The effect of course section size on the cost of instruction in agriculture
by Jacob Robert Hehn

A thesis submitted to the Graduate Faculty in partial fulfillment of the requirements for the degree of DOCTOR OF PHILOSOPHY in Agricultural Economics
Montana State University

Abstract:
The financing of a modern program of education in a university involves large sums of money. Wise managements of a university's resources requires constant analyses of costs.

Past efforts to establish the cost of instruction have centered on average costs per unit of production, specifically cost per student-credit-hour produced. This information has been of limited usefulness for decision-making.

The possibility of over-utilization (or under-utilization) of a course section as it relates to a stated optimum size and what this means in terms of unit costs, both average and marginal, is examined. It is concluded that for a large percentage of the courses offered in the two professional curricula examined, agriculture and engineering, there is no linear relationship between the number of student registrations and the total cost of a teaching section.

Data on the nature of the section of instruction--numbers of sections, distribution by size, average size and numbers of student registrations—-were acquired from the colleges of agriculture and engineering at Colorado State University. An examination of the data made it possible to conclude that additional student registrations could be absorbed at both the lower division and upper division undergraduate level without adding to the total cost of instruction; that is to say, average cost per student registration would decrease with additional student registra-tions. This is important for faculty, academic administrators, curriculum committees and other decision-makers in a university.

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ABSTRACT

The financing of a modern program of education in a university involves large sums of money. Wise managements of a university's resources requires constant analyses of costs.

Past efforts to establish the cost of instruction have centered on average costs per unit of production, specifically cost per student-credit-hour produced. This information has been of limited usefulness for decision-making.

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CHAPTER I

INTRODUCTION

The financing of a modern program of education in a university involves large sums of money. Anyone who is at all acquainted with modern institutions of higher education is aware of the importance of financial matters in the operation of a college or university. Correlations between institutional excellence and financial factors are known to be high. The university that cannot meet competition in faculty salaries and instructional equipment is scheduled for mediocrity. Rules of thumb are not adequate for the multi-million dollar enterprises most universities have become.

Justification for the Study

Most analyses of university costs and specifically, instructional costs are undertaken because costs may be a manifestation of good management or they may also be evidence of mismanagement. Most efforts, until very recently, to establish the cost of instruction have centered on unit costs. This approach applies an after-the-fact computation which establishes cost per some unit of production. The decision-making process which affects instructional cost involves many individuals--academic administrators, curriculum committees, faculty, presidents, and recently, students. Unit cost data have been of limited usefulness to these decision-makers. Other information must be added to unit cost data. Wide-spread apprehensions arise in most colleges and universities whenever

economic analysis, sophisticated or otherwise, is brought to bear on education. This dissertation will attempt to take account of these apprehensions.

Purpose of the Study

The purpose of this study is to evaluate objective instructional production and cost data from one university, Colorado State University, in order to isolate those factors which are pertinent to an economic analysis of the teaching function, analyze their interaction, and provide a basis for the allocation of the limited resources available to the university.

The Problem

What are the factors which must be employed in an economic analysis of instruction and what is the nature of the interaction of the factors which affect the cost of instruction?

Sub-Problems

1) What implications do low (or high) unit costs have for university admissions policies, scholarship policies, and the like?
2) Can a cost curve be developed for an individual course in an university and for groups of courses?
3) What emphasis is appropriate for the traditional cost per student credit hour approach in planning?
4) What is the relationship between the number of students enrolled in a class and the total direct costs of the class?

5) Is the relationship between numbers of students in a department, college, or university and cost of instruction a linear relationship?

6) Is the effort to measure the incremental cost of each additional student in a class effective as a planning tool?

7) Of what importance is the number of "sections" or "events" of instruction in the determination of cost?

It is not intended that this paper will answer adequately any or all of these questions.

The analysis utilized two techniques. The interaction of the factors which affect the cost of teaching were examined. Teaching production and cost data from Colorado State University records were acquired and the interaction of the factors affecting the cost of teaching analyzed. The study proceeded in the following sequence:

Step 1. A historical development of attempts to develop cost analyses in colleges and universities and a review of the literature relative to the problem.

Step 2. A description of how the data which relate to faculty productivity and costs of production were assembled in terms of the economic factors to be explored.

Step 3. The interaction of the factors were analyzed.

Step 4. Conclusions are stated in terms of their significance for university planning.

The possibility of over-utilization (or under-utilization) of a course section as it relates to a stated optimum size and what this means in terms of unit costs, both average and marginal, was examined. The study will attempt to establish whether there is a linear relationship between the number of student registrations and total costs and whether there is a relationship between the number of student registrations and the total cost of a section. Data for specific departments and colleges describing the percent of the courses offered as single-section and multi-sectioned at all levels of instruction were assembled. From this, the study will proceed to the implications for planning: projected additional faculty needs and admissions policies.

