NONSECONDARY STUDENTS
IN ALL PROGRAMS (PER STUDENT)

HOURS

1500

1000

500

0

1379 HRS.	1220 HRS.	964 HRS.	924 HRS.
Practical Nursing	Cosmetology	Air Con- ditioning	Auto Mechanics

HOURS

1500

1000

500

0

1227 HRS.	1073 HRS.
Nonsecondary Students	Secondary Students
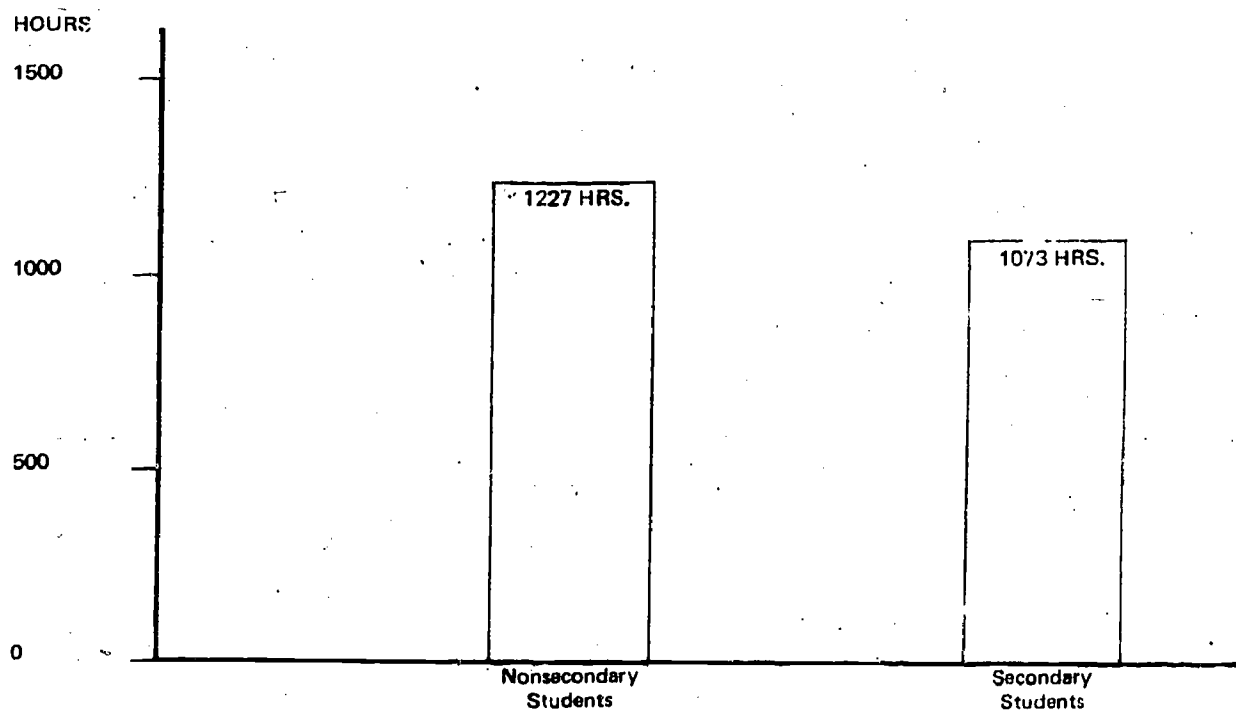
variance, comparisons and analyses of public costs per student and private costs per student between programs and between secondary and nonsecondary students in all programs follow.[1]

The average public cost for the nursing program ($2076) was significantly (p < .001) higher than for either the cosmetology program ($1777), the auto mechanics program ($1342), or the air conditioning program ($1312). Largely contributing to the higher public cost for the nursing program was the longer period of time students spent in the nursing program as compared to the other three programs. Average hours of attendance in the nursing program (1379) was significantly (p < .001) greater than for either the cosmetology program (1220), the air conditioning program (964), or the auto mechanics program (924). Another factor which contributed to the higher public cost for the nursing program was a higher unit cost ($1296 per FTE in 1970-71, as compared to the unit costs for the auto mechanics program ($1064 per FTE in 1970-71), and the cosmetology program ($1261 per FTE in 1970-71).[2]

The average public cost for the cosmetology program ($1777) was significantly (p < .001) higher than the average public cost for the auto mechanics program ($1342) and for

---

[1]See Appendixes F and H for analyses of variance of public costs between programs and between secondary and nonsecondary students in all programs, respectively.

[2]Appendix D presents the public unit costs (cost per FTE) for each program.

the air conditioning program ($1312). Largely contributing
to the higher public cost for the cosmetology program (as
compared to auto mechanics and air conditioning) was the
greater length of time students spent in the cosmetology pro-
gram.[1] Hours of attendance in the cosmetology program (1220)
was significantly (p < .001) greater than in either the auto
mechanics program (924) or in the air conditioning program
(964). Another factor which contributed to the higher pub-
lic costs for the cosmetology program was the higher unit
cost ($1261 per FTE in 1970-71) for cosmetology as compared
to the unit costs for the auto mechanics program ($1144 per
FTE in 1970-71), and the air conditioning program ($1064 per
FTE in 1970-71).

There was no significant difference in the average
public cost between the auto mechanics program ($1342) and
the air conditioning program ($1312). The insignificant
differences in the number of hours of attendance between the
auto mechanics program (924) and the air conditioning pro-
gram (964) contributed to these similarities.

Over all programs the average public cost for second-
ary students ($1488) was significantly (p < .001) lower than
the average public cost for nonsecondary students ($1838).
Largely contributing to the lower public cost for secondary
students was a significantly (p < .001) lower number of hours

---

[2]One factor contributing to the higher average number
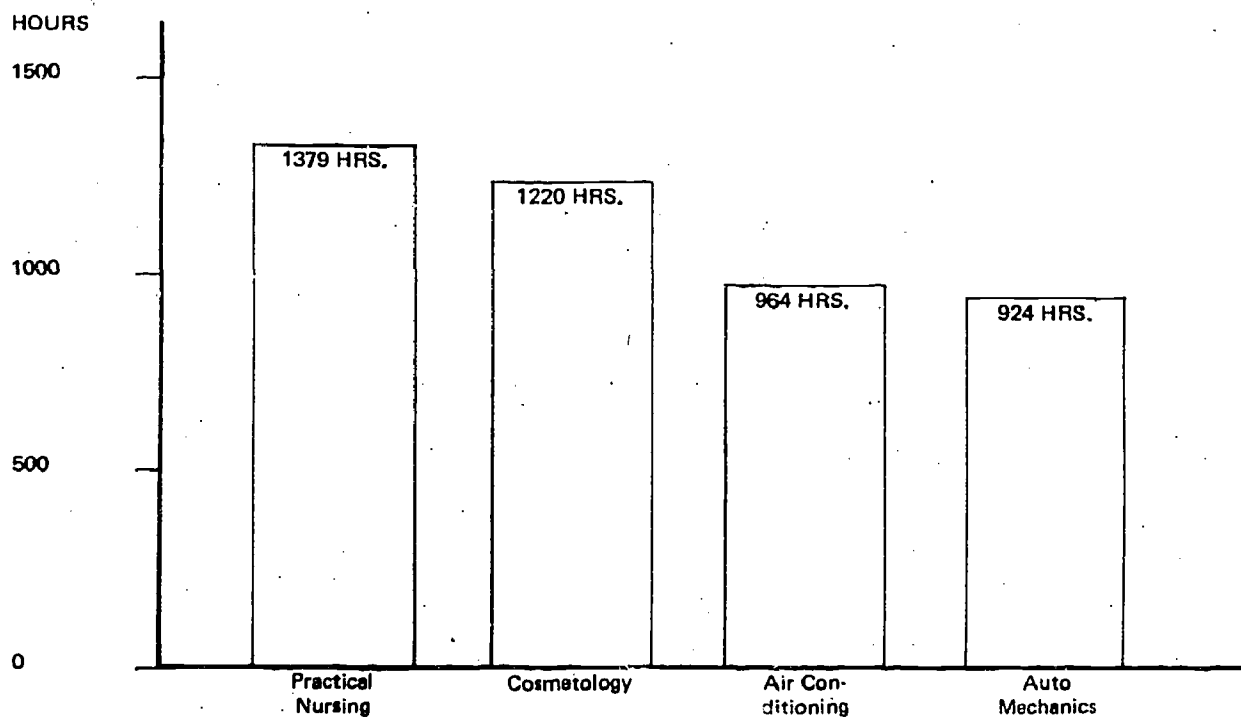of hours of attendance in the nursing and cosmetology pro-
grams is that a minimum of 1200 hours of attendance in these
programs is required in order to take the state licensing
examinations.

of attendance in vocational education programs by secondary
students (1073 hours) as compared to nonsecondary students
(1227 hours).[1]

Private costs

Like the calculation of public costs, the calculation
of private costs was based on two factors: (1) the quantity
of time that a student spent in a given program, and (2) the
value or cost per unit of that time. For private costs
there were two factors included in the cost of a unit of
time. The major factor was the opportunity cost of foregone
earnings, while a comparatively minor factor was the direct
costs incurred by students for tuition, books, supplies, uni-
forms, and special equipment. Since these latter costs only
slightly affected total private costs, reference only is made
to Appendix E where these costs for each program are re-
ported.

The average private cost per student for each prog.am
and for secondary and nonsecondary students in all programs
appears in Table 9. Like public costs, private costs were
also a function of the number of hours a student attended a
vocational education program. Therefore, hours of attendance
reported here are the same as those portrayed in Table 8 and
discussed under public costs.

Based upon the statistical technique of analysis of

[1]Differences in public cost and hours of attendance
did occur between programs, and are reported in Appendix H.

