A cost analysis of instruction at Montana State University
by Stephen Ross Hample

A dissertation submitted in partial fulfillment of the requirements for the degree of DOCTOR OF EDUCATION
Montana State University
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Abstract:
The problem of this study was to develop a method of cost analysis which would provide answers to the following questions: (1) What are the instructional costs per quarter for a full-time equivalent (FTE) student in each academic major at the baccalaureate, master's and doctoral levels? and (2) What are the total instructional costs per student for the baccalaureate, master's and doctoral degrees in each academic major? Instructional costs and student credit hour production for the 1972-1973 Fiscal Year at Montana State University were examined.

Major attention was focused upon faculty salaries which were considered in relation to credits taught by individual faculty members.

The production of student credit hours was also used as a basis for allocating indirect instructional costs. The results of this first portion of the study were defined to be "department oriented" instructional costs.

A second phase of the study utilized an Induced Course Load Matrix (ICLM) computer program to obtain average course loads for students in various majors and student levels. These average course loads, in terms of credits, were then combined with the "department oriented costs" per credit to obtain what were defined as "student major oriented costs" per FTE student per quarter. Division of these costs, per quarter by an average FTE course load per quarter yielded the "student major oriented" costs per student credit hour.

The final phase of the study combined academic program lengths, in terms of credits, with the "student major oriented" costs to obtain the average instructional cost per baccalaureate, master's and doctoral degree granted in each academic major at Montana State University.

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A dissertation submitted in partial fulfillment
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DOCTOR OF EDUCATION

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ABSTRACT

The problem of this study was to develop a method of cost analysis which would provide answers to the following questions: (1) What are the instructional costs per quarter for a full-time equivalent (FTE) student in each academic major at the baccalaureate, master's and doctoral levels? and (2) What are the total instructional costs per student for the baccalaureate, master's and doctoral degrees in each academic major?

Instructional costs and student credit hour production for the 1972-1973 Fiscal Year at Montana State University were examined. Major attention was focused upon faculty salaries which were considered in relation to credits taught by individual faculty members. The production of student credit hours was also used as a basis for allocating indirect instructional costs. The results of this first portion of the study were defined to be "department oriented" instructional costs.

A second phase of the study utilized an Induced Course Load Matrix (ICLM) computer program to obtain average course loads for students in various majors and student levels. These average course loads, in terms of credits, were then combined with the "department oriented costs" per credit to obtain what were defined as "student major oriented costs" per FTE student per quarter. Division of these costs, per quarter by an average FTE course load per quarter yielded the "student major oriented" costs per student credit hour.

The final phase of the study combined academic program lengths, in terms of credits, with the "student major oriented" costs to obtain the average instructional cost per baccalaureate, master's and doctoral degree granted in each academic major at Montana State University.

CHAPTER 1

INTRODUCTION

During the last few years a great deal of interest and activity in the field of cost analysis as it applies to higher education has occurred. This increased activity can be attributed, at least in part, to the financial constraints which colleges and universities are currently facing, to the concomitant interest in "accountability" in education, and to the increased availability of management tools, such as computer programs, which now aid the implementation of cost analysis techniques. While industry has used the methods of cost analysis for over fifty years, education is only now beginning to refine these concepts and apply them to the educational setting. It must be kept in mind, however, that the manufacture of nuts and bolts is a distinctly different process from the education of human minds and that the adaptation of managerial techniques to education requires a different set of definitions, processes, and underlying assumptions. With these handicaps and with only the recent capability to efficiently analyze large amounts of data, it is understandable that cost analysis in higher education is only now emerging.

This study was supported by the Office of the Vice President for Administration for Montana State University in the form of a stipend and by the Montana Commission on Postsecondary Education in the form of partial payment of computer costs.

PURPOSE OF THE STUDY

The purpose of the study was to provide relatively objective information on the costs of degrees for consideration in making internal and external decisions regarding the operation of Montana State University. The study was both a vehicle by which information was gathered for the Montana Commission on Postsecondary Education and a research effort launched to assist in the internal management of the University.

PROBLEM OF THE STUDY

The problem of this study was to develop a method of cost analysis which could provide answers to the following questions: (1) What are the instructional costs per quarter for a full-time equivalent student in each academic major at the baccalaureate, master's and doctoral levels? and (2) What are the total instructional costs per student for the baccalaureate, master's and doctoral degrees in each academic major?

IMPORTANCE OF THE STUDY

The desire for cost information on Montana State University (MSU) instruction by the State Legislature of Montana was evidenced by the requests for data by the legislature's Commission on Postsecondary

Education. Further requests for data are continually and increasingly made by federal agencies. The interim report of the National Commission on the Financing of Postsecondary Education (1973a:5) stated that the National Commission

> hopes that enough institutions will voluntarily undertake its suggested interim procedures to establish a national data base. In this way, further refinements could be derived before national standard requirements are imposed on all postsecondary educational institutions.

In particular, the methods developed by the National Center for Higher Education Management Systems (NCHEMS) were deemed to be worthy of investigation since the National Commission (1974a:v.) stated that "this interim procedures manual was taken, in large part, directly from NCHEMS publications." It is hoped that the results of this study will allow more informed decisions to be made and thus will enhance the future of Montana State University.

GENERAL RESULTS OBTAINED

The funds expended from the instructional budget for the Fiscal Year 1972-1973 were examined and the costs to the State per student credit hour, per quarter of enrollment and per degree offered at MSU were determined.

A distinction was made between "department oriented" and "student major oriented" costs per student credit hour (SCH) and comparisons between these two types of costs were made. Detailed

information, at the department level, including direct and indirect costs breakdowns, were provided to the departments, but only aggregate costs are presented in this paper.