This paper attempts to look into the general economy of instructional programs by examining the nature of the section of instruction--numbers, distribution by size, average size, and numbers of student registrations. It will attempt to establish what relevancy, if any, these statistics may have for the efficient use of the resources of a department or a college within a university. It is expected that this effort will lead to additional efforts to develop the data and procedures required to facilitate projections and evaluation of alternate plans.

Further studies could attempt to establish the cost of the "teaching event" as it appears to the university and proceed from this to a more inclusive concept of cost which encompasses the investment made by the student himself. The income given up by the student is an opportunity cost which may be the largest component of the total investment in

university education. In any case, consideration of this additional element into a cost of instruction analysis may produce decisions different than those found acceptable when student opportunity costs are ignored.

CHAPTER II

HISTORICAL DEVELOPMENT OF EFFORTS TO IDENTIFY THE ELEMENTS IN THE COST OF INSTRUCTION AND ESTABLISH THEIR INTERACTION

Any effort to establish the cost of instruction must begin with the subject of financial accounting. This chapter will concern itself with the development of financial accounting in our colleges and universities, specifically the function of accounting which concerns itself with analyzing expenditures and other data in a way which might develop meaningful relationships.

Russell 1/, in describing early efforts at institutional accounting, reminded us that most accounting systems of colleges and universities prior to 1925 revealed a lack of uniformity in policies and procedures. The lack of uniformity in colleges and universities was in direct contrast to the considerable uniformity found in the public elementary and secondary school systems. Russell traced the history of progress toward uniformity in colleges and universities in some detail. Russell stated:

> Apparently the first important realization of the lack of uniformity in college and university accounting practices arose from the proposal of the Carnegie pension plan. When Andrew Carnegie in 1905 established an endowed foundation to provide pensions for faculty members in American higher institutions, it appeared necessary to limit participation in the program to the stronger and better institutions of

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1/ John Dale Russell, The Finance of Higher Education, (2nd ed.), Chicago, University of Chicago, 1954.

the country. Financial stability seemed to be one of the appropriate criteria for the selection of participating institutions, so information regarding finances was requested from all colleges and universities applying. Analysis of the reports that were submitted quickly revealed the need for agreement on terminology and practices in keeping financial records.

Motivated by this experience, the Carnegie Foundation, in its annual report for 1910, made an important series of recommendations to colleges with respect to the manner in which financial reports should be prepared. In this first attempt at the development of uniformity, the suggestions made were reasonable and at the same time progressive. They provided a base not only for improvement in existing practice but from which later efforts at improvement might proceed. The actual effect of the recommendations, however, seems to have been decidedly limited, so far as modifications of accounting practices were concerned. The Foundation itself made no attempt to coerce institutions into following its suggested accounting plan, and only slight progress toward uniformity in college accounting practices was achieved as a result of this first effort in that direction.

A committee appointed by the Association of University and College Business Officers reported in 1917 a suggested uniform classification of expenditures for higher institutions. This committee, under the leadership of J. C. Christensen, of the University of Michigan, proposed a sound system of classification of income and expenditure, essentially in harmony with the plan that had been suggested by the Carnegie Foundation. The report of the committee was contained in the Proceedings of the Association, but few institutions outside of the middle western state universities seem to have done much to revise their accounting practices in accordance with its recommendations.

The General Education Board of New York, a philanthropic foundation established by John D. Rockefeller, also became interested in the problem of college accounting at about the time of the publication of the suggestions by the Carnegie Foundation. The reasons for the interest of both foundations were somewhat similar. The General Education Board was entering on a program of philanthropic giving to American higher education, and, naturally, it wished to have some definite assurance regarding the financial position of the institutions it was seeking to aid. The unsound financial policies followed in many colleges, and the lack of uniformity in their reporting practices, soon became clearly evident. For some time the

Board, through its staff members, gave advice on financial and accounting matters individually to the institutions with which it made contact.

A great forward step was taken in 1922, when the General Education Board published a volume by Trevor Arnett entitled College and University Finance.[6] Mr. Arnett had had the opportunity to visit a large number of colleges and to inspect their accounting systems, besides having served for many years as auditor of the University of Chicago. He was thus peculiarly well qualified for the authorship of a treatise on financial management. At about the time the book was published, Mr. Arnett joined the staff of the General Education Board and later became its president, a position from which he retired in 1936.

The merits of Arnett's College and University Finance were so apparent that the book became almost immediately the bible of business managers. Besides the suggestions with reference to accounting and reporting, the book contains a sound treatment of many other phases of financial administration, including budgetary procedure and management of endowments. Although for a long period of years the book was to be found on the desk of practically every progressive business manager, the suggestions it contains with respect to budgeting and endowment management seem to have been followed more carefully than those with respect to accounting. While many colleges and universities made some modification in their accounting practices to conform with Arnett's suggestions, a decade after the publication of the book the accounting systems in a great majority of institutions still departed so markedly from the basic features of the plan that uniformity seemed a very distant goal.