TABLE 9

AVERAGE PRIVATE OR STUDENT COSTS, IN DOLLARS, BY PROGRAMS AND BY SECONDARY AND NONSECONDARY STUDENTS IN ALL PROGRAMS (PER STUDENT)

$2823. — Practical Nursing
$2524. — Cosmetology
$1983. — Air Conditioning
$1884. — Auto Mechanics

$2485. — Nonsecondary Students
$2271. — Secondary Students
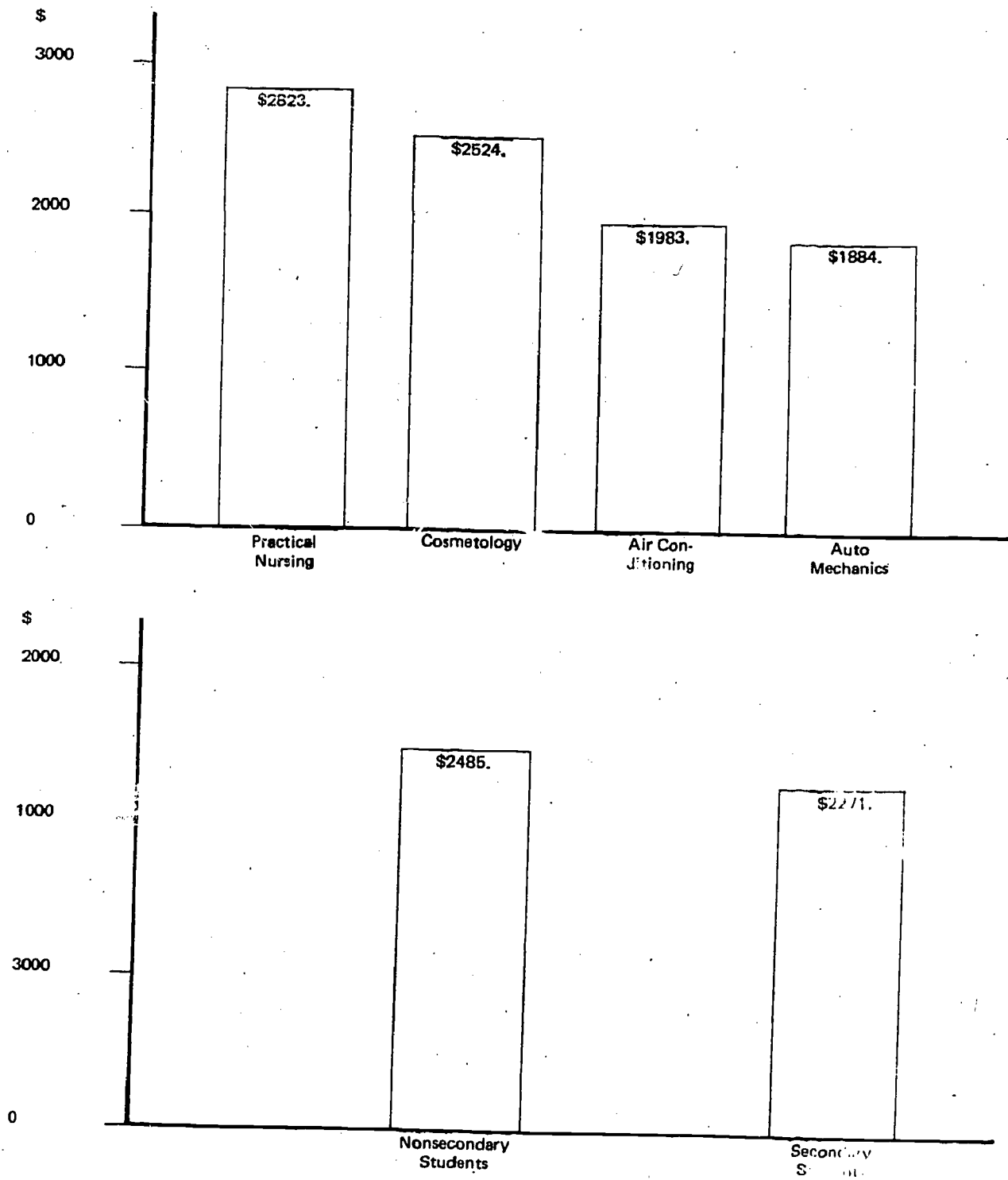
variance, comparisons between programs and between secondary and nonsecondary students in all programs of private costs per student and hours of attendance per student follows.[1]

The average private cost for the nursing program ($2823) was significantly (p <.001) higher than for either the cosmetology program ($2524), the air conditioning program ($1983), or the auto mechanics program ($1884). Largely contributing to the higher private cost for the nursing program was the longer period of time students spent in the nursing program as compared to the other three programs.

The average private cost for the cosmetology program ($2524) was significantly (p <.001) higher than the average private cost for either the auto mechanics program ($1884) or the air conditioning program ($1983). Largely contributing to the higher private cost for the cosmetology program (as compared to auto mechanics and air conditioning(was the greater length of time students spent in the cosmetology program.

There were no significant differences in average private cost between the auto mechanics program ($1884) and the air conditioning program ($1983). The fact that there was no significant difference in the number of hours of attendance between the auto mechanics program (924) and the air conditioning program (964) contributed largely to the similarity in private cost.

---

[1]See Appendixes F and H for analyses of variance of private costs between programs and between secondary and nonsecondary students in all programs, respectively.

Over all programs the average private cost for second-
ary students ($2271) was significantly (p <.01) lower than
the average private cost for nonsecondary students ($2485).
A significantly (p <.001) lower number of hours of attend-
ance by secondary students (1073 hours) as compared to non-
secondary students (1227 hours) largely contributed to lower
private costs for secondary students.[1]

Socio-demographic effects
on costs

In order to analyze the effects of student socio-
demographic characteristics on public costs and private
costs per student for each program, multiple regression
analysis was employed. Since public costs and private costs
per student were a function of hours of attendance in a pro-
gram, the multiple regression analyzed the relationship be-
tween student socio-demographic characteristics and hours of
attendance in each program. The complete regressions appear
in Appendix K, while a summary of the statistically signifi-
cant socio-demographic variables appears in Table 10. A
discussion of summary Table 10 follows.

The region in Florida where persons were enrolled in
vocational education was significantly related to hours of
attendance only in the cosmetology program. Persons enrolled
in cosmetology in central Florida remained in training, on
net (that is, holding the effects of all other variables

---

[1]There were differences in private costs between pro-
grams as reported in Appendix H.

constant), 33 hours less than persons who were enrolled in
cosmetology in southeast Florida. There were no significant
differences in hours of attendance between the other regions.

TABLE 10

SUMMARY OF MULTIPLE REGRESSION ANALYSES OF
SOCIO-DEMOGRAPHIC EFFECTS ON STUDENT
HOURS OF ATTENDANCE IN EACH PROGRAM.

Socio-Demographic Variables	Programs			
	Auto Mechanics	Air Conditioning	Practical Nursing	Cosmetology
Region	NSR	NSR	NSR	SR[d]
Race	SR[b]	NSR	NSR	SR[d]
Marital Status	SR[b]	SR[b]	SR[d]	NSR
Father's Annual Income	SR[a]	SR[d]	SR[d]	SR[d]
Age	NSR	SR[a]	NSR	NSR
Father's Education	SR[a]	NSR	NSR	NSR
Mother's Education	SR[c]	SR[b]	NSR	NSR

SR = Significantly Related.

NSR = Not Significantly Related.

[a]Significant at .001 level.

[b]Significant at .01 level.

[c]Significant at .05 level.

[d]Significant at .10 level.

Race was significantly related to the number of hours of attendance in the auto mechanics and cosmetology programs. White persons attended the auto mechanics programs, on net, 397 hours less than did nonwhite persons. Likewise, white persons attended the cosmetology program 56 hours less than nonwhite persons.

Marital status was significantly related to the number of hours of attendance in all programs except cosmetology. Single persons attended the auto mechanics and air conditioning programs, on net, 320 and 298 hours less than separated, widowed or divorced persons in the auto mechanics and air conditioning programs, respectively. Similarly, married persons attended the nursing program, on net, 76 hours more than separated, widowed or divorced persons in the nursing program.

Students' fathers' annual incomes were significantly related to the number of hours of attendance in all programs. In the auto mechanics program higher categories of income ($8001 - $9000 and $10,001 or above) were associated with a lower number of hours of attendance (268 and 428 hours, respectively) as compared to similar persons whose fathers' annual incomes were in the lowest category (up to $4000). In the nursing program, however, a higher category of income ($9001 - $10,000) was associated with a higher number of hours of attendance (210 hours) as compared to persons whose fathers were in the lowest income category (up to $4000). In the air conditioning and cosmetology programs, persons whose fathers' annual incomes were in the $4001 - $5000 category

took 364 and 419 hours less, respectively, than persons whose fathers' annual incomes were in the lowest category (up to $4000).

Age was significantly related to hours of attendance in only the air conditioning program. For each year older a person was, his hours of attendance in the air conditioning program decreased by 18 hours.

Father's education was significantly related to hours of attendance in only the auto mechanics program. Hours of attendance increased at the rate of 32 hours for each additional year of father's education.

Mother's education was significantly related to hours of attendance in the auto mechanics and air conditioning programs. As mother's education increased, hours of attendance in the auto mechanics program increased at the rate of 44 hours for each additional year of mother's education; in the air conditioning program hours of attendance increased at the rate of 56 hours per year.

Comparison and Analysis of Benefit-Cost Ratios

In order to determine the return on investment in vocational education programs, program benefits were linked to program costs[1] in the form of benefit-cost ratios, which served as economic efficiency indices of vocational education

---

[1]A discussion and correlation analysis of the relationship between public costs and public benefits, and between private costs and private benefits appears in Appendix L.

programs.[1] The purpose of benefit-cost ratios was to provide economic indicators for evaluating a program by itself and in relation to other programs.

Since benefits occur over future time periods, benefits were discounted back to their present value, thereby making benefits comparable with present value costs. The resultant figure was a discounted benefit-cost ratio.

Benefit-cost ratios are equivalent to the percentage rate of annual return on investment (cost) in vocational education programs and the reciprocal of the benefit-cost ratio is equivalent to the number of years it will take a person (or society) to receive a "total return" on his (its) investment in vocational education programs.

Average public and private benefit-cost ratios for each program and for secondary and nonsecondary students in all programs, discounted at 10 per cent, appear in Tables 11 and 12. In themselves, benefit-cost ratios show that all programs had a very positive rate of return on investment, both for the individual and for society although investment returns differed between programs.

Based upon the statistical technique of analysis of

----

[1]The benefit-cost ratios reported herein should not be considered precise indices of the economic efficiency of vocational education programs nor secondary versus nonsecondary student economic behavior. Rather, the calculated public and private benefit-cost ratios should be thought of as direction indicators for public and private investment in vocational education. In addition, these benefit-cost ratios are limited to monetary measures which, perhaps, are only minor criteria in evaluating public and private investment in vocational education.