DEFINITION OF TERMS

The term "department oriented" was used to denote cost figures obtained by the traditional method of considering the cost required, by department, to produce a unit of instruction, i.e.: the allocation of all costs back to departments and the division, for each department, of the sum of these costs by the total number of instructional units produced within the given department. The term "student major oriented" was used to denote the cost per unit of instruction taken by an average student in a given major. The average student in a given major usually takes a mixture of courses offered in several departments, each of which may have a different "department oriented" cost per SCH. The "student major oriented" method considered this mixture of different costing courses and resulted in the average of these costs as viewed from a student unit standpoint.

Students who, on their registration records, were classified as freshmen and sophomores were defined to be "lower division students" for purposes of this study. "Upper division" and "graduate" students were defined in a similar manner with the term "student level" being used to refer to one of the three levels so defined.

The term "course level" was used in a corresponding manner with "lower division" courses being defined as those with catalog numbers between 0 and 299; "upper division" between 300 and 499; and "graduate," between 500 and 999.

"Subject area" is a term used for registration purposes at MSU to classify courses. It was used in exactly the same sense in this study. A "department" refers to an organizational unit within a college of the University. One example is the Department of History, Government and Philosophy which offers instruction in each of the three individual subject areas.

A student's "major" field of study was used as it appeared on student registration records. The term "field of knowledge" was used, in certain instances, in a slightly broader sense to represent a merger of several similar majors or options into one category.

GENERAL PROCEDURES USED

The department oriented costs per student credit hour were obtained in the manner specified by the Montana Commission on Post-secondary Education. Faculty salaries were allocated on the basis of credits taught as listed on faculty activity reports. Indirect costs, such as physical plant operating costs, administrative, and student services costs were allocated on the basis of the student credit hours produced by each department. Library costs, however, were allocated on

the basis of weighted student credit hours. After all instructional costs were allocated, by course level, to each department, the department oriented costs per SCH were computed.

An Induced Course Load Matrix (ICLM) computer program obtained from the National Center for Higher Education Management Systems (NCHEMS) was used to identify the average "mix" of courses taken by students in each major at each of the lower division, upper division, and graduate student levels.

While the required lengths of bachelor's degree programs (in terms of credits) was readily available, the length of graduate programs required further investigation due to the more individualized requirements for each graduate degree. Individual student programs on file in the Graduate office were examined and average program lengths, by field of knowledge, were determined for the master's and doctoral degrees awarded.

The results of the three preceding procedures were combined to compute the student major oriented costs per SCH, the costs per quarter of registration, and the costs per degree granted; by level and by field of knowledge. Finally, some comparisons were made between student major oriented and department oriented costs per student credit hour.

LIMITATIONS AND DELIMITATIONS

The review of literature attempted to focus on current developments of national importance in the area of cost analyses of higher education and did not generally include a review of methods used or results obtained at individual institutions.

The general philosophy of this study was to strike a middle course on the continuum between very detailed and individually less reliable results on one extreme and a single aggregate but reliable result on the other. In several situations, several alternative procedures were considered with the final choice made to conform with the method specified by the Montana Commission on Postsecondary Education.

The study was delimited to the consideration of State instructional funds in the exploration of variations in instructional costs by student level, by course level, by department and by student major without extending these results to future budgetary considerations. It has been a study of "what is" rather than "what should be."

CHAPTER 2

REVIEW OF RELATED LITERATURE

This review of literature was undertaken to provide the writer with a working knowledge of the developments in cost analyses in higher education and to provide background material for persons using the results of this study.

THE IMPORTANCE OF COST STUDIES

In his book, Institutional Research in the University: A Handbook, Dressel (1971:15) states:

> Institutional research and management information systems cannot bring utopia in higher education; but higher education cannot be rational and open until it has the factual basis in data collection and study to permit sound evaluation of resource allocation and of the consequent quality of education provided. No institution can know how to improve itself without knowing in some detail how it has been and is operating.

A cost analysis of instructional resources represents a major aspect of institutional research and one which has recently become the object of attention of the State and Federal Legislatures.

The Montana forty-third legislative assembly, in establishing the Montana Commission on Postsecondary Education, stated the following charge. "The Commission shall further devise a system of accountability that will accurately measure educational output in relation to financial input."

In 1972, the National Commission on the Financing of

Postsecondary Education was created by Congress and charged with developing "national uniform standard procedures for determining the annual per-student costs of providing postsecondary education for students in attendance at various types and classes of institutions of higher education." (National Commission on Financing Postsecondary Education, 1973b:321)

That instructional costs continue to be of congressional concern is evidenced by the following statement:

> 'How can higher education convince the government as well as the public that higher education isn't costing more than it's worth, that most colleges aren't poorly managed, and that higher education leaders are indeed using the best available techniques to understand the economics of their institutions?' The answer is simple: Spell it out in dollars and cents -- and get the information to the people who need to know, according to Robert C. Adringa, minority staff director, Committee on Education and Labor, U.S. House of Representatives. (Cost of Education, 1974:9)

RESULTS FROM SELECTED COST ANALYSES AT OTHER INSTITUTIONS

While there are probably as many methods of analyzing instructional costs as there are institutions, and although work is currently being done in this area, no uniform procedures have yet emerged. The following experiences at individual institutions are provided to highlight various aspects of the cost analysis process.

Gibson, (1968), in his very thorough study of unit costs at the University of Colorado distributed instructional salaries on the basis of a separate work load study, but used the following methods for the

other indirect costs: Operation and Maintenance costs (excluding those for Library and Administration) were distributed to each department on the basis of floor space. Library expenses were allocated to student levels (lower division, upper division, graduate) on the basis of an estimated ratio of use of 1:1.5 : 1.8. (This compares with a similar estimated ratio of 1:2.4 : 2.8 at Stanford, as cited by Gibson, but both estimates apparently do not consider differences in the cost of materials used.) Administration, student aid and all other costs which were not incurred by any particular departments or levels were distributed on the basis of student credit hours.