In the meantime other groups had also been convinced of the need for greater uniformity in the accounting and reporting practices of colleges and universities. The staff of the United States Office of Education, having responsibility for the compilation of statistics relating to education, was keenly aware of the deficiency in the published data concerning the finances of higher institutions. A Committee of the Association of American Colleges, concerned with the cost of education, had found its work seriously hampered through inability to obtain trustworthy data for interinstitutional comparisons. The associations of college and university business officers had frequently discussed the need for some further standardization of accounting and reporting practices. The regional accrediting agencies had also encountered the problem in enforcing financial standards for accreditation.

The United States Office of Education, through Dr. Arthur J. Klein, then serving as chief of the Division of Higher Education, took the leadership in securing the appointment of a committee to work on the problem. This committee, appointed in 1930 under the title of National Committee on Standard Reports for Institutions of Higher Education, represented in its membership practically all the organizations that had displayed an interest in the problem, including the Association of American Colleges and the Council of Church Boards of Education, the various associations of college and university business officers, and the American Association of Collegiate Registrars. The General Education Board of New York gave evidence of its continued interest in the problem by providing a generous grant of funds for the work of the National Committee.

The National Committee deliberated on the problems of financial reporting for a number of years. Advice was sought from experts in the technical field of accounting, such as the Terminology Committee of the American Institute of Accountants, from research workers in the field of education, from college presidents and other administrative officers, and from various agencies which make authoritative use of financial information from colleges and universities. Preliminary bulletins on various phases of the problem, presenting tentative findings and recommendations, were issued from time to time. The definitive final report of the committee was published early in 1935.[7]

The committee not only published its recommendations but also provided a valuable follow-up in the form of advisory service to colleges. As an outgrowth of these activities the American Council on Education, assisted by a grant from an endowed foundation, established in the autumn of 1935 the Financial Advisory Service for higher institutions, with an office at its headquarters in Washington, D. C. The leadership under which this service was inaugurated was the same as that which guided the National Committee through the preparation of its final report. The Financial Advisory Service was discontinued in 1941 when further support could not be obtained. During the six years of its existence the organization rendered notable service through the publication of a series of bulletins ("American Council on Education Studies," Series III) and books and through consultations with individual college officers and various associations and agencies interested in financial accounting and reporting.

The work of the National Committee was limited chiefly to the problems of financial reporting, and the subject of accounting techniques was treated only incidentally. Although the first chapter of the committee's final report is devoted to a theoretical discussion of the characteristics and functions of institutional accounting, and the final chapter concerns the classification of accounts, the committee did not set up a complete model accounting system for colleges to follow.[8] The character of an institution's financial reports, however, goes far to determine the nature of its accounting system.

The report of the National Committee has everywhere been recognized as marking a notable advance in institutional accounting and reporting practices. Within a few years after its publication a number of influential agencies adopted it as the basis of their financial reporting. The forms on which reports are made to the United States Office of Education were changed to accord with the recommended pattern of classification. Many of the denominational boards of education revised their reporting requirements to follow the recommendations of the National Committee. The North Central Association of Colleges and Secondary Schools requires that financial reports from its member-institutions of higher education be set up in the form recommended by the National Committee, and the reports are made on the same forms as are used by the United States Office of Education; the Association further strongly urges that its member-institutions set up their financial accounting systems in the recommended manner. At least one state (Texas) has by legislative mandate required its publicly-controlled institutions to keep their financial accounts in the manner prescribed by the National Committee, and in other states the same end has been achieved by boards and other rule-making agencies. A considerable number of colleges and universities have voluntarily manifested an eagerness to modify their accounting and reporting organizations to conform to the recommended plan.

In the early 1940's there was every reason to believe that institutions would rapidly adopt the principles suggested in the report of the National Committee. There was hope that statistics concerning the finances of higher education in the United States would become increasingly reliable and informative. Some even expected that institutional reports would provide financial data on such a uniform basis that direct comparisons between and among colleges and universities would be feasible. The events of the decade of the 1940's, however, indicated that this optimism was unwarranted. The discontinuance of the

Financial Advisory Service of the American Council on Education withdrew an important stimulus toward uniformity. The absorption of the country and the institutions of higher education in the war effort, and in postwar problems of financing, prevented business officers from continuing the attention they had been giving to the development of uniform accounting procedures. Normal turnover in the field of college business management brought into positions of leadership new personnel who had not been closely identified with the earlier movement toward uniformity in accounting procedures. As a result of these and other factors, a complete standardization of financial accounting practices and procedures in institutions of higher education seems at midcentury still to be a distant, though desirable, goal.

In a Master's thesis written in 1950 at the University of Illinois, entitled "Progress in Financial Reporting in Selected Universities since 1930", Harvey Sherer reaches a rather optimistic conclusion regarding the progress that has been made in the general adoption of the recommendations of the National Committee on Standard Reports. He notes that a number of the Committee's recommendations have not been generally adopted, but his evidence clearly shows that the pronouncements of the Committee are recognized as the generally accepted principles for financial accounting in institutions of higher education. He finds also that there is a high degree of uniformity in the application of these principles by colleges and universities. His conclusion that "great progress has been made" is certainly sound, even though the evidence of his study indicates that still further progress in the direction of uniformity is possible and desirable.