TABLE 11

AVERAGE PUBLIC BENEFIT-COST RATIOS BY PROGRAMS
AND BY SECONDARY AND NONSECONDARY STUDENTS
IN ALL PROGRAMS (PER STUDENT)[1]

TABLE 12

AVERAGE PRIVATE OR STUDENT BENEFIT-COST RATIOS BY PROGRAMS AND BY SECONDARY AND NONSECONDARY STUDENTS IN ALL PROGRAMS (PER STUDENT)[1]
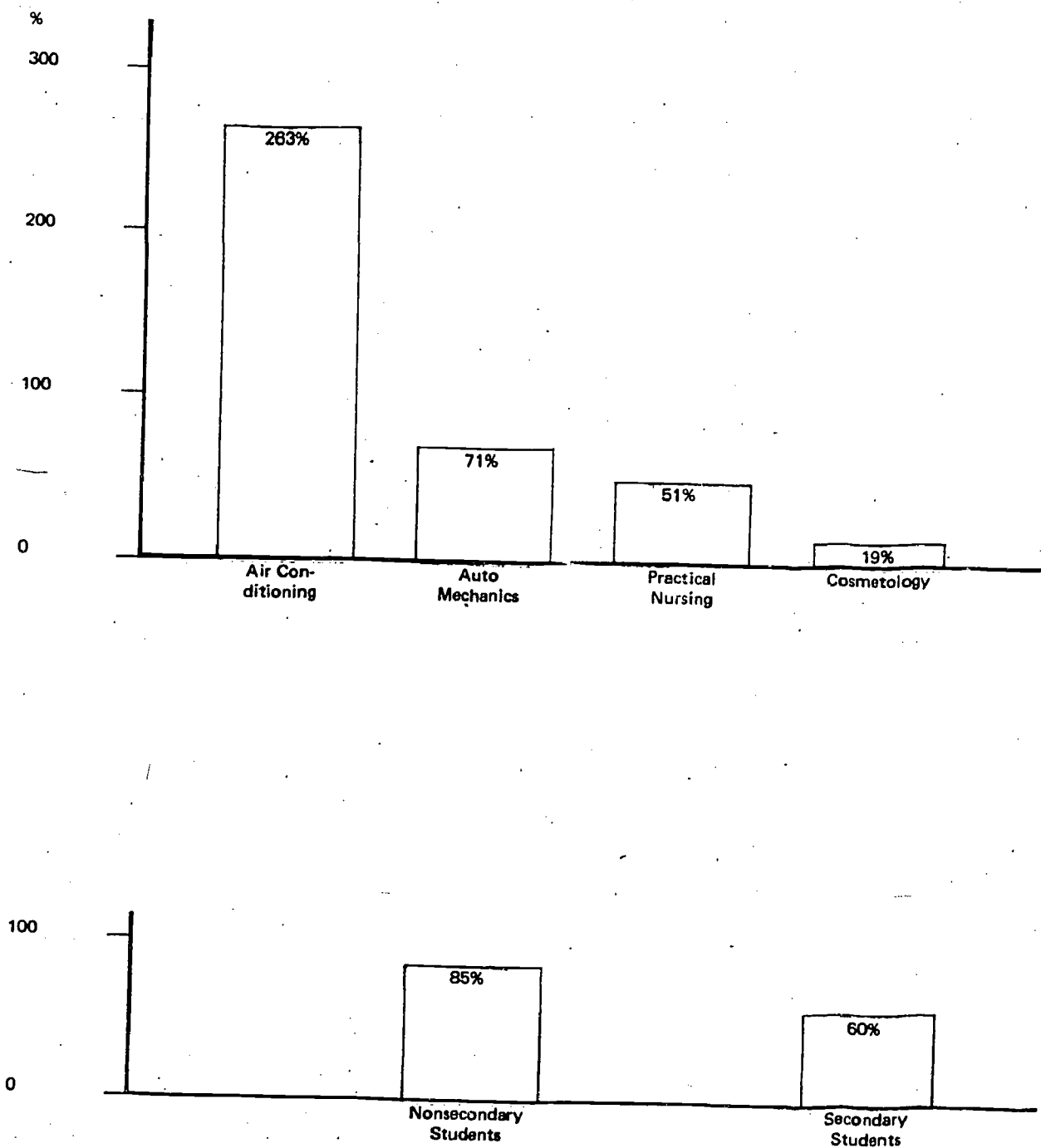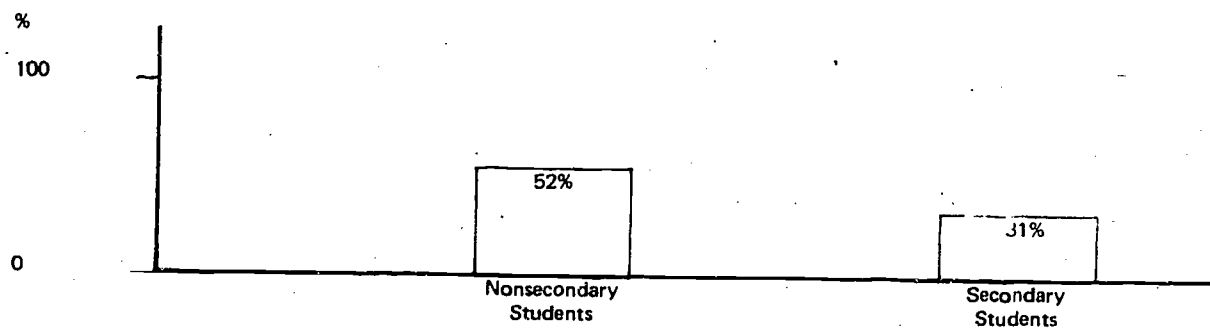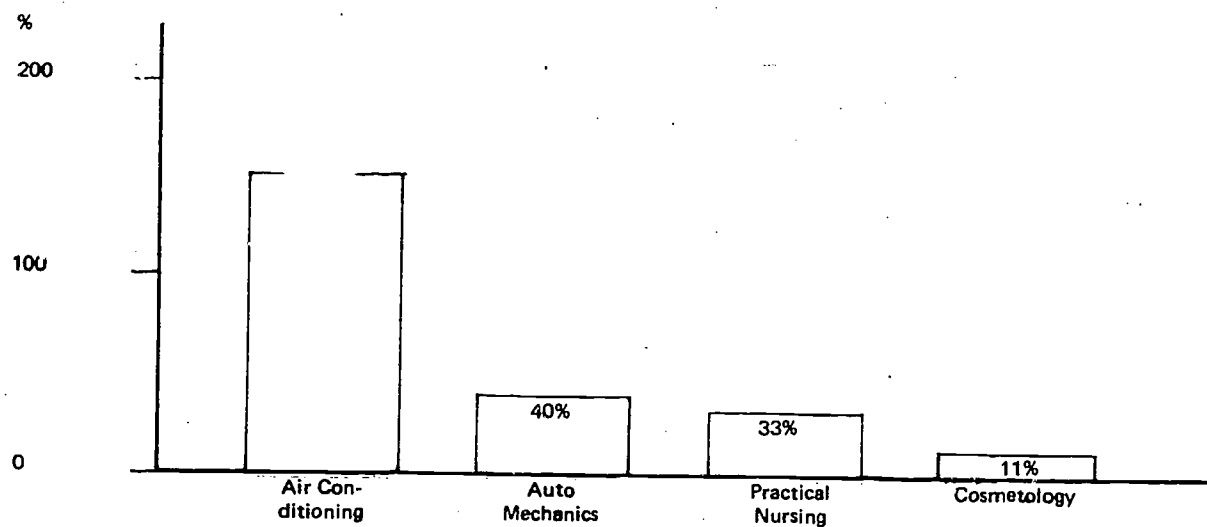
[1]Benefits were discounted in the benefit-cost ratio at a 10 per cent rate. See section entitled Methodology for determining Benefit-Cost Ratios in previous chapter for a discussion of the discounting technique.

variance, comparisons and analyses of average public and private benefit-cost ratios between programs and between secondary and nonsecondary students in all programs follow.[1]

The public benefit-cost ratio for the air conditioning program (2.63) was significantly (p <.001) higher than for either the auto mechanics program (.71), the nursing program (.51), or the cosmetology program (.19). Similarly, the private benefit-cost ratio for the air conditioning program (1.50) was significantly (p <.001) higher than for either the auto mechanics program (.40), the nursing program (.33), or the cosmetology program (.11).

There were no significant differences in public benefit-cost ratios between either the auto mechanics program, the nursing program or the cosmetology program. Likewise, there were no significant differences in private benefit-cost ratios between these programs.

The reason for the comparatively high public and private benefit-cost ratios for the air conditioning program was because the air conditioning program had the lowest public cost, and next lowest private cost,[2] and the highest public and private benefits of the four programs. Thus, when

---

[1]See Appendixes F and H for analyses of variance of public and private benefit-cost ratios between programs and between secondary and nonsecondary students in all programs, respectively.

[2]The average private costs for the air conditioning program were only $101 more than average private costs for cosmetology, the lowest private cost program.

comparatively high benefits were combined with comparatively low costs, the results were comparatively high benefit-cost ratios.

Separate evaluations of benefits and costs, however, do not always yield such simple results. For example, the public and private costs of the nursing program were significantly higher than either the cosmetology program or the auto mechanics program. If a comparison between these three programs were based upon costs alone, the obvious choice for the worst program would have been the nursing program, since it had the highest costs. However, when benefits of these programs were joined with costs in the form of benefit-cost ratios, the resultant evaluations (based on both benefits and costs) revealed no significant differences in the public and private benefit-cost ratios for these programs. Thus, in terms of returns on investment, nursing, cosmetology, and auto mechanics did not differ significantly.

Over all programs the average public benefit-cost ratio for nonsecondary students (.85) was significantly ($p < .05$) higher than for secondary students (.60). Similarly, the average private benefit-cost ratio for nonsecondary students (.52) was significantly higher than the average private benefit-cost ratio for secondary students (.31).[1]

The higher public cost for nonsecondary students ($1838) as compared to secondary students ($1488) was more

_____

[2]There were differences in public and private benefit-cost ratios between programs, as reported in Appendix

than offset by the higher public benefits for nonsecondary
students ($1224) as compared to the public benefits for
secondary students ($940). In terms of private costs and
benefits, on the average, the higher private costs for non-
secondary students ($2485) as compared to secondary students
($2271) were also more than offset by the higher private
benefits for nonsecondary students ($1037) as compared to
secondary students ($774). Thus, in terms of economic re-
turns as measured by benefit-cost ratios, nonsecondary stu-
dents received higher returns on investment than secondary
students, both on public investment and private investment.