By far the leading and most studied component of instructional costs is the cost of faculty salaries. Adair's study, "Cost Analysis of Instruction at the University of Arkansas in 1968," was concerned only with the faculty salary costs of instruction.

A very sophisticated model, based on a large number of parameters and differential equations, was developed at Michigan State University in 1967. The report of the study (Keeney, M.G., et al., 1967:38) indicated that, as a side benefit to the simulation results, "when the proposed faculty and support facilities file is established... the computed cost of education by field and level at any point in time will be a matter of record." For each faculty member, a card was created showing his salary per term allocated to instruction. Then for each student registration, a card was created (for each course) listing

the instructor. All course cards were then filed according to the instructor and this method was used to allocate faculty salary costs. Unfortunately, such studies are easier to design than to implement. In the conclusion of the report (p. 134-135) it was noted that,

> A number of irregularities in the two files known as 'Faculty Card No. 1' and 'Course Card No. 2' have made the job long and difficult from back-programming and logical points of view. A list of the major problems and irregularities is provided.

No subsequent use of this method was discovered in the review of literature.

A study at Wayne State University was reported by Hubbard (1962: 110) in which course levels were determined by the level of students enrolled rather than by the course number listed in the catalog. Thus, if 10 percent of the enrollment in a normally classified senior level course consisted of graduate students, the course would be treated as a 90 percent undergraduate and a 10 percent graduate course for purposes of the study. This method appears to be concerned with the same issues as the ICLM method, but with a concentration on course levels rather than on patterns of registrations by student level at the various (catalog defined) course levels. The Wayne State University study also requested faculty members to allocate their time to individual courses rather than using credit hours taught as a basis for allocation.

E. G. Bogue (1971) concluded in his paper, "An Inquiry Into the Relationship Between Instructional Cost Patterns and Assumptions

Influencing Analysis of Basic Data in Unit Cost Studies," that there is a tendency toward higher unit costs at the doctoral level when allocation follows faculty distribution of effort rather than course credit value. The following results were reported by Bogue from a study at Memphis State University.

Results of Two Methods of Distributing
Faculty Cost by Level

	By Course Credit	By Faculty Effort
Lower Division	46.39%	45.72%
Upper Division	32.37%	32.21%
Master's Level	17.15%	17.30%
Doctoral Level	2.13%	2.69%

A similar investigation by Sheehan and Michaels (1971) also reported that the use of weekly contact hours gave about the same results as the use of "teaching units" (related to credits taught). This study also used several different weighting scales in assigning library costs to different academic areas:

Library costs were distributed without regard to student major, then were weighted by major:

	Humanities	Social Sciences	Natural Sciences
Test 6	3	2	1
Test 7	10	5	1

Tests six and seven were performed during the cost study because it was felt that the method of allocating library expenditures to the departments was theoretically not the best choice. It was necessary because departmental library service data were

unavailable. The insensitivity of results (the total cost/SCH figure) to these changes indicated that the choice made was not critical to the final results.

Cost studies vary in detail, with one of the most detailed being reported by Keene and Strenglein (1973) at the University of South Florida. This study, covering the 1967-68 and 1968-69 fiscal years, listed the expenses per full time equivalent student, by department for postage, telephone, and travel; for office and instructional supplies; and for printing and machine rental.

SIMILARITIES IN COST STUDIES

While many variations in the methodologies of cost studies have been indicated, a few basic principles are common to almost all studies. The allocation of educational resources is principally represented by faculty salaries and the unit of educational output generally used is the student credit hour or a related measure of student enrollment over a period of time.

Gibson (1968:19), in his review of the literature, concluded that the unit of educational output which is almost universally used is the student credit hour (SCH).

In a discussion of the credit hour system, James Hefferman (1973) traces the use of the credit hour since its inception at Harvard in 1869 and cites (p. 64) a survey conducted in 1932 for the National Committee on Standard Reports for Institutions of Higher Education.

This survey studied cost analyses employed by American Colleges and Universities with one of its conclusions being, "The criteria used in all analyses for instructional programs were derived in some way from the credit hour."

The allocation of faculty salaries is discussed in the following section.

LITERATURE RELATED TO NCHEMS DEVELOPMENTS

At the time this study was undertaken several products related to the ICLM program were under development by the National Center for Higher Education Management Systems (NCHEMS).

The Faculty Activity Analysis program was developed to allocate faculty salaries to institutional programs and to provide a standard method for analyzing faculty activities. It is described in three technical reports issued by NCHEMS.

Technical Report 24 by Romney (1971) contains a review of the literature in the field and provides a theoretical base for the development of the NCHEMS survey instrument. Technical Report 44 by Manning and Romney (1973:v) presents the survey instrument and discusses the "procedural questions involved in conducting an activity survey." Technical Report 54 by Romney and Manning (1974:iii) "suggests and illustrates a variety of faculty activity information displaying formats and analysis techniques."

The distinctions between faculty assignment, activity, and effort are described (pp. 24-26) in Technical Report 44. Essentially, faculty assignments are those tasks for which faculty members have a specific responsibility (specific courses, research projects, etc.). Faculty activities are those tasks (assigned or unassigned) which are actually performed. Faculty effort would seek to consider not only the number of tasks performed or assigned, but also the native difficulty of each task.

The choice by NCHEMS of suggesting the use of faculty activity measures as a basis for allocating costs has not met with universal acceptance as evidenced by the following comments by Ruth C. Silva in the final report of the National Commission on the Financing of Postsecondary Education (1973:385-386).

> Nothing in the Commission's Report or in the staff Report on Interim Standards should be interpreted to endorse any NCHEMS procedures except those specifically spelled out in the staff report approved by the Commission's committee on December fourteenth.
>
> Most particularly, on December seventh, the Commission rejected the NCHEMS 'faculty effort' or 'faculty activity' reports as a recommended basis for allocating a faculty member's salary among the various functions that a faculty member performs....The Commission and its committee voted to recommend that these allocations be made on the basis of the functions assigned to each faculty member -- i.e. faculty assignment rather than faculty activity reports.