In 1938 a committee was formed to prepare a manual of college and university business administration. The Carnegie Foundation in 1942 made a grant to the American Council on Education to finance the work of this committee. The project moved slowly, however, during the war years. Later the membership of the committee was changed, and a decision reached that the first task should be to prepare a revision of the manual originally published in 1935 as a result of the work of the National Committee on Standard Reports for Institutions of Higher Education. The 1935 report was out of print and difficult to obtain, so a real need existed for a revision of it. The committee completed its work and published the revised report in 1952. The revised edition supported practically all the basic principles of the 1935 report and made only a few minor changes, though it did include some chapters on additional topics.

In 1935 the National Committee on Standard Reports for Institutions of Higher Education published a volume entitled Financial Reports for Colleges and Universities. This volume contains a detailed plan for unit-cost computations including a method of allocating overhead costs as well as an analysis of direct instructional cost.

The U. S. Office of Education published Bulletin No. 21, entitled University Unit Costs, in 1937. The plan for cost computation proposed by the National Committee in the 1935 volume was used as a basis for this report. This study revealed both differences in student-credit-hour costs among curricula or disciplines within a university and substantial unit-cost variations among universities for the same subjects or disciplines. The study did establish some, but not universal, uniformity between institutions with respect to greater student-credit-hour costs at the upper division and graduate division levels than at the lower division.

Additional encouragement to the use of unit cost data came during and following World War II. The various armed services training programs at colleges and universities--e.g., V-12, V-5, ASTP--required cost data to arrive at contract rates for the educational services rendered. After World War II, colleges and universities able to demonstrate that their tuition charges did not represent the total cost of instruction were in a position to negotiate with the Veteran's Administration for reimbursement of some part of a calculated expenditure per student. This provided a direct impetus to efforts to establish unit costs. Some of these efforts were no more than a computation which

involved dividing total institutional instructional expenditures by the number of students enrolled without respect to curriculum or level of work (graduate or undergraduate). 2/ This procedure, although crude, is still in practice. President Francis H. Horn of the University of Rhode Island reported 3/:

> The last time I saw figures (they were for 1959-60) Yale stated that the net cost to Yale per student was $1,602. Upon inquiry, I was informed that the figure was arrived at by a formula which took the total University expenditures, subtracted income from charges on term bills and from gifts (exclusive of the Alumni Fund), and divided the difference by the total university enrollment. The result was the net cost of Yale's annual subsidy to each student. I question the defensibility of the formula. The practice of my predecessor at the University of Rhode Island was just as indefensible. Every year he published figures on the cost per student to the state. He arrived at this figure by dividing the total state appropriation by the number of full-time students. But what about the part-time students?

To understand the impetus to efforts to establish unit costs during and after World War II one must have some understanding of the nature of the enrollment increases which occurred after World War II. In the decade of the 1950's when the U. S. population of college age increased about 1 percent per year, college and university enrollments rose by 1.6 percent per year. In the years 1955-60 enrollments increased by

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2/ No literature is cited here; the author reports this as personal experience having followed precisely this practice as the chief business officer of a small college following World War II.

3/ The University of Wisconsin Office of Institutional Studies, The Role of Institutional Research in Planning. Proceedings of Third Annual National Institutional Research Forum, May 5-7, 1963, Madison, The University of Wisconsin, 1963, pp. 8-9.

2.6 percent annually. In the first part of the nineteenth century, new colleges took care of much of the demand for additional college education. 4/ A large share of the increases in enrollment in the decade of the 1950's took place in existing colleges and universities. Table I is descriptive of the increase in enrollments, e.g., enrollments in public institutions increased 42.5 percent in the five-year period 1955-60.

The point in this brief discussion of enrollment increases is to emphasize the importance of specific and accurate cost and management data for colleges and universities now confronted with large increases in enrollments. Many university administrators had serious doubts that the growth in resources available to higher education would parallel the growth of enrollment.

Many different approaches to analyzing expenditures were employed, but the techniques may be classified into two major types: (1) computation and comparison of percent of total educational and general expenditures that have been used by the various functions performed by the institution, and (2) the determination of the cost per unit of service, such as cost per student or cost per student-credit-hour.

4/ Selma J. Mushkin, State Financing of Higher Education, Economics of Higher Education, Office of Education, Department of Health, Education and Welfare: OE-50027, Bulletin 1962, No. 5, Washington, D. C., Government Printing Office, 1962, pp. 221-222.