In terms of public investment returns, society in-
vested (public costs), on the average, a total of $1312 per
student in the air conditioning program which yielded a rate
of return of 263 per cent per year, thereby receiving a
total return on its investment in less than six months. The
following table summarizes the public investment returns for
the other programs.

Society Invested		Society Received	
		Rate of Return	Total Return on Investment
Auto Mechanics	$1342	71%	1.4 years
Practical Nursing	$2076	51%	1.9 years
Cosmetology	$1777	19%	5.2 years

Over all programs society invested (public cost), on
the average, a total of $1488 per secondary student which
yielded a rate of return of 60 per cent per year, thereby

receiving a total return on its investment in 1.7 years. For
society's average investment (public cost) of $1885 per non-
secondary student,   ry realized a rate of return on 85
per cent per year, thereby receiving a total return in 1.3
years. Thus, society's comparatively higher investment in
nonsecondary students yielded comparatively higher rates of
return, and was therefore more profitable, on the average,
than its lower investment in secondary students.

In terms of investment returns to individuals, a
student who attended the air conditioning program invested
(private cost), on the average, a total of $1983 (comprised
of foregone earnings and direct costs for tuition, books,
supplies, uniforms, and special equipment) which yielded a
rate of return of 150 per cent per year, thereby receiving a
total return on his investment in eight months. The follow-
ing summarizes student investment returns for the other pro-
grams.

Student Invested		Student Received	
		Rate of Return	Total Return on Investment
Auto Mechanics	$1884	40%	2.5 years
Practical Nursing	$2823	33%	3.0 years
Cosmetology	$2523	11%	9.0 years

Over all programs, a secondary student invested (pri-
vate cost), on the average, a total of $2271 which yielded a
rate of return of 31 per cent per year thereby receiving a
total return on his investment in 3.2 years. Similarly, a

nonsecondary student invested (private cost), on the average,
$2485 which yielded a rate of return of 52 per cent per year,
thereby receiving a total return on his investment in 1.9
years. Thus, a nonsecondary student's comparatively higher
investment in vocational education yielded comparatively
higher rates of return and therefore, on the average, was
more profitable than a secondary student's investment in
vocational education.

CHAPTER IV

A BENEFIT-COST PLANNING MODEL

Throughout this study, one of the objectives of the
author was to analyze data that will be useful to educational
decision makers and prospective vocational education stu-
dents. This chapter incorporates the procedures and data
used in the computation of the economic return indicators of
vocational education programs--benefit-cost ratios--into a
model for simulating and projecting the economic returns of
vocational education programs.

While the evaluation methodology was oriented toward
what had actually occurred in the past--ex post evaluation--
the model presented in this chapter is oriented toward the
future--ex ante evaluation. Since ex ante evaluations are
usually based upon ex post data and evaluations, the evalua-
tion methodology presented in Chapter II, and the results
of the analysis from Chapter III serve as input to the
benefit-cost planning model.

Figure 3 on the following page illustrates the flow
chart design of a benefit-cost planning model for projecting
the benefit-cost ratios of vocational education programs.

Historical data on program benefits, costs, benefit-
cost ratios, and student socio-demographic characteristics
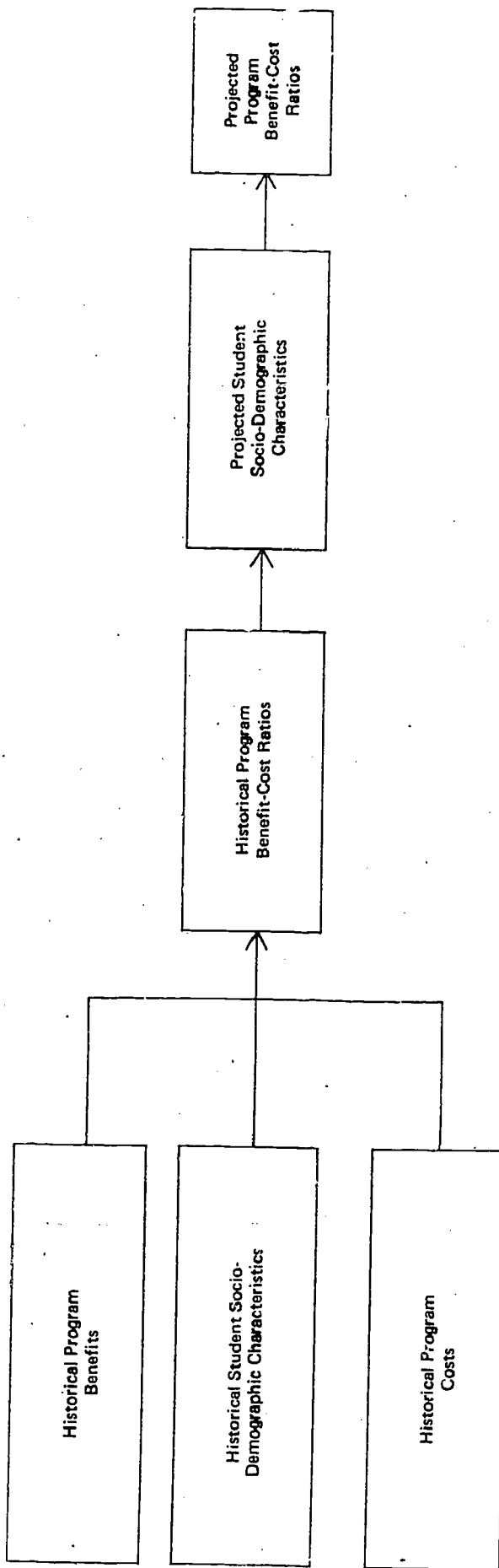
FIGURE 3

A BENEFIT-COST PLANNING MODEL

may be determined by using the algorithms presented in
Chapter II and analyzed in Chapter III. Estimated student
socio-demographic characteristics can be obtained from ad-
ministering the questionnaire used in this study to prospec-
tive vocational education students[1] or by extrapolating from
past trend data.

When the projected socio-demographic characteristics
for a group of students are combined in a mathematical for-
mula which has been derived for a particular vocational edu-
cation program, the results can indicate the projected
economic returns of that program, measured in terms of the
benefit-cost ratio.

One statistical technique for projection purposes
is multiple linear regression. The basic form of the equa-
tion for multiple linear regression is:

$$(1) \quad Y = a + b_1X_1 + b_2X_2 + \ldots b_nX_n$$

where:

Y represents the dependent variable (benefit-cost
ratio);

a represents the value of Y when all X = 0 (inter-
cept term);

b represents the regression coefficient or the amount
by which the value of Y changes with one unit
change in X; and

X represents the unit measure of the change in Y.

---

[1]The questionnaire must be modified for projection
purposes, since prospective students will not know their
future employment patterns nor their salaries. Thus, those
items must be deleted for projection purposes.

Thus, the multiple regression equation can utilize historical or trend data on the relationship between student socio-demographic variables and benefit-cost ratios in order to project the dependent variable (benefit-cost ratio) into the future.

Table 13 is a summary of the socio-demographic variables which were significantly related to the private benefit-cost ratio in each of the four programs.[1] For illustration purposes the significant variables in Table 13 for the nursing program are entered into the equation discussed below.

As shown in summary Table 13, ex post evaluation data revealed that the following socio-demographic (independent) variables were significantly associated with the private benefit-cost ratio for students who attended the nursing program. Those variables were: region of Florida where a student attended the program and where he was employed; relation of employment to vocational training (relatedness index); amount of involuntary unemployment; number of children; and high school level completed.

As a practical example of the prediction equation, assume that a group of nursing students will have the following socio-demographic characteristics which are significant to the regression equation: trained and employed in southeast Florida; 1.5 relatedness index; 3 children; completed

[1]The complete multiple regression analysis for private benefit-cost ratios appears in Appendix M.

TABLE 13

SUMMARY OF MULTIPLE REGRESSION ANALYSES OF SOCIO-
DEMOGRAPHIC EFFECTS ON PRIVATE BENEFIT-COST
RATIOS FOR EACH PROGRAM

Socio-Demographic Variables	Programs			
	Auto Mechanics	Air Conditioning	Practical Nursing	Cosmetology
Region	SR^c	SR^a	SR^a	NSR
Relatedness Index	NSR	SR^d	SR^c	NSR
Additional Related Training	SR^b	NSR	NSR	SR^c
Race	SR^d	SR^d	NSR	NSR
Secondary Student	SR^a	NSR	NSR	SR^a
Father Lived with Family	SR^a	SR^b	NSR	NSR
Father's Annual Income	SR^a	SR^c	NSR	SR^c
Hours of Attendance	NSR	NSR	SR^a	NSR
Involuntary Unemployment	NSR	NSR	SR^a	NSR
Age	NSR	NSR	NSR	SR^b
Number of Children	NSR	NSR	NSR	SR^b
High School Grade Point Average	SR^a	NSR	NSR	NSR
High School Level Completed	NSR	NSR	SR^b	NSR
Father's Education	NSR	SR^c	NSR	NSR
Mother's Education	SR^c	SR^b	NSR	NSR

SR = Significantly Related

NSR = Not Significantly Related

[a] Significant at .001 level.

[b] Significant at .01 level.

[c] Significant at .05 level.

[d] Significant at .10 level.

4 years of high school; and attended the nursing program for 1200 hours.

When the values for these socio-demographic charac-teristics (independent variables) are inserted into the regression equation, it provides a projection of the privat.benefit-cost ratio (dependent variable) for the nursing pro-gram as follows:

$$(2) \quad Y = -1.21 + (-.28)(1) + (.25)(1.5) + (-.05)(3) +$$
$$(.16)(4) + (.001)(1200)$$

$$Y = .57.$$

The projected average private benefit-cost ratio for these students in the nursing program is .57. In other words, students with the assumed socio-demographic character-istics will, on the average, realize a rate of return of 57 per cent on their investment in the nursing program.