Appendix B of Technical Report 24 also contains the results of a survey which show that few faculty members would recommend the use of

the survey for considerations of salary, promotion, or tenure.

In fairness to the authors of the NCHEMS materials, it should be noted that no other faculty survey instrument has gained wide acceptance either. In presenting a paper on faculty workloads, Robert McClintock (1965) stated,

> It is not the purpose of this presentation to describe or compare the techniques of faculty load studies and analysis at various colleges and universities; I suspect that there are as many approaches as there are institutions.

Subsequent to the undertaking of this study, further progress was made on the NCHEMS Information Exchange Procedures (IEP) process with the development of standard cost study procedures, as described in Technical Report 65 by Johnson and Huff (1975). These standard cost procedures are designed to be used with other NCHEMS products, including the Faculty Activity Analysis and the institutional outcomes portion of the Information Exchange Procedures program.

While this study utilized the NCHEMS Induced Course Load Matrix and resembles the standardized cost study procedures in general, the NCHEMS methodology is much more comprehensive, including capital costs, and requires more data. The full range of the IEP program and the corresponding data requirements are described in Technical Reports 63-66, with a summary of the project contained in Technical Report 46 by Romney (1973).

While some early cost studies in higher education were conducted,

the development of computer assisted techniques (principally by NCHEMS) now enables institutions to analyze costs in ways which were previously impractical. This development is accompanied by demands for standardized procedures of cost analysis with the goal of "accountability" in higher education. The increased attention given to this aspect of education over the last few years shows no signs of abatement.

CHAPTER 3

DESIGN OF THE STUDY

This study was designed to determine: (1) the instructional costs per quarter for a full time equivalent student in each academic major at the baccalaureate, master's and doctoral level; and (2) the total instructional costs per student for the baccalaureate, master's and doctoral degree in each academic major. It was undertaken to provide information requested by the Montana Postsecondary Commission and to assist in the internal management of Montana State University.

The method of gathering data for the study was designed to be in conformance with the methods required by the Commission while the analysis of the data, extending beyond that required by the Commission, was based upon methods suggested by Montana State University and specifically involving the Induced Course Load Matrix (ICLM) program developed by NCHEMS. The merging of these methods was one of the goals of this writer.

This chapter presents the data required to make the cost analysis, some assumptions that were made, and the methodology used in analyzing the data.

DATA REQUIRED AND SOURCES

The Montana State University Business Office provided this writer with a roster of all faculty members of the University who were

compensated with instructional funds during the 1972-1973 fiscal year. For each faculty member listed, the quarterly faculty workload reports on file with the University administration were examined to obtain a basis for allocating instructional effort. Each faculty workload report (see Appendix) contained, in addition to other information, the listing of courses and the corresponding credits taught by an individual faculty member during a given quarter. This record of credits taught was used to allocate faculty effort by course level and by subject area. Since faculty workload reports for the Summer Quarter were available only from the College of Education, it was necessary to examine the original grade reports on file in the Registrar's Office for the Summer Quarter for each class taught by each faculty member. Usually, only one grade sheet was submitted for independent study and thesis registration with the supervising faculty member simply adding his initials next to the individual grade. In such cases or in cases where signatures were illegible, the departments were contacted to supply the name of the unidentified faculty member. In general, no faculty workload reports were filed and no final grade sheets were signed by graduate teaching assistants with the College of Education again being an exception. Where sufficient records were unavailable, consultations were held with the Dean of the appropriate college or the chairman of the appropriate department.

Financial information, including the salary of each faculty

member, support salaries, operating costs, computer costs, and administrative and other indirect costs, was provided by the Montana State University Business Office in a format requested by the Commission.

Detailed registration records using official fifth week enrollment reports and in the form of computer tapes were provided by the Registrar. Each student record identified the student by student major and by student level and identified his course registrations by subject area, by course level and by the number of credit hours involved.

This information was then processed by a series of computer programs purchased by Montana State University from NCHEMS. Total non-weighted student credit hour production by level and by department was provided by the Registrar with weighted SCH production calculated from these figures.

While the registration records for each quarter of the fiscal year provided information on the "mix" of courses taken by various types of students during the year studied, they provided no indication of the length of each student's academic program. The numbers of required credits, for all academic majors, were obtained from the Registrar's office and were used as the measure of program length for students earning a bachelor's degree. The lengths of master's degree programs were determined by examining, for each person receiving a master's degree at Montana State University during the 1972-1973 fiscal year, the graduate program filed by the student with the Graduate

Office at the beginning of his graduate work. Information on the program length for doctoral degrees was obtained in a similar manner with the exception that three fiscal years, 1971-1972, 1972-1973, and 1973-1974 were used.

METHODS AND ASSUMPTIONS USED IN THE STUDY

Since this study was a cost analysis of instruction, only expenditures of funds from the instructional budget were used and only the instructional production of degrees and student credit hours were considered. While other costs (the total costs to the students, research costs, . . .) and benefits (the sociological as well as the academic contribution to the "total individual," the advance of the frontiers of knowledge. . .) can easily be suggested, this study and that of the Commission were delimited in size and scope to a more feasible consideration of commonly measured costs of education. Accordingly, neither the costs nor the products of sponsored research, extension programs and public service were considered.

In order to compute the cost of a degree granted to an average student in a given area, it was assumed that the student majored in that area during the entire length of his degree program. This assumption was required since the student courseload information was obtained from the available quarterly registration records for the 1972-1973 fiscal year rather than from any source of longitudinal data.