TABLE I. INCREASE IN PUBLIC COLLEGE AND UNIVERSITY ENROLLMENTS AS A PERCENT OF TOTAL INCREASE IN OPENING FALL ENROLLMENTS, AND PERCENTAGE CHANGE IN ENROLLMENTS IN PUBLIC AND PRIVATE INSTITUTIONS, 5-YEAR PERIOD 1955-60, BY STATE.*

State	Percentage of Total Increase in Opening Fall Enrollments in Public Institutions	Percentage Change 1/	
		Public Institutions	Private Institutions
Alaska	100.0	106.1	--
Nevada	100.0	123.7	--
Wyoming	100.0	30.0	--
Arizona	98.5	78.4	48.8
North Dakota	98.5	50.1	14.6
Louisiana	97.1	46.6	2.7
New Mexico	96.4	61.4	34.4
Colorado	93.5	64.9	11.2
Oklahoma	90.8	28.6	8.9
California	87.4	53.4	32.3
Montana	87.3	42.3	33.0
Washington	86.9	49.0	19.9
Minnesota	86.8	68.4	18.5
Mississippi	85.9	41.8	25.4
New Jersey	85.4	178.1	9.8
Oregon	85.1	62.3	28.6
Michigan	82.6	36.1	25.7
Wisconsin	81.6	42.8	18.0
Kansas	81.4	35.7	33.1
Florida	77.6	74.5	24.0
Indiana	76.5	41.7	17.2
Nebraska	76.3	41.1	30.1
Hawaii	76.1	50.0	2/
Virginia	74.6	39.2	26.5
Tennessee	71.4	54.8	27.0
New Hampshire	71.4	52.4	19.0
Idaho	71.3	36.5	52.7
Illinois	67.8	53.2	19.2
South Dakota	67.8	33.4	43.1
Missouri	65.9	47.4	16.3
Maine	65.8	62.3	49.0
West Virginia	65.7	25.0	41.1
Kentucky	65.6	44.4	38.9

(table continued)

TABLE I. (Continued)

State	Percentage of Total Increase in Opening Fall Enrollments in Public Institutions	Percentage Change 1/	
		Public Institutions	Private Institutions
North Carolina	65.3	45.3	26.8
South Carolina	64.6	41.0	24.0
Delaware	59.9	22.1	82.3
Maryland	59.6	37.4	34.5
Rhode Island	58.7	96.0	29.7
Alabama	57.8	15.3	36.3
Utah	56.8	25.5	38.3
Vermont	54.9	28.7	20.1
Georgia	54.5	16.0	29.4
Ohio	54.0	33.2	34.7
Arkansas	52.4	25.0	84.4
Texas	46.7	14.2	39.8
Pennsylvania	39.1	49.2	18.6
Iowa	35.4	19.2	41.2
Connecticut	35.0	31.0	38.2
Massachusetts	32.5	90.1	23.4
New York	31.3	21.0	21.0
District of Columbia	1.5	3.4	32.0

1/ Alaska, Nevada, and Wyoming have no private institutions. The relatively large percent of change in public institutions in New Jersey reflects the shift of Rutgers from a private institution to a State university during this period.

2/ No degree-credit enrollment in private institutions reported in 1955.

*Source: Compiled by Justin Lewis from data on opening fall enrollment, U. S. Department of Health, Education, and Welfare, Office of Education, Research and Statistics Division, 1962.

The first of these has the advantage of being easily determined in terms of percentage of total expenditure. An example using data from Oklahoma University follows in Table II.

The method is also useful when applied to data over several years, thereby permitting a comparison between years of operation; an expenditure pattern is revealed.

There are shortcomings. This technique reveals nothing relative to the efficiency of funds expended. For example, in the Oklahoma University data, it is not possible to say that the expenditure of $5,414,109, representing 56.5 percent of total expenditures, was sufficient for this function. Obviously, any conclusions made about a particular institution and supported by data do not necessarily apply to other institutions.

The technique employing a cost per unit of service is, in brief, a computation which adds instructional salary expenditures plus instructional operating expenditures and divides the total (the direct instructional cost) by the student-credit-hours produced. The shortcoming lies with the student-credit-hour as a unit of measurement.

Generally the use of unit instructional costs has been upheld as a good measure of instructional production: Russell and Doi state emphatically: 5/ "The student-credit-hour is the best available measure of the production of instructional services in the department or institution."

5/ John Dale Russell and James I. Doi, Analysis of Expenditures for Instruction, College and University Business, Vol. 21:43, April, 1956, p. 43.

TABLE II. EXPENDITURE AND PERCENTAGE DISTRIBUTION OF TOTAL EDUCATIONAL AND GENERAL EXPENSES BY INSTITUTIONAL FUNCTIONS: OKLAHOMA UNIVERSITY, FISCAL YEAR 1961-62.*

Total	General Administration	General Expense	Instruction	Organized Activities	Organized Research	Extension & Public Services	Libraries	Physical Plant
$9,579,460	$503,793	$627,633	$5,414,109	$311,968	$230,979	$852,284	$502,494	$1,136,200
100.0%	5.3%	6.5%	56.5%	3.3%	2.4%	8.9%	5.2%	11.9%

*Source: Charles R. Walker and John J. Coffelt, Financing Current Operating Costs of Higher Education, Oklahoma State Regents for Higher Education, State Capitol, Oklahoma City, 1963, pp. 13-14.