While the above regression equation illustrates the use of the model for projecting private benefit-cost ratios, the benefit-cost planning model also can be used for project-ing public benefit-cost ratios for vocational education pro-grams. Substituting historical public benefits, costs, and benefit-cost ratios for private benefits, costs, and benefit-cost ratios will enable projection of public benefit-cost ratios.

The projection equation as illustrated is only for the nursing program and the set of data assumed above. As the program and data change so will the projection equation.

The reader must also recognize that actual private benefit-cost ratios may differ from that which was projected as a result of factors separate from different student socio-demographic characteristics. The actual private benefit-cost ratio may be more or less than the projected one due to un-predictable effects of cyclical and/or irregular forces. For example, changes in labor market conditions or educational technology which reduce the amount of time in a program and thus costs, are difficult to predict, but will affect the actual private benefit-cost ratio in the future.

CHAPTER V

SUMMARY AND CONCLUSIONS

With increasing demands being placed upon educational funders and education decision makers regarding the efficient allocation of public resources, and the problems of educational choice which confront students regarding the allocation of one of their most valuable resources--time, the need for evaluation and planning of educational programs is patent. Intrinsic to the educational evaluation and planning process is the need to link educational costs (public investment of tax dollars, and students' investment of time and money) with educational benefits (public and student economic returns).

When costs are joined with benefits, the resultant figure, a benefit-cost ratio, provides evaluative indications of the historical economic success of vocational education programs. In addition, data generated in the calculation of historical benefit-cost ratios can also serve as input for planning purposes by providing mathematical formulae for projecting returns on investment in vocational education programs into the future.

This statewide study compared and analyzed the benefits, costs, and benefit-cost ratios of students who attended

selected vocational education programs in Florida. Incorporating existing program cost data with data collected by means of student follow-up questionnaires, this study consisted of four principal phases.

The first phase was concerned with selection of programs and classification of study participants. Vocational education programs located at area vocational centers in four designated geographical regions of Florida were selected. These programs were: (1) auto mechanics, (2) air conditioning and refrigeration, (3) practical nursing, and (4) cosmetology. Study participants were classified in terms of (1) graduates, (2) early leavers (those who left the vocational program before normal graduation time), (3) students who attended vocational education while enrolled in day high school (secondary students), and (4) students who attended vocational education while not enrolled in day high school (nonsecondary students).

The second phase was concerned with developing methodologies for determining program benefits, costs, and benefit-cost ratios. Criteria and algorithms for measuring benefits relative to labor market performance were developed. Costs were determined by algorithms based upon a student's length of time in attendance in a given program. Benefits were then linked to costs in the form of discounted benefit-cost ratios. The discounted benefit-cost ratio was a number which indicated the percentage rate of return on investment in each vocational education program.

The third phase was concerned with an historical evaluation. Historical benefit-cost profiles for each vocational education program and for secondary and nonsecondary students in all programs were constructed. Then the benefit-cost profiles were analyzed and compared between vocational programs and between secondary and nonsecondary students.

The fourth phase incorporated the procedures and data used in the historical evaluation of the economic returns from vocational-education programs into a benefit-cost planning model.

The most cogent findings and conclusions of this study were as follows:

1. The benefit-cost profiles which were constructed indicated that rates of return from investment in each of the four selected vocational education programs were positive and significant. The average rate of return was 76 per cent per year on investment of public tax dollars and 54 per cent per year on investment of students' time and money. In other words, on the average, society will recoup its average investment of $1716 per student in 1.3 years, and, on the average, a student will recoup his average investment of $2411 in 1.9 years.

    These findings suggest that promotion and expansion of vocational education in Florida would be a wise economic investment.

2. There were statistically significant differences in the rates of return on investment between the air

conditioning program, and either the auto mechanics, practical nursing, or cosmetology programs. Between the latter three programs, however, there were no statistically significant differences in rates of return on investment.

These findings suggest that an optimal allocation of resources between these four programs should be more heavily weighted toward the air conditioning program.

3. There were statistically significant differences in rates of return on investment between secondary and nonsecondary students. On both public and student investments, nonsecondary students had higher rates of return than did secondary students.

This finding suggests that, in economic terms, vocational education is more profitable at the nonsecondary level than at the secondary level.

4. On the average, student costs ($2411) of vocational education are greater than public costs ($1716). On the average, student costs represented about 60 per cent of the total cost of education.

In order to provide students with information necessary for allocating their resources, it is suggested that summaries of studies such as this be provided to students and guidance counselors.

5. The methodology which was developed in this study proved

effective in conducting a benefit-cost study of voca-
tional education programs in Florida.

This methodology could be used in several ways in addi-
tion to studies of this kind. For example, it could be
used (1) to contrast the economic efficiency between
vocational education programs offered in the public sec-
tor and those offered in the private sector, and/or
(2) to contrast the economic efficiency of discreet com-
ponents of individual programs, such as alignment and
wheel balance, power train, and engine rebuild in an auto
mechanics program.

6. A benefit-cost planning model was developed which proved
effective for projecting rates of return on investment
in vocational education into the future.

An educational planner or student contemplating enrolling
in vocational education could use the benefit-cost plan-
ning model to assist in the allocation of resources in
order to maximize public and student benefits.

APPENDIX A

FOLLOW-UP QUESTIONNAIRE

1. What was the name of the vocational-technical education program you took and vocational school you attended?
Program _____ School _____

2. About how many hours of study did you complete? _____ hours   Date started: Month _____ Year_____
Date completed: Month _____ Year_____

3. Have you had *related* working experience prior to completion of your training listed in number (1) above? Yes _____ No _____ If YES: How many weeks of experience have you had? _____ weeks

4. While taking the training in number (1) above, were you employed either full-time or part-time? Yes _____ No _____
If YES: On the average how many hours per week did you work? _____ Hours

5. Since completion, have you had any *additional* formal vocational-technical training? Yes _____ No _____ If YES: Was it in the same field as your training listed in number (1) above? Yes _____ No _____ How long was it? _____ Hours

6. Since completion, have you attended a community college or a four year college or university for any period of time? Yes _____ No _____

7. Since completion, have you been on active duty in the military for three months or longer? Yes _____ No _____ If YES: When did you go on active duty? Month _____ Year _____ When were you discharged? Month _____ Year _____

8. Since completion, have you held a job for one month or longer? Yes _____ No _____ If YES: Starting with your present or most recent job and working down to your first job after completion of vocational training, please answer below. Again, this information is strictly confidential.

	What is (was) this job called?	Starting Date	Ending Date	Weekly salary before taxes & deduction*	Average No. of hours per week worked	Is (was) this job related to your vocational training program?	Location of job
Present or Most Recent Job		Month Year	Month Year	___ Up to $25 ___ 26-50 ___ 51-75 ___ 76-100 ___ 101-125 ___ 126-150 ___ 151 or over	___ hours	__ Very related __ Related __ Unrelated	City State
Next Most Recent Job		Month Year	Month Year	___ Up to $25 ___ 26-50 ___ 51-75 ___ 76-100 ___ 101-125 ___ 126-150 ___ 151 or over	___ hours	__ Very related __ Related __ Unrelated	City State
Next Job		Month Year	Month Year	___ Up to $25 ___ 26-50 ___ 51-75 ___ 76-100 ___ 101-125 ___ 126-150 ___ 151 or over	___ hours	__ Very related __ Related __ Unrelated	City State
Next Job		Month Year	Month Year	___ Up to $25 ___ 26-50 ___ 51-75 ___ 76-100 ___ 101-125 ___ 126-150 ___ 151 or over	___ hours	__ Very related __ Related __ Unrelated	City State

*Present weekly salary or weekly salary when you *left* job.

[1]Portions of this questionnaire were adapted from Kaufman, *et al.*, *Cost-Effectiveness*, pp. 239-46.

APPENDIX A.--(Continued)

9. Since your completion, have you been involuntarily unemployed for one month or longer? Yes _____ No _____ If YES: How many months? _____ months

10. Are you: _____ Male   Are you: _____ Single
    _____ Female   _____ Married
    _____ Separated, Divorced or Widowed

What is your age? _____   Are you: _____ White
    _____ Black
    _____ Other

How many children do you have? _____

11. What was your overall grade point average in high school? _____

12. Were you enrolled in day high school when you took the vocational training in (1h) above? Yes _____ No _____

13. What is the highest year of high school you completed? _____

14. Did your father live with your family for the majority of your elementary and high school years? Yes _____ No _____ If YES: What was the highest year of school your father completed? _____ year

15. What is your father's annual income?
    ___ Up to $4,000   ___ 7,001-8,000
    ___ 4,001-5,000   ___ 8,001-9,000
    ___ 5,001-6,000   ___ 9,001-10,000
    ___ 6,001-7,000   ___ 10,001 or over

16. What was the highest year of school your mother completed? _____

Please detach questionnaire, place in self addressed postage paid envelope and mail.
Thank you for your cooperation.

APPENDIX B

THE FLORIDA STATE UNIVERSITY

STUDY GROUP FOR FLORIDA STATE-WIDE
EVALUATION OF VOCATIONAL-TECHNICAL EDUCATION

TALLAHASSEE, FLORIDA

Dear Former Vocational-Technical Education Student:

In order to improve vocational-technical education in Florida, a statistical study is being conducted by means of the attached questionnaire. Through your cooperation in filling out. detaching, and mailing back the questionnaire in the enclosed, addressed and stamped envelope, a research study is being conducted that will enable Florida vocational schools to better serve the needs of their students.

Your name is NOT wanted. All of the information collected will be combined and none of your information will ever be divulged.

Thank you very much for your cooperation.