In an industrial setting, the costs of producing defective units may be considered as overhead and then added to the costs of the acceptable units which roll off the finish line. In higher education, a significant number of students never reach the finish line of graduation, yet they may benefit from the partial completion of their degrees and a question arises as to whether or not the cost of their education should be considered as overhead and charged against the completed degrees. This would result if the total instructional costs were simply divided by the total number of degrees. However, in this study a cost is computed for each unit (student) in each line (quarter) in the production process (education at MSU) with the total cost for each finished product (graduate) computed by summing the costs for each part of the process without adding as overhead the cost of the unfinished products. The costs and benefits of partially completed degrees were not considered in this study.

The methodology may be considered as consisting of three parts. The first portion of the study consisted of the allocation of instructional costs by department and by level and then the division of those costs by the corresponding number of student credit hours (SCH) produced to obtain cost per SCH figures. A second portion of the study consisted of building an Induced Course Load Matrix which provided an average "mix" of courses in which a student in a given major and in a given level would normally enroll. The third portion involved determining

the length (in terms of credits) of the program required or undertaken for a degree. Finally, it remained to merge these three portions and to arrive at the instructional cost per degree.

Determination of Costs
Per SCH by Department

The major instructional costs, faculty salaries, were allocated on the basis of credits taught in accordance with the procedure recommended by the commission. The advising of students, the participation in University Committees, research activities and other informal instructional responsibilities of faculty members, while essential to the University learning process, were not considered individually, but were assumed to be "overhead" costs of instruction directly related to the formal instructional activities of the faculty members. Each faculty member's salary, reported by department, was first obtained. If a faculty member held a joint appointment among two or more departments, his salary was divided according to the terms of his contract. Thus, if a person was appointed as a half-time faculty member in each of two departments, his salary was evenly divided for the purposes of this study and he was subsequently treated in the same manner as two persons employed in the University on a half-time basis. Secondly, a tally sheet was constructed for each faculty member (full time and part time) in each department. Faculty workload reports filed by the individual faculty members were then located and a tally was kept of

the courses, and the corresponding credits, taught by each individual during the fiscal year (see Appendix, Form P.S.-2).

A slight modification was made by the Commission for reporting independent study courses (including thesis and dissertation registrations) and student teaching. The number of credits reported as being taught by a faculty member in one of these situations was multiplied by a factor (decided upon by the Commission) of 1/6 and 1/12 respectively. This product was then multiplied by the number of persons enrolled in the particular course. For example, if a professor supervised two registrations for a Master's thesis at five credits each, he would be considered to have taught the equivalent of 5 x 1/6 x 2 = 1.67 credits at the graduate level. Another faculty member supervising ten student teachers, each registered for eight credits of student teaching, would be considered to have taught the equivalent of 8 x 1/12 x 10 = 6.67 credits at the upper division level. After the total credits (or equivalent credits) taught for the year had been obtained, the percentage distribution of each individual faculty member's total credits to the three course levels (lower division, upper division, and graduate) was computed and the resulting percentages were used to allocate that individual's salary by level within the department in which the individual taught.

The following example illustrates this procedure:

	Credit Hours Per Year	Percent	Faculty Member's Salary Distribution
Lower Division	20	50.0%	$ 8,000
Upper Division	15	37.5%	$ 6,000
Graduate	5	12.5%	$ 2,000
Total	40	100.0%	$16,000

FIGURE 1

DISTRIBUTION OF FACULTY SALARIES TO COURSE LEVELS

A complication arose in certain lab and/or studio courses. One architecture laboratory, for example, included students from two classes, as well as individual graduate students, being alternately or simultaneously advised by three faculty members. In such (relatively few) cases, the individual faculty members were contacted by phone and requested to estimate the allocation of their efforts to the course levels for the laboratory sections in question. In the College of Professional Schools, some departments reported faculty instruction efforts broken down by contact hours rather than by credit hours and percentages were computed on this basis. Where information on the teaching load of graduate teaching assistants was not available, the college deans were contacted and asked to obtain an estimate of the course level involved, rather than simply assuming that such

instruction was given at the lower division level.

While other methods, such as the NCHEMS Faculty Activity Analysis program, could have been used to allocate faculty salaries, the method used was requested by the Commission and utilized existing data files.

After all individual faculty (and GTA) salaries were distributed to the course levels, departmental totals by level were formed. These totals of individual salaries were checked against departmental totals obtained separately from the Business Office. For the few departments in which the sum of the individual salaries did not quite equal the departmental totals (due perhaps to missing data on some part-time faculty or terminations within the fiscal year), the discrepancy was divided in the same ratio (by level) as existed for the salaries in question. The divided discrepancy was then added, by level, to the total individual salaries by level, thus reconciling the difference. For example, if the total faculty salaries obtained from the above tallies for a department amounted to $200,000 as compared to a total of $201,000 reported by the Business Office, the following correcting adjustment would be made:

	Total Faculty Salaries		Correcting Adjustments		Reconciled Total Faculty Salaries
Lower Division	$ 90,000 (45%)	+	$ 450	=	$ 90,450
Upper Division	$ 80,000 (40%)	+	$ 400	=	$ 80,400
Graduate	$ 30,000 (15%)	+	$ 150	=	$ 30,150
Total	$200,000(100%)	+	$1000	=	$201,000

FIGURE 2

RECONCILIATION OF TOTAL FACULTY SALARIES

These totals (corrected as necessary) were then increased by 12 percent to include fringe benefits to obtain total faculty compensations.

Under the assumption that the effort represented by support (secretarial, etc.) salaries would be expended by course level in the same ratios as the total effort expenditure, the percentage breakdown (by level) of total instructional (faculty + GTA) salaries was applied to the total compensation (including both faculty and support salaries plus fringe benefits) for each department to obtain the total salaries and fringe benefits by course level of instruction for each department.