However, the controversy on this point continues. Sherer 6/, is emphatic in his denunciation of unit cost techniques when he says:

> Unit instructional costs computed by the approved methods of today tend to emphasize the immediate specific expenditure without consideration for quality received. Furthermore, at present, we have no standards by which to judge the future quality of the immediate in higher education.

Sherer proceeded to explain that every unit cost figure, high or low, is found to have a perfectly logical explanation. High unit costs may be a manifestation of a course just getting started with few student registrations or a graduate course. Low unit costs may represent a straight lecture course with many student registrations.

In 1952 the Commission on Financing Higher Education issued a volume by John D. Millett entitled, "Financing Higher Education in the United States". 7/ Although Millett was consistently skeptical about the value of cost studies, his analysis revealed that faculty salaries are an important cost factor, but operate on the cost of instruction along with the size of teaching load and the student-faculty ratio.

As might be expected, the interest in the unit cost approach continues. Williams 8/ reported in 1961 that, as a general rule of thumb, upper division costs could be expected to be approximately twice that of lower division unit costs.

6/ Harvey Sherer, Progress in Financial Reporting in Selected Universities Since 1930, (Champaign, Illinois: The Illinois Bookstore), 1950.

7/ John D. Millett, Financing Higher Education in the United States, The Staff Report of the Commission on Financing Higher Education, New York, Columbia University Press, 1952.

8/ Robert L. Williams, "The Cost of Educating One College Student," The Educational Record, Vol. 43, No. 4, October 1961, pp. 322-323.

A comprehensive study in higher education in Oklahoma was undertaken by the Oklahoma State Regents for Higher Education in 1961. 9/ Determination of unit costs was an important part of this study. The study revealed that in only a few cases were upper division costs twice the amount of the lower division costs. The explanation offered for this was the relatively low faculty salary level in the state. The study concluded further that instructional costs increase with the advance in the class level of the student.

The research efforts beginning with that of the 1920's succeeded in establishing some of the factors affecting the cost of instruction. They include the following:

- Faculty salaries
- Distribution of faculty time
- Distribution of faculty by rank
- Class size
- Teaching load
- Scope and type of instructional program
- Level of instruction

A review of the literature relating to the analysis of expenditures in colleges and universities reveals that most of the attention has been concentrated on the concept of "average cost per unit" of service produced. The result has been undue emphasis on average unit expenditure or average

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9/ Charles R. Walker and John J. Coffelt, Financing Current Operating Costs of Higher Education, Oklahoma State Regents for Higher Education, State Capitol, Oklahoma City, 1963, pp. 13-14.

unit-cost analyses with lesser emphasis on the marginal cost aspect of this problem. The approach found most easy to comprehend by the legislatures, boards of control, faculties, and others responsible for the interpretation of budgets and budget requests has been one that divides the total cost of instruction by the total number of students receiving instruction to establish an average budget per student. Funds required in the ensuing year are then computed by multiplying the additional number of students anticipated times the expenditure per student in the prior year and adding factors for price increases and whatever quality improvement levels are to be pursued.

The most recent major step in the analysis of the instructional costs in American colleges and universities came with Cooperative Research Project No. 1853 undertaken by the Institute of Public Administration of the University of Michigan. This research effort was reported in 1966. 10/ A sample of 110 colleges and universities was selected in the study as were 16 governing boards and coordinating agencies, 5 budget offices, and 3 regional associations. This author was one of those interviewed in the sampling of 110 colleges and universities. The study had as its task the development of an analytic procedure which could be applied to all institutions of higher learning and would develop the information necessary to answer questions. One of the important areas

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10/ John E. Swanson, Wesley, Arden, and Homer E. Still, Jr., Financial Analysis of Current Operations of Colleges and Universities, Institute of Public Administration, The University of Michigan, Ann Arbor, Michigan, 1966.

of the evaluative function of management is that of costs. The study was intended to develop procedures for establishing cost, identifying the factors which caused this cost to be what it was and the relationships between these factors and the actual dollar expenditures.

The Michigan study is a landmark of progress in the field of cost analysis in colleges and universities and it is expected that it will stimulate further studies in the field.

This dissertation will attempt to look into the general economy of instructional programs by examining the nature of the section of instruction--numbers, distribution by size, average size and numbers of student registrations. It will attempt to establish what relevancy, if any, these statistics may have for the efficient use of the resources of a department or a college within a university. It is expected that this will lead to additional efforts to develop the data and procedures required to facilitate projection and evaluation of alternate plans.

CHAPTER III

PER UNIT COST OF INSTRUCTION

The cost of production incurred by a university will be considered to consist of the money outlays the university must make for resources used to produce its product. This chapter will concentrate on the "per unit" aspects of costs and will explore the advantages and disadvantages of unit expenditures as a tool for the analysis of organized instruction.

Essentially, per unit costs are no more than a definition of total costs which takes into account the units of output. The literature relating to the analysis of university expenditures has concentrated on the unit cost approach. Some of this literature has been cited in the preceding chapter. Much controversy exists over the use of the unit-cost technique in universities. Industry has made a good deal of this approach, particularly the average-unit-cost aspects. Marginal unit cost information is much more difficult to acquire, both in industry and higher education.