APPENDIX C

WAGE RATES FOR UNSKILLED WORKERS IN FLORIDA BY REGION

	Lowest Prevailing Wage Rate	Mid-Points	Highest Prevailing Wage Rate
Northwest and North Florida			
Ft. Walton	$1.60	$1.80	$2.00
Gainesville	1.25	1.95	2.65
Lake City	1.40	1.81	2.23
Marianna	1.40	1.62	1.85
Perry	1.60	1.80	2.00
Tallahassee	1.00	1.65	2.30
Mean		1.77	
Central Florida			
Daytona	1.30	2.07	2.85
Lakeland	1.20	1.82	2.50
Leesburg	1.68	1.92	2.25
Ocala	1.60	1.67	1.75
Orlando	1.45	1.60	1.75
Sanford	1.40	1.55	1.70
Mean		1.78	
Southwest Florida			
Bradenton	1.50	1.95	2.40
Clearwater	1.60	2.35	3.10
Ft. Myers	1.40	2.20	3.00
Sarasota	1.60	1.80	2.00
St. Petersburg	1.60	2.05	2.50
Tampa	1.40	2.70	4.00
Winter Haven	1.60	2.06	2.52
Mean		2.16	
Southeast Florida			
Ft. Lauderdale	1.45	2.40	3.35
Ft. Pierce	1.25	2.16	3.07
Hollywood	1.50	1.75	2.00
Key West	1.25	1.87	2.50
Miami	1.45	2.40	3.35
West Palm Beach	1.45	2.06	2.52
Mean		2.17	

Source: Florida Department of Commerce, "Survey of Wage Rates for Unskilled Workers in Florida" (unpublished study, Tallahassee, Florida: 1970).

APPENDIX D

AVERAGE PUBLIC COSTS PER FULL-TIME EQUIVALENT (FTE)
(ONE FTE EQUALS 810 STUDENT HOURS OF ATTENDANCE)

Region[a]	Year	Auto Mechanics	Air-Conditioning	Nursing	Cos-metology
North Florida	1968-69	$1112[b]	$	$1326	$1302
	1969-70	1178[c]		1405	1379
	1970-71	1219[d]		1454	1428
Central Florida	1968-69	1047	1038	1219	1391
	1969-70	1109	1100	1291	1474
	1970-71	1148	1139	1336	1526
Southwest Florida	1968-69	1051	1106	968	1050
	1969-70	1113	1172	1025	1112
	1970-71	1152	1213	1061	1151
Southeast Florida	1968-69	1077	806	938	808
	1969-70	1135	854	994	856
	1970-71	1175	884	1029	886

[a]Inter-regional differences in program public costs per FTE
primarily were due to (1) inter-retional price differentials of teacher
salaries and costs of equipment, supplies, etc., and (2) different
program utilization rates as measured by the ratio of the capacity num-
ber of student hours of attendance to the actual number of student
hours of attendance.

[b]1969-70 figure reduced by 3.4 per cent, tne implicit price
deflator used in the calculation of GNP. Source of implicit price de-
flator: U.S. Department of Commerce, Business Conditions Digest
(Washington, D.C.: Government Printing Office, 1972), p. 216.

[c]1970-71 figure reduced by 3.4 per cent, the implicit price
deflator used in the calculation of GNP.

[d]Weighted average of all such courses at area vocational cen-
ters included in the study. Figure included social operating cos's and
costs accruing from investments in fixed assets. This figure was de-
rived from working papers for the Associated Consultant's repor Cur-
rent Operating Costs, 1970-71, Florida Area Vocational/Technical Centers.

Source: Associated Consultants in Education, Inc. Current Operat-
ing Costs, 1970-71, Florida Area Vocational/Technical Cen-
ters (Tallahassee, Florida: 1972).

APPENDIX E

PRIVATE DIRECT COSTS PER FULL-TIME EQUIVALENT (FTE)
(ONE FTE EQUALS 810 STUDENT HOURS OF ATTENDANCE)

Region	Year	Auto Mechanics	Air-Conditioning	Nursing	Cos-metology
North Florida	1968-69	$58^a		$108	$51
	1969-70	61^b		114	54
	1970-71	63^c		118	56
Central Florida	1968-69	51	46	60	82
	1969-70	54	49	64	87
	1970-71	56	51	66	90
Southwest Florida	1968-69	43	74	87	69
	1969-70	46	78	92	73
	1970-71	48	81	95	76
Southeast Florida	1968-69	32	39	68	49
	1969-70	34	41	72	52
	1970-71	35	42	75	54

[a]1969-70 figure reduced by 5.6 per cent, the implicit price deflator used in the calculation of GNP. Source of implicit price deflator: U.S. Department of Commerce, Business Conditions D..est (Washington, D.C.: Government Printing Office, 1972), p. 216.

[b]1970-71 figure reduced by 3.4 per cent, the implicit price deflator used in the calculation of GNP.

[c]Cost figures furnished by institutional administrators at selected area vocational centers.

Source: Institutional administrators at selected area vocation... centers. Costs include student costs for tuition, books, supplies, uniforms, and special equipment. Costs figures were inflated by a factor of 1.06 in order to impute opportunity costs. Costs are an average of the selected programs within a region, weighted according to the number of student hours of attendance.

APPENDIX F

ANALYSES OF VARIANCE OF MEANS OF INDEPENDENT AND DEPENDENT VARIABLES BETWEEN PROGRAMS[1]

	Auto Mechanics		Air Conditioning		Practical Nursing		Cosmetology		F-Ratio
	$\bar{X}$	(S)	$\bar{X}$	(S)	$\bar{X}$	(S)	X	(S)	
Independent Variables									
Hours of Attendance	923.82	(350.76)	963.59	(330.96)	1378.89	(193.15)	1219.87	(95.97)	61.27[a]
Age	21.05	(4.28)	29.37	(10.90)	33.33	(11.36)	22.45	(5.15)	39.53[a]
High School Grade Point Average	2.39	(.37)	2.54	(.43)	2.59	(.48)	2.5.	(.43)	2.87[c]
Father's Education[2]	10.98	(4.72)	10.44	(4.52)	10.40	(4.12)	10.65	(4.86)	1.42
Mother's Education	11.87	(2.04)	10.65	(2.38)	10.21	(3.17)	10.80	(2.29)	5.35[b]
Public Cost	$1342.00	(524.00)	1312.00	(487.00)	2076.00	(430.00)	1777.00	(453.00)	45.21[a]
Private Cost	$1884.00	(683.00)	1983.00	(694.00)	2823.00	(471.00)	2524.00	(284.00)	55.55[a]
Dependent Variables									
Relatedness Index	1.60	(.45)	1.68	(.46)	1.92	(.26)	1.95	(.20)	20.81[a]
Involuntary Unemployment (months)	.58	(1.34)	.17	(.57)	.87	(2.40)	.26	(1.02)	3.17[c]
Public Benefit	$ 987.00	(1348.00)	2646.00	(1653.00)	1252.00	(963.00)	393.00	(1181.00)	35.65[a]
Private Benefit	$ 816.00	(1113.00)	2230.00	(1400.00)	1056.00	(831.00)	333.00	(994.00)	35.61[a]
Public Benefit-Cost Ratio[3]	.71	(1.70)	2.63	(3.34)	.51	(.52)	.19	(.76)	26.08[a]
Private Benefit-Cost Ratio[3]	.40	(.67)	1.50	(1.93)	.33	(.37)	.11	(.31)	27.09[d]
Number of Observations	62		46		99		101		

[1] This table analyzes differences in means between all programs. The test on the following page entitled Scheffe's Multiple Range Test for Differences between Program Means, reports significant differences between pairs of programs.

[2] Number of observations for Father's Education for each program is 32, 55, 74, and 85, respectively.

[3] Discounted at 10 per cent rate.

[a] Significant at .001 level.

[b] Significant at .01 level.

[c] Significant at .05 level.

[d] Significant at .10 level.

$\bar{X}$ = group means.

(S) = Standard deviations.

APPENDIX F.--(Continued)

SCHEFFE'S MULTIPLE RANGE TEST FOR DETERMINING DIFFERENCES
OF MEANS OF INDEPENDENT AND DEPENDENT VARIABLES
BETWEEN PAIRS OF PROGRAMS[1]

Variable		F-Ratio
Independent Variables		
Hours of Study	3 is greater than 1^a	141.11
	4 is greater than 1^a	60.19
	3 is greater than 2^a	96.73
	4 is greater than 2^a	37.10
	3 is greater than 4^a	22.59
Age	2 is greater than 1^a	25.41
	3 is greater than 1^a	79.25
	3 is greater than 4^a	81.44
Mother's Education	1 is greater than 3^b	16.69
Social Cost	3 is greater than 1^a	93.60
	4 is greater than 1^a	33.48
	3 is greater than 2^a	84.43
	4 is greater than 2^a	31.47
	3 is greater than 4^a	20.58
Private Cost	3 is greater than 1^a	127.99
	4 is greater than 1^a	67.35
	3 is greater than 2^a	84.38
	4 is greater than 2^a	35.22
	3 is greater than 4^a	17.02
Dependent Variables		
Relatedness Index	3 is greater than 1^-	37.05
	4 is greater than 1^a	44.78
	3 is greater than 2^b	18.88
	4 is greater than 2^a	21.97
Involuntary Unemployment (months)	3 is greater than 2^b	14.18
	3 is greater than 4^d	7.15
Social Benefit	2 is greater than 1^a	47.62
	1 is greater than 4^d	8.88
	2 is greater than 3^a	39.99
	2 is greater than 4^a	105.12
	3 is greater than 4^a	24.17
Private Benefit	2 is greater than 1^a	48.61
	2 is greater than 3^a	39.86
	2 is greater than 4^a	104.72
	3 is greater than 4^a	24.06
Social Benefit-Cost Ratio	2 is greater than 1^a	36.39
	2 is greater than 3^a	51.92
	2 is greater than 4^a	72.06
Private Benefit-Cost Ratio	2 is greater than 1^a	40.55
	2 is greater than 3^a	54.58
	2 is greater than 4^a	77.00

[1]Numbers 1 - 4 refer to programs as follows: 1 = auto mechanics; 2 = air conditioning and refrigeration; 3 = practical nursing; 4 = cosmetology.

[a]Significant at .001 level.

[b]Significant at .01 level.

[c]Significant at .05 level.