The following example utilizes the figures from the previous illustration, with $11,000 in GTA salaries having been added to obtain the total instructional salaries.

	Total Instructional Salaries	Percent	Total Salaries and Fringe Benefits
Lower Division	$101,450	47.8%	$129,557
Upper Division	$ 80,400	37.9%	$102,724
Graduate	$ 30,150	14.3%	$ 38,759
Total	$212,000	100.0%	$271,040

FIGURE 3

DISTRIBUTION OF TOTAL SALARIES AND FRINGE BENEFITS TO COURSE LEVELS

The $271,040 represents an addition of $30,000 in support salaries to the $212,000 of instruction salaries with the total being increased by 12 percent to account for fringe benefits. Percentages were applied to the total compensation rather than apportioning the support salaries on the percentage basis, adding the salaries by level and then applying the 12 percent adjustment to each level. The latter method cited, while being more intuitive would have required a greater number of arithmetic operations with an increased chance for computational error. With the large number of calculations in the study, the use of the former method significantly reduced the time required for the hand calculations involved.

Other departmental costs consisting of supplies, travel, and computer costs were obtained from the business cffice for each department without regard to course levels.

Each department was also assigned a portion of the operating costs of the dean's office for its particular college. This assignment was made in direct proportion to the department's share of total (non-weighted) student credit hours (SCH) produced by the college. If a department produced 20 percent of the student credit hours generated within its college, then that department was assigned 20 percent of the operating costs of the dean's office.

Institutional operating costs were also charged back to the individual departments. Administrative, physical plant, and other general operating costs were allocated in direct proportion to the department's share of SCH production relative to the total amount of SCH's produced by the University.

Library costs were assigned in a manner similar to that used for operating costs, except that weighted student credit hours (using weights of one for lower division, two for upper division and four for graduate student credit hours) were used, on the assumption that the production of student credit hours at increasing course levels requires increasing amounts of library resources. The particular weights used were decided upon by the Commission.

After the above collection of departmental costs and the apportioning of college and institutional "overhead" instructional costs were completed, one total "non-salary" instructional cost was obtained for each department. This cost was then prorated to the

course levels in direct proportion to the breakdown by course level of the (non-weighted) student credit hour production of the department.

The following example assumes that total "non-salary" instructional cost so obtained for a given department was $160,000.

	Student Credit Hours Produced	Percent	"Non-Salary" Instructional Costs
Lower Division	8,000	69.5%	$111,200
Upper Division	3,000	26.1%	$ 41,760
Graduate	500	4.4%	$ 7,040
Total	11,500	100.0%	$160,000

FIGURE 4

DISTRIBUTION OF "NON-SALARY" INSTRUCTIONAL COSTS TO COURSE LEVELS

In the above manner, "non-salary" instructional costs by department and by course level were obtained.

The "salary," total salaries and fringe benefits, and the "non-salary" instructional costs were then added by department and by level, to obtain the total instructional costs by department by level. These total costs, aggregated through various allocation methods, were then divided by the number of (non-weighted) student credit hours produced by the corresponding department at the corresponding level to obtain the departmental costs per student credit hour by level.

	Total Salaries and Fringe Benefits		"Non-Salary" Instructional Costs		Total Instructional Costs		SCH		Costs Per SCH
Lower Division	$129,557	+	$111,200	=	$240,757	÷	8000	=	$ 30.09
Upper Division	$102,724	+	$ 41,760	=	$144,484	÷	3000	=	$ 48.16
Graduate	$ 38,759	+	$ 7,040	=	$ 45,799	÷	500	=	$187.92

FIGURE 5

DETERMINATION OF DEPARTMENT ORIENTED COSTS PER STUDENT CREDIT HOUR BY COURSE LEVEL

While the cost per student credit hour at a given level for Department A may be twice that for Department B, it would probably be incorrect to conclude that the cost of offering a degree in the field of knowledge A is twice that of a similar degree in field B. Since a student in field A is likely to take courses in other, less expensive, departments than Department A (and the reverse for a student in field B), the actual difference in the cost of offering degrees in the two fields is likely to be less than a straight linear projection would assume. In order to illustrate how student major oriented costs were obtained, let us consider an example involving two students. Student (a) is a freshman whose major is in Department A. During a given quarter he is enrolled in ten credits of lower division course work in Department A and five credits in Department B. Student (b) is majoring in Department B with the reverse courseload.

If we assume that the lower division (department oriented) cost per student credit hour is $60 for Department A and $30 for Department B, the "student major oriented" cost for these two students would be computed as follows:

Cost for Student (a) = (10 credits from Dept. A. @ $60 per SCH
+ 5 credits from Dept. B. @ $30 per SCH)
÷ 15 credits taken
= $750 ÷ 15
= $50 per SCH

Cost for Student (b) = (5 credits from Dept. A. @ $60 per SCH
= 10 credits from Dept. B. @ $30 per SCH)
÷ 15 credits taken
= $600 ÷ 15
= $40 per SCH

Thus, we can see that the student oriented cost for the quarter under consideration is $50 per SCH for the first student enrolled in a major within Department A and $40 per SCH for the student enrolled in a major within Department B.

The two concepts and terms "department oriented" and "student major oriented" as illustrated above are used in the remainder of this study.

The development of an Induced Course Load Matrix (ICLM) was undertaken to obtain the actual distribution of student courseloads

(the breakdown of the 15 credits as in the previous example) for the average FTE student considering all student majors, all departments, all student levels and all course levels.

The Induced Course Load Matrix (ICLM)

This computer program, developed by the National Center for Higher Education Management Systems (NCHEMS), is, in essence, a method for sorting large amounts of registration data into user-defined categories. If a college were to consist of only two departments offering a total of three majors, the sorting procedure could be considered as the construction of a 2 x 3 matrix. Assume that when a student registers for a class that he must fill out an IBM card for each class. This card identifies him by social security number, year in school and major. The card also contains the number of the course, the department in which it is taught and the number of credits for which the course is taken.