A serious criticism of the use of unit costs stems from the problem of obtaining a valid measure of education production in terms of some measurable unit. Universities do indeed produce units in the sense that, say, a degree is produced or a student-credit-hour is produced. The imparting of knowledge through an active production process involving teachers, students, librarians, equipment, and the like is, at best, difficult to measure. This chapter will explore specifically the student-credit-hour as the unit of measure of educational output. 1/

1/ Refer to Appendix A.

Average cost per student-credit-hour is derived by dividing the total expenditures for the various outputs by the respective outputs. In Table III total costs are those incurred at the department level and consist primarily of compensation to teaching faculty, support staff, and expenditures for routine operation of a department or college--e.g., instructional supplies and materials, and travel.

TABLE III. AVERAGE COST PER STUDENT-CREDIT-HOUR, COLLEGE OF ENGINEERING, 1963-64 THROUGH 1966-67.*

Academic Year	Dollars Expended	SCH Produced	Cost Per Student-Credit-Hour
1963-64	$394,286	16,788	$23.49
1964-65	432,301	18,728	23.11
1965-66	634,100	19,702	36.36
1966-67	708,662	21,750	32.58

*Source: Office of Budgets, Operating Budgets for Fiscal Year, 1963-64 Through 1966-67, (Fort Collins: Colorado State University), 1967.

Although the SCH approach to a description of output has some merit for instruction at the lower level (freshmen and sophomore) and the upper level (junior and senior), it may not be as useful for an analysis of graduate level work. For the latter, a distinction should be made. Generally, the graduate student in the first year beyond the baccalaureate degree is engaged in course work somewhat typical of his undergraduate years. Beyond the first year of graduate work and particularly in the later stages of the student's doctoral program, course work may be a less important part of his work. In an effort to fit a number scheme,

many colleges and universities in recent years have awarded credit for "dissertation" or "research" registrations. Unless something of the sort is done, the graduate instruction load in a college or department can be much understated. The difficulty of computing costs and projecting needs is obvious.

The first task in assessing the usefulness of the cost per student-credit-hour units is to establish that there is indeed a relationship between the expenditure items and the production items. In Table IV the expenditures in the College of Engineering have been related to the student-credit-hours which have been produced by that college. Specifically, only the direct costs of teaching are related to student-credit-hour production. Logical analysis confirms that the expenditure and production items, the input and output items, are related to each other and thus the proposition may have some usefulness.

The basic shortcoming, of course, has to do with the question whether the SCH accurately measures the output of a college. Examination of the following table reveals that there is some doubt that it does. The case concerns the College of Engineering during the academic year 1964-65.

TABLE IV. STUDENT-CREDIT-HOURS PRODUCED PER MAJOR, COLLEGE OF ENGINEERING, 1964-65.*

Lower Division		SCH Produced Per	Upper Division		SCH Produced Per	Graduate Division		SCH Produced Per
SCH Produced	Majors	Major	SCH Produced	Majors	Major	SCH Produced	Majors	Major
5,390	516	10.4	10,910	326	33.5	2,408	185	13.0

*Source: Office of Admissions and Registrar, Student Statistical Report, Fall Quarter, 1960-61 Through 1967-68, (Fort Collins: Colorado State University), 1967.

An explanation for the "Number of SCH Per Major" is essential. The College of Engineering does not, as a college, offer a great many service courses for other disciplines. An opposite situation exists in, say, the College of Science and Arts, wherein the Department of English devotes as much as 75 percent of its effort, measured in SCH, to service work for other disciplines.

The common course of study for the freshmen year for all engineering majors listed below requires only 4.5 credits of a total of 51, some 8 percent, from courses within the College of Engineering itself. The specific courses are ME 1 and ME 2 (Engineering Graphics) and CE 12 (Engineering Profession).

This clearly accounts for the low SCH produced per major at the lower division. Contrast this with the junior and senior years during which the engineering student completes only 15 to 25 percent of his course work outside the College of Engineering. This is reflected in the large number of student-credit-hours, 33.5, per major at the upper division. The student-credit-hours per major at the graduate division, 13.0, reflect in large part the progression from the normal course work typical of undergraduate work toward the one-to-one (one faculty to one student) relationship found in instruction at the graduate level. The student-credit-hour as a unit of production measure is much less useful at the graduate level.

Some useful information can be gleaned from the cost per student-credit-hour exercises. Table VI extracts specific information from Table III.