APPENDIX G

CHI SQUARE ANALYSIS			INDEPENDENT VARIABLES BETWEEN PROGRAMS		
	...anics	Air- Conditioning	Practical Nursing	Cosmetology	chi Square
Regions					
North Florida	12.9%	0.0%	23.2%	18.8%	31.84[a]
Central Florida	25.8	45.7	22.2	18.8	df = 9
Southwest Florida	33.9	26.1	26.3	16.8	
Southeast Florida	27.4	28.3	28.3	45.5	
Related Working Experience					
Yes	56.5	50.0	54.5	21.8	29.32[a]
No	43.5	50.0	45.5	78.2	df = 3
Additional Training					
Yes	17.7	15.2	22.2	6.9	9.43[b]
No	82.3	84.8	77.8	93.1	df = 3
Employed During Training					
Yes	72.6	69.6	26.3	46.0	42.41[a]
No	27.4	30.4	73.7	54.0	df = 3
Military Service					
Yes	11.3	8.7	0.0	0.0	
No	88.7	91.3	100.0	100.0	
Marital Status					
Single	77.4	32.6	17.2	32.7	61.55[a]
Married, Separated, Widowed, or Divorced	22.6	67.4	82.8	67.3	df = 3
Race					
White	88.7	91.3	81.8	93.1	6.67[d]
Nonwhite	11.3	8.7	18.2	6.9	df = 3
Level of Student					
Secondary Student	60.7	34.8	9.1	44.6	51.01[a]
Non-secondary Student	39.3	65.2	90.9	55.4	df = 3
High School Level Completed					
1-3 yrs.	12.9	6.5	7.1	7.9	2.09
4 yrs.	87.1	93.5	92.9	92.1	df = 3
Father's Annual Income					
Up to $6,000	13.5	17.9	17.5	10.8	4.54
6,001 - 8,000	30.8	21.4	20.0	27.7	df = 9
8,001 - 10,000	23.1	21.4	22.5	30.1	
10,001 or above	32.7	39.3	40.0	31.3	

[a]Significant at .001 level.

[b]Significant at .01 level.

[c]Significant at .05 level.

[d]Significant at .10 level.

df = degrees of freedom.

APPENDIX H

ANALYSES OF VARIANCE OF MEANS OF INDEPENDENT AND DEPENDENT VARIABLES BETWEEN SECONDARY AND NONSECONDARY STUDENTS[1]

	Auto Mechanics		Air-Conditioning		Cosmetology		All Programs Combined	
	Mean	F-Ratio	Mean	F-Ratio	Mean	F-Ratio	Mean	F-Ratio
Independent Variables								
Hours of Attendance								
Secondary	915	.06	979	.05	1195	5.87	1073	19.74[a]
Nonsecondary	937		956		1240		1227	
Public Cost ($)								
Secondary	1315	.24	1297	.02	1612	12.01[a]	1488	30.01[a]
Nonsecondary	1381		1320		1911		1838	
Private Cost ($)								
Secondary	1898	.04	2149	1.42	2555	1.00	2271	8.10[b]
Nonsecondary	1864		1894		2499		2485	
Dependent Variables								
Relatedness Index								
Secondary	1.65	.91	1.53	2.53[d]	1.94	.39	1.77	4.70[b]
Nonsecondary	1.54		1.76		1.96		1.86	
Public Benefit ($)								
Secondary	1244	3.47[c]	1931	5.01[c]	333	.21	940	2.76[c]
Nonsecondary	607		3027		441		1224	
Private Benefit ($)								
Secondary	1028	3.48[c]	1602	5.41[b]	273	.29	774	3.37[c]
Nonsecondary	502		2565		381		1037	
Public Benefit-Cost Ratio[2]								
Secondary	.80	.20	1.64	2.25	.19	.00	.60	2.86[c]
Nonsecondary	.60		3.16		.19		.85	
Private Benefit-Cost Ratio								
Secondary	.50	.25	.90	3.27[c]	.09	.83	.35	2.98[c]
Nonsecondary	.39		2.01		.16		.58	
Number of Observations								
Secondary	37		16		45		107	
Nonsecondary	25		30		56		201	
Degrees of Freedom	2,60		2,44		2,99		2,306	

[1]The practical nursing program was omitted from a separate analysis because of the relatively small proportion of secondary students. Nine out of ninety-nine students were secondary students.

[2]Discounted at 10 per cent rate.

[a]Significant at .001 level.

[b]Significant at .01 level.

[c]Significant at .05 level.

[d]Significant at .10 level.

APPENDIX I

MULTIPLE REGRESSION ANALYSES OF SOCIO-DEMOGRAPHIC EFFECTS ON PUBLIC BENEFITS FOR EACH PROGRAM

	Auto Mechanics		Air Conditioning		Practical Nursing		Cosmetology	
	b^1	$(s)^2$	b	(s)	b	(s)	b	(s)
Regions								
North Florida								
Central Florida	379.60	(304.65)	707.30[b]	(499.98)				
Southwest Flo			-1338.22[b]	(502.36)	-724.44[a]	(177.56)		
Southeast Florida								
Related Working Experience								
Relatedness Index	555.25[b]	(302.87)	-656.34	(482.97)	384.99	(291.03)	761.20	(588.91)
Additional Training	1123.63[b]	(337.44)	429.76[c]	(291.63)				
Additional Related Training			-4232.58[c]	(1958.86)			-532.49[c]	(261.97)
Race								
White	1446.75[b]	(470.95)	2529.72[b]	(889.40)				
Nonwhite[3]								
Secondary Student	730.48[b]	(268.37)						
Father Lived with Family							480.89[d]	(252.22)
Marital Status								
Single			-700.29	(458.91)				
Married								
Separated, Widowed, or Divorced3							482.46[c]	(242.96)
Father's Annual Income Data	-981.03[c]	(381.12)						
Father's Annual Income								
Up to $4,000[3]								
4,001 to 5,000								
5,001 to 6,000			-2466.41	(1481.43)				
6,001 to 7,000	-506.38	(404.34)						
7,001 to 8,000			-1014.47	(684.49)				
8,001 to 9,000	780.15[d]	(399.98)						
9,001 to 10,000			-1132.18	(998.85)			925.76[c]	(362.77)
10,000 or Above	1233.66[b]	(358.96)					678.17[d]	(351.93)
Hours of Attendance	1.68[a]	(.42)					500.23	(315.63)
Employed During Training								
Involuntary Unemployment					301.42[a]	(195.62)	275.20	(211.40)
Age					-197.04[a]	(32.16)		
Number of Children							148.26[a]	((42.22)
High School Grade Point Average			1877.28[a]	(460.01)	218.06	(159.98)	-26.11[d]	(162.75)
High School Level Completed							472.13[d]	(256.68)
Father's Education			64.56	(51.20)				
Mother's Education	63.76	(72.93)						
Number of Observations	62		46		99		101	
Coefficient of Determination	.60		.61		.64		.63	
Mean of Dependent Variable	987	(1347)	2646	(1653)	1252	(963)	393	(1181)
Intercept Term	-3684.30		-3724.01		-213.08		-6573.61	

[a] Significant at .001 level.

[b] Significant at .01 level.

[c] Significant at .05 level.

[d] Significant at .10 level.

[1] b is the regression coefficient.

[2] (s) is the standard error of the regression coefficient.

[3] This regressor of the variable enters into the intercept term. The other regressors of the variable are interpreted as deviations from this regressor.

APPENDIX J

MULTIPLE REGRESSION ANALYSES OF SOCIO-DEMOGRAPHIC EFFECTS ON PRIVATE BENEFITS FOR EACH PROGRAM

	Auto Mechanics		Air-Conditioning		Practical Nursing		Cosmetology	
	b^1	$(S)^2$	b	(S)	b	(S)	b	(S)
Regions								
North Flori...								
...	308.74	(251.90)	404.72[c]	(407.17)	-213.48	(165.62)		
...east Florida[3]			-979.67[c]	(423.69)	-806.96[a]	(163.57)		
Related Working Experience								
Relatedness Index	467.73	(250.43)	705.18[d]	(397.23)			811.75[d]	(490.00)
Additional Training	937.12	(279.01)	2504.12	(1274.83)	-244.72	(138.02)		
Additional Related Training			-1389.44	(1215.31)			-341.01[c]	(150.79)
Race								
White	1209.49[a]	(389.40)	2014.13[b]	(746.13)				
Nonwhite[3]								
Secondary Student	604.89	(221.90)					416.12[d]	(209.86)
Marital Status								
Single			-618.46	(387.50)				
Married					-225.00	(144.38)	394.60[d]	(202.16)
Separated, Widowed or Divorced[3]								
Father's Annual Income Data	-823.88[b]	(315.13)						
Father's Annual Income								
Up to $4,000[3]								
4,001 - 5,000								
5,001 - 6,000								
6,001 - 7,000	-413.27	(334.32)			-427.94	(345.50)		
7,001 - 8,000								
8,001 - 9,000	656.96[d]	(330.72)					773.64[c]	(301.84)
9,001 - 10,000							541.11	(292.82)
10,001 or above	1029.29[a]	(296.80)					417.50	(262.62)
Hours of Attendance	1.40[a]	(.35)			.60[d]	(.35)		
Employed During Training					219.14	(155.83)	229.39	(175.90)
Involuntary Unemployment			-525.84[d]	(282.96)	-173.62[a]	(28.90)		
Age					17.95[c]	(7.64)	127.87[a]	(35.13)
Number of Children					-58.15	(45.10)	-212.67	(135.42)
High School Grade Point Average			1447.59[a]	(367.16)	185.18	(137.26)	380.63	(215.23)
High School Level Completed								
Father's Education			55.09	(41.90)				
Mother's Education	47.32	(60.30)						
Number of Observations	62		46		99		101	
Coefficient of Determination	.60		.59		.51		.54	
Mean of the Dependent Variable	816	(1112)	2230	(1400)	1056	(831)	333	(994)
Intercept term	-3008.92		-2430.63		-492.56		-5885.36	

[a] Significant at .001 level.

[b] Significant at .01 level.

[c] Significant at .05 level.

[d] Significant at .10 level.

[1] b is the regression coefficient.

[2] (S) is the standard error of the regression coefficient.

[3] This regressor of the variable enters into the intercept term. The other regressors of the variable are interpreted as deviations from this regressor.