Consider the following "matrix:"

		Major		
		Biology	Chemistry	Bio-Chemistry
Department	Biology			
	Chemistry			

FIGURE 6

A SAMPLE MATRIX FORMAT

The computer now reads each IBM card and sorts all courses taught by the Biology Department into one group. It then sorts this group of cards into three smaller subgroups according to the major of the student who filled out the card. This process is repeated for the other department(s). For each of the subgroups so obtained, the number of credits appearing on each card are added to obtain a total for that subgroup. The result is known as the Induced Work Load Matrix (IWLM). An example of an IWLM would be the following:

	Biology Majors	Chemistry Majors	Bio-Chemistry Majors
Biology Department	535 (SCH)	480 (SCH)	375 (SCH)
Chemistry Department	215 (SCH)	1020 (SCH)	750 (SCH)

Enrollments in each major:

Biology	Chemistry	Bio-Chemistry
50	100	75

FIGURE 7

IWLM: DISTRIBUTION OF CREDITS TAUGHT BY MAJOR, BY DEPARTMENT

Division of the entries in the IWLM by the number of (FTE) enrollments in each major yields the following Induced Course Load Matrix (ICLM).

	Biology Majors	Chemistry Majors	Bio-Chemistry Majors
Biology Department	10.70	4.80	5.00
Chemistry Department	4.30	10.20	10.00
Total Credits Per Major	15.00	15.00	15.00

FIGURE 8

ICLM: DISTRIBUTION OF AVERAGE CREDITS TAUGHT PER MAJOR BY DEPARTMENT

The Induced Course Load Matrix (ICLM) is obtained as indicated. For example, in the IWLM we see that the chemistry department taught a total of 750 credits to bio-chemistry majors. Since there are 75 bio-chemistry majors assumed in this example, we arrive at an average of 10 credits per student in this category as shown in the ICLM.

Although this simple example used only two departments and three student majors with no considerations of course levels or student levels, the basic principle is illustrated. In actual practice, three course levels and three student levels were used with nine ICLM tables produced, each of which represented a portion of the total student registration pattern.

The choice of the three course levels was made to correspond with the previously derived department oriented costs per SCH at the lower division, upper division, and graduate course levels. An additional reason for not differentiating between master's and doctoral

course levels, was that such distinctions had not been previously used for most registration purposes.

The choice of three student levels was made, for this initial application at MSU, so as to allow more detail than a simpler undergraduate/graduate distinction while avoiding complications in using too fine a breakdown.

After the ICLM was compiled, based on registrations for the 1972-1973 fiscal year, the resulting average course load information was multiplied (by department, by course level) by the corresponding (department oriented) cost per student credit hour obtained previously. This multiplication process followed that of the example cited using student majors (a) and (b) discussed previously. However, in actual practice, the situation is more complex with a much larger number of student majors and departments and with three separate student levels and course levels considered. A short computer program was developed to multiply the appropriate department oriented cost vectors (one for each course level) through the individual matrices (a total of nine, one for each student level at each course level) obtained from the ICLM program.

This process yielded the instructional cost per full-time equivalent (FTE) student (based on 15 credits for undergraduates and 12 credits for graduates) for a typical quarter by student level. While this was an intermediate step in the process, these results were

divided by the average credit load (15 or 12) to obtain an average cost per student credit hour by student major (as opposed to department) and by student level (as opposed to course level) to be articulated with lengths of degree programs in terms of credits, as opposed to calendar quarters of registrations.

Program Lengths

The required number of credits for graduation, by student major, constituted the program length for undergraduate degrees in this study, rather than the less precise concept of twelve full-time quarters.

The lengths of master's degree programs were determined by examining the individual graduate programs (on file in the graduate office) of persons who obtained the master's degree during the 1972-1973 fiscal year and by then grouping the programs by field of knowledge (as indicated by the title of the degree) and computing the average number of credits taken towards the degrees. Only credits taken beyond the previously obtained degree were counted in this computation. Credits transfered in from other institutions and appearing on the graduate program were counted as having been taken at MSU.

The lengths of doctoral programs were computed in the same manner, with the exception that the process was extended to include doctoral graduates in the 1971-1972 and 1973-1974 fiscal years in

order to increase the sample size.

Costs Per Degree

The results of the three preceding processes (allocation of costs, matching student registrations with costs, and determination of program lengths) were combined to obtain a final cost per degree granted. The department oriented costs (by course level) per student credit hour offered were previously combined with the student registration information from the ICLM yielding instructional (student major oriented) costs per student credit hour taken (by student level) by field of knowledge (student major). For each degree granted, the length of the program (in terms of credits) was multiplied by the cost per credit in the appropriate field and at the appropriate level. Students obtaining a bachelor's degree were assumed to have been classified for half of their college career as lower division students and half as upper division students, with one-half of the total number of credits considered for each level in the computation of degree costs.

In several student major areas, fewer majors (options) were reported at the lower division (student) level than at the upper division (student) level. This occurred when a general student major (agriculture) was used by lower division students who later registered in more specialized majors (agricultural business, agricultural education, etc.), and in such cases one general lower division cost figure

was added to the costs for the more specialized upper division majors to obtain a cost for a degree in the specialized area. In cases where a few students registered in specialized options at the lower division level, although most students in that major area registered under the general major, a weighted average lower division (student major oriented) cost per SCH was computed. These few registrations may be the result of an early decision and intentional registration on the part of the student, a recent change in student major options offered, or an error in student registrations. These specialized lower division registrations had little effect on the weighted (by the number of student majors) average since they were few in number and since apparently all students at this level tend to take a general mix of introductory courses. Such isolated registrations (consisting of fewer than five students in a student major option) were used in computing the averages, but were not listed in the final reports.

Costs were computed for graduate degrees to represent only the additional costs for each particular degree and not to include the costs of previous degrees.

After the final costs per degree were obtained, an additional comparison was made to provide some insight into the dampening effect on cost differentials resulting from the use of student major oriented costs per SCH rather than by simply multiplying department oriented costs per SCH by program length. For each student level, ten

department oriented costs and ten student major oriented costs were randomly selected and plotted on the same graph to visually illustrate the effect. The arithmetic means and standard deviations for both sets of costs were also computed. Finally, several diverse (in terms of costs per SCH) student majors and departments were used to indicate the range in the cost of degrees obtained by the two methods.

CHAPTER 4

RESULTS OF THE STUDY

The data presented in this chapter comprise several intermediate results of the study as well as the final costs per degrees granted. Results are presented in aggregated form rather than specifying the course loads of individual students, the workloads of individual faculty members, or the itemized details of departmental expenses.

Department Oriented Instructional Costs Per Student Credit Hour Taught

The results of the allocation of instructional costs by department and by level are contained in the following tables accompanied by the number of student credit hours (SCH) on which they were based. These results served as an intermediate step and do not include any considerations of student course loads.

The range in costs per student credit hour (SCH) at the lower division course level was from $17.36 in sociology to $90.13 in electrical engineering, while at the upper division level the range was from $20.51 in physical education to $71.03 in physics. At the graduate level, the range was from $33.50 in history, government and philosophy to $214.79 in veterinary science with exclusion from consideration of departments (film and television, modern languages and speech) which produced fewer than twenty student credit hours at this level.

The departments of plant pathology and intercultural studies

were reorganized during the fiscal year, with few student credit hours being produced in either department. For this reason they are not included in the following tables.

While the final costs per degree granted, presented near the end of this chapter, have been rounded off to the nearest dollar, in all intermediate results, such as those in Tables 1 - 5, the cents were retained since they were used in further calculations. The number of student credit hours produced by department, by level has been included to aid the reader in assessing the reliability of the costs. While some department oriented costs were based on a small number of student credit hours produced, these costs also had a minimal effect on the total costs per degree for the simple reason that courses in these areas were taken by so few students.

TABLE 1

DEPARTMENT ORIENTED INSTRUCTIONAL COSTS PER STUDENT CREDIT HOUR
BY DEPARTMENT, BY COURSE LEVEL

COLLEGE OF AGRICULTURE

Department	LOWER DIVISION		UPPER DIVISION		GRADUATE	
	SCH Production	Cost/ SCH	SCH Production	Cost/ SCH	SCH Production	Cost/ SCH
Agriculture Economics and Economics	8,088	$25.05	3,070	$44.16	346	$84.82
Agriculture and Industrial Education	588	58.04	1,178	68.92	185	113.44
Animal Science	2,898	48.00	3,459	43.00	381	92.54
Plant and Soil Science	5,168	20.14	1,856	39.98	633	84.08
Veterinary Science	--	--	677	38.53	42	214.79

TABLE 2

DEPARTMENT ORIENTED INSTRUCTIONAL COSTS PER STUDENT CREDIT HOUR
BY DEPARTMENT, BY COURSE LEVEL

COLLEGE OF EDUCATION

Department	LOWER DIVISION		UPPER DIVISION		GRADUATE	
	SCH Production	Cost/ SCH	SCH Production	Cost/ SCH	SCH Production	Cost/ SCH
Educational Services	--	$ --	1,025	$41.62	2,474	$49.75
Elementary Education	--	--	6,478	33.95	654	59.84
Physical Education	8,246	29.64	9.347	20.51	515	95.64
Secondary Education and Foundations	1,831	38.27	7,053	37.42	1,262	52.33

TABLE 3

DEPARTMENT ORIENTED INSTRUCTIONAL COSTS PER STUDENT CREDIT HOUR
BY DEPARTMENT, BY COURSE LEVEL

COLLEGE OF ENGINEERING

Department	LOWER DIVISION		UPPER DIVISION		GRADUATE	
	SCH Production	Cost/ SCH	SCH Production	Cost/ SCH	SCH Production	Cost/ SCH
Agricultural Engineering	668	$37.02	1,264	$43.89	68	$60.15
Chemical Engineering	528	71.16	2,464	53.03	694	109.08
Civil Engineering and Engineering Mechanics	1,815	46.04	4,811	49.84	626	155.04
Electrical Engineering	572	90.13	3,309	62.53	630	118.11
Industrial Engineering/ Computer Science	1,954	44.77	3,806	46.82	455	103.01
Mechanical Engineering and Mechanical Technology	1,540	41.57	3,198	60.52	356	88.16

TABLE 4

DEPARTMENT ORIENTED INSTRUCTIONAL COSTS PER STUDENT CREDIT HOUR
BY DEPARTMENT, BY COURSE LEVEL

COLLEGE OF LETTERS AND SCIENCE

Department	LOWER DIVISION		UPPER DIVISION		GRADUATE	
	SCH Production	Cost/ SCH	SCH Production	Cost/ SCH	SCH Production	Cost/ SCH
Botany and Microbiology	13,849	$21.34	4,132	$47.03	1,010	$89.07
Chemistry	16,287	26.68	2,583	45.65	1,476	99.45
Earth Science	5,848	27.43	1,374	55.07	201	156.92
English and Theatre Arts	10,736	28.49	5,277	30.34	40	153.12
History, Government, & Philosophy	12,778	25.71	6,514	26.23	168	33.50
Mathematics	23,356	25.63	2,234	66.47	668	147.38
Military Science	523	35.48	729	35.45	--	--
Modern Languages	3,649	38.89	866	55.30	7	30.55
Physics	8,758	25.98	1,372	71.03	566	193.57
Psychology	8,218	19.51	2,762	30.57	529	71.98
Sociology	