TABLE V. COURSE OF STUDY FOR FRESHMEN YEAR (AGRICULTURAL ENGINEERING, CIVIL ENGINEERING, ELECTRICAL ENGINEERING, AND MECHANICAL ENGINEERING).*

	Course	Fall	Winter	Spring
CE 12	Engineering Profession	.5		
C 2,3	Fundamental Chemistry	4.0	4.0	
C 4a	Fundamentals of Organic Chemistry			
M 17, 36,37	Anal. Geometry and Calculus	5.0	5.0	5.0
E 2,3	English Composition	3.0	3.0	3.0
Sp 23	Public Speaking			
Hy 50, 51,52	History of Civilization	3.0	3.0	3.0
ME 1,2	Engineering Graphics		2.0	2.0
PE	Physical Education	.5	.5	.5
	Total	16.0	17.5	17.5

*Source: Office of Admissions and Registrar, Biennial Catalog 1964-65 and 1965-66, (Fort Collins: Colorado State University), 1964.

TABLE VI. EXPENDITURES PER SCH AND STUDENT-FACULTY RATIOS, COLLEGE OF ENGINEERING, 1963-64 THROUGH 1966-67.*

Year	Dollars Expended	SCH Produced	$/SCH	FTE Students	FTE Faculty	FTE Ratios: Students to Faculty
1963-64	$394,286	16,788	23.49	373.03	32.67	11.42 to 1.00
1964-65	432,301	18,728	23.11	416.18	33.22	12.53 to 1.00
1965-66	634,100	19,702	36.36	437.82	46.84	9.35 to 1.00
1966-67	708,662	21,750	32.58	483.33	48.17	10.03 to 1.00

*Source: Office of Admissions and Registrar, Biennial Catalog 1964-65 and 1965-66, (Fort Collins: Colorado State University), 1964.

The year 1965-66 reveals a dramatic increase (from $432,301 to $634,100) in the budget for this college, a 46.6 percent increase. This is reflected in the increase in the expenditures per student-credit-hour from $23.11 to $36.36, an increase of 57.3 percent.

The student-faculty ratio is derived by computing the number of FTE students (SCH produced ÷ 45 SCH) as described earlier and dividing the FTE students by FTE faculty. 2/ Again, the budget increase in 1965-66 is reflected in a narrowing of the student-faculty-ratio.

It is possible that price increases absorbed a significant part of the budget increase. This deserves specific exploration. The instructional budget 3/ for this college was distributed as follows for the years 1964-65 and 1965-66:

	1964-65	1965-66	Increase
Faculty salaries	370,543	568,952	198,409
Non-professional staff salaries	44,666	48,848	4,182
Total Personal Services Budget	415,209	617,800	202,591
Operations: Supplies, Materials, Travel, etc.	10,000	16,300	6,300
Total Budget	425,209	634,100	208,891

Faculty salaries, all ranks combined, increased an average of 8.0 percent from 1964-65 to 1965-66, requiring $29,643.

2/ Refer to Appendix B.

3/ Office of Budgets, Operating Budgets for Fiscal Years, 1964-65 and 1965-66, (Fort Collins: Colorado State University), 1964 and 1965.

TABLE VII. MEAN FACULTY SALARIES, ACADEMIC YEAR EQUIVALENT, COLLEGE OF ENGINEERING, 1963-64 THROUGH 1967-68, INDIVIDUAL RANKS AND ALL RANKS COMBINED.*

	Mean Salaries--Academic Year Equivalent				
Year	Professors	Associate Professors	Assistant Professors	Instructors	All Ranks Combined
1963-64	13,008	9,498	8,209	6,200	9,988
1964-65	13,171	10,266	8,511	6,100	10,233
1965-66	14,540	10,769	9,141	6,534	10,313
1966-67	14,923	11,804	9,641	6,442	10,911
1967-68	16,714	12,583	10,322	7,242	12,195

*Source: Office of Budgets, Faculty Salaries Analysis, 1963-64 Through 1967-68, (Fort Collins: Colorado State University).

Non-professional staff salaries increased by 5.0 percent and required $2,233. In summary, increases in prices, specifically salaries, account for $31,876 in a total budget increase of $202,591 for personal services. The balance of the increase of this college budget was available for additional staff and increases in the operations budget for supplies, materials, and travel. The increase for the latter was $6,300 leaving the amount $170,715, which was available for additional staff. With a budget increase of this magnitude, given no more than 5.2 percent increase in the college teaching load, as measured in SCH, and given price increases of the order of those described, it appears probable that the budget increase in 1965-66 was able to support a reduction in teaching loads and thereby an improvement in the quality of instruction. The examination of both the "expenditure per SCH" and the "student-faculty" ratio would point in this direction. Obviously, auxiliary evidence is essential.

Reference to Table III indicates that the expenditure per SCH in 1964-65, $23.11, was 38 cents less per SCH than the $23.49 expended in 1963-64. It is entirely possible that this decrease represents a decrease in the "quality of instruction". It is also possible that the additional SCH produced in 1964-65, specifically 1,940 more than in 1963-64, did not require additional faculty or additional teaching sections. In fact, only .55 FTE additional faculty were employed. Note that these were 1,940 additional SCH produced; 1,940 SCH reduces to 43.11 additional FTE students, which obviously cannot be assigned to the addition of .55 FTE faculty.

In summary, at best, an analysis of average unit costs based on accounting records gives a rough approximation to the relative efficiencies among colleges or departments of instruction.