APPENDIX K

MULTIPLE REGRESSION ANALYSES OF SOCIO-DEMOGRAPHIC EFFECTS ON
HOURS OF ATTENDANCE FOR EACH PROGRAM

	Auto Mechanics		Air Conditioning		Practical Nursing		Cosmetology	
	b^1	$(S)^2$	b	(S)	b	(S)	b	(S)
Regions								
North Florida								
Central Florida								33.41^d	(20.04)
Southwest Florida$_3$			-124.64	(92.65)				
Southeast Florida^3								
Race								
White $_3$	-397.14^b	(126.83)						
Nonwhite^3							-55.50^d	(30.91)
Secondary Student					-98.11	(65.87)	-25.37	(15.98)
Father Lived with Family								
Marital Status								
Single	-319.54^b	(117.82)	-297.94^b	(111.37)				
Married					75.95^d	(40.52)		—
Separated, Widowed,								
or Divorced^3								
Father's Annual Income Data								
Father's Annual Income								
Up to $4,000^3								
4,001 - 5,000	-200.41	(154.93)	-364.19^d	(205.93)			-419.35^a	(56.54)
5,001 - 6,000			-236.94	(199.81)				
6,001 - 7,000					159.92	(104.44)		
7,001 - 8,000								
8,001 - 9,000	-267.53^d	(141.43)						
9,001 - 10,000			-313.33	(193.48)	209.50^d	(108.89)		
10,001 or Above	-427.72^a	(114.03)					27.45	(21.30)
Employed During Training								
Age	17.82	(13.47)	-18.19^a	(4.80)				
Number of Children	-195.91	(114.04)			-19.35	(12.39)		
High School Grade Pt. Average	133.08	(125.94)	102.98	(96.38)				
High School Level Completed								
Father's Education	32.29^a	(8.74)						
Mother's Education	44.39^c	(20.47)	56.38^b	(17.98)				
Related Working Experience								
Number of Observations	62		46		99		101	
Coefficient of Determination	.43		.51		.15		.42	
Mean of Dependent Variable	924	(351)	964	(331)	1379	(193)	1220	(96)
Intercept Term	177.12		804.90		1361.00		1280.77	

[a]Significant at .001 level.

[b]Significant at .01 level.

[c]Significant at .05 level.

[d]Significant at .10 level.

[1]b is the regression coefficient.

[2](S) is the standard error of the regression coefficient.

[3]This regressor of the variable enters into the intercept term. The other regressors
of the variable are interpreted as deviations from this regressor.

APPENDIX L

A DISCUSSION AND CORRELATION ANALYSIS OF THE RELATIONSHIP BETWEEN COSTS AND BENEFITS

The relationship between public costs and public benefits, and the relationship between private costs and private benefits were analyzed by means of simple correlation. If significant relationships existed, then it may have been possible to project public and private benefits on the basis of costs.

However, as seen in the following table, the correlations between either public costs and public benefits, or between private costs and private benefits were significant in only one case; for the auto mechanics program, private costs were significantly ($p < .05$) related to private benefits.

The nonsignificant correlations between costs and benefits in the vast majority (seven out of eight correlations) of cases suggests that knowledge about the costs of vocational education does little good relative to determining corresponding benefits. This supports the thesis that evaluation based upon costs alone is a rather weak form of evaluation, since costs were not significantly related to benefits.

APPENDIX L.--(Continued)

CORRELATION ANALYSIS BETWEEN PUBLIC COSTS AND
PUBLIC BENEFITS AND BETWEEN PRIVATE COSTS
AND PRIVATE BENEFITS FOR EACH PROGRAM

	Programs			
Correlation Between	Auto Mechanics N = 62	Air Condi-tioning N = 46	Practical Nursing N = 99	Cosmet-ology N = 101
Public Costs and Public Benefits	.186	.040	.194	-.127
Private Costs and Private Benefits	.271^c	.043	-.167	.022
Degrees of Freedom	60	44	97	99

[a]Significant at .001 level.

[b]Significant at .01 level.

[c]Significant at .05 level.

[d]Significant at .10 level.

APPENDIX M

MULTIPLE REGRESSION ANALYSES OF SOCIO-DEMOGRAPHIC EFFECTS ON PRIVATE BENEFIT-COST RATIOS FOR EACH PROGRAM

	Auto Mechanics		Air Conditioning		Practical Nursing		Cosmetology	
	b[1]	(S)[2]	b	(S)	b	(S)	b	(S)
Regions								
North Florida								
Central Florida	.43[c]	(.17)	1.58[a]	(.42)	.12[d]	(.07)		
Southwest Florida3								
Southeast Florida3					-.28[a]	(.07)		
Related Working Experience								
Relatedness Index			-.91[d]	(.48)	.25[c]	(.12)	.29	(.19)
Additional Training					-.11	(.07)		
Additional Related Training	.70[b]	(.24)					-.54[c]	(.21)
Race								
White	.43[d]	(.25)	1.28[d]	(.77)	.09	(.09)		
Nonwhite3								
Secondary Student	.71[a]	(.19)						
Father Lived with Family	-3.62[a]	(.53)	-3.14[b]	(1.15)			.15[d]	(.08)
Marital Status								
Single								
Married								
Separated, Widowed, or Divorced3							.11	(.08)
Father's Annual Income Data	3.31[a]	(.54)						
Father's Annual Income								
Up to $4,000								
4,001 to 5,000								
5,001 to 6,000								
6,001 to 7,000			2.62[c]	(.99)				
7,001 to 8,000			1.36[d]	(.69)				
8,001 to 9,000								
9,001 to 10,000	-.39	(.29)			-.23	(.17)	.30[c]	(.12)
10,000 or Above	-.41[c]	(.20)	1.08	(.55)			.22	(.16)
Hours of Attendance					.001[a]	(.00)	.16	(.10)
Employed During Training								
Involuntary Unemployment								
Age					-.08[a]	(.01)		
Number of Children	.11	(.02)	.03	(.02)			.03[b]	(.01)
High School Grade Point Average	.46[a]	(.21)			-.05[c]	(.02)	.12	(.08)
High School Level Completed					.16[b]	(.06)		
Father's Education			.26[b]	(.11)				
Mother's Education	.08[c]	(.04)	-.35[b]	(.11)	-.02	(.02)		
Number of Observations	62		46		99		101	
Coefficient of Determination	.74		.79		.59		.35	
Mean of the Dependent Variable	.45	(.93)	1.67	(2.15)	.37	(.41)	.13	(.40)
Intercept Term	-5.04		7.31		-1.21		-2.89	

[a] Significant at .001 level.

[b] Significant at .01 level.

[c] Significant at .05 level.

[d] Significant at .10 level.

[1] b is the regression coefficient.

[2] (S) is the standard error of the regression coefficient.

[3] This regressor of the variable enters into the intercept term. The other regressors of the variable are interpreted at deviations from this regressor.

BIBLIOGRAPHY

Associated Consultants in Education, Inc. "Current Operating
    Costs, 1970-1971, Florida Area Vocational/Technical
    Centers." Report to the Florida Division of Voca-
    tional, Technical and Adult Education, Tallahassee,
    Florida, April 30, 1972. Tallahassee: author, 1972.

Becker, Gary S. "Investment in Human Capital: A Theoretical
    Analysis." Journal of Political Economy, LXX (Supple-
    ment, October, 1962), 9-49.

Carroll, Adger B., and Ihnen, Loren A. "Costs and Returns for
    Investments in Technical Schooling by a Group of
    North Carolina High School Graduates." Economics
    Research Report No. 5. Department of Economics:
    North Carolina State University, December, 1967.

Corizzini, Arthur J. "The Decision to Invest in Vocational
    Education: An Analysis of Costs and Benefits." Jour-
    nal of Human Resources, III (Supplement, Fall, 1968),
    88-120.

_____. "When Should Vocational Training Begin?" Madison,
    Wisconsin: Center for Studies in Vocational and Tech-
    nical Education, University of Wisconsin, 1968.

Eckstein, Otto. "A Survey of the Theory of Public Expendi-
    ture Criteria." Public Finance: Needs, Services and
    Utilization. A Conference of the Universities.
    Princeton, New Jersey: Princeton University Press,
    1961.

Florida. Annual Report of the Florida State Advisory Council
    on Vocational, Technical Education. 1971.

Florida. Florida State Plan for the Administration of Voca-
    tional Education. Parts I, II, and III. 1971.

Florida. Finance and Taxation: Schools, Statutes (1971),
    Vol. I.

Fogel, Walter. "The Effects of Low Educational Attainment
    on Incomes: A Comparative Study of Selected Ethnic
    Groups." The Journal of Human Resources, I (Fall,
    1966), 22-40.

Harris, Marshall A. "Cost-Benefit Analysis of Occupational
    Training Programs." Perspectives on Progress:
    Career Education in Florida. Edited by Richard H. P.
    Kraft. Report to the Florida Department of Education,
    Tallahassee, Florida, 1971. Tallahassee: The
    Florida State University, 1971.

Kaufman, Jacob J., et al. "A Cost-Effectiveness Study of
    Vocational Education: A Comparison of Vocational and
    Non-Vocational Education in Secondary Schools."
    Report to the U.S. Office of Education, Washington,
    D.C., March, 1969. University Park: Pennsylvania
    State University, 1969.

_____. "Cost-Effectiveness Analysis as a Method for the
    Evaluation of Vocational and Technical Education."
    Paper presented at the National Institute for Improv-
    ing Vocational Education Evaluation, University of
    Arkansas, August 4-8, 1969.

Kraft, Richard H. P. "Cost-Effectiveness Analysis of
    Vocational-Technical Education Programs." Report
    to the Florida State Department of Education, Talla-
    hassee, Florida, June, 1969. Tallahassee: The
    Florida State University, 1969.

Prest, A. R. and Turvey, Ralph. "Cost-Benefit Analysis: A
    Survey." The Economic Journal, LXXV (December, 1965),
    684-735.

Raichle, Henry. "A Cost-Utility Analysis of a Selected Post-
    Secondary Vocational-Technical Education Program."
    Unpublished Ph.D. dissertation, The Florida State Uni-
    versity, 1969.

Renshaw, E. F. "Estimating the Returns to Education." Read-
    ings in the Economics of Education. Edited by Mary
    Jean Bowman. Paris: United Nations, Educational,
    Scientific and Cultural Organization, 1968.

Schultz, Theodore W. The Economic Value of Education. New
    York: Columbia University Press, 1963.

Spiegelman, Robert C. "A Benefit-Cost Model to Evaluate Edu-
    cational Programs." Socio-Economic Planning Sciences,
    I (1968), 443-60.

U.S. Department of Labor. Manpower Report of the President,
    1972.

Weisbrod, Burton A. "Conceptual Issues in Evaluating Training
    Programs." Monthly Labor Review, LXXXIX (October,
    1966), 1091-1097 .

_____. "Education and Investment in Human Capital."
    Journal of Political Economy, CIX (Supplement,
    October, 1962), 106-123.

Wiseman, Jack. "Cost-Benefit Analysis in Education."
    Southern Economic Journal, XXXII (July, 1965), 1-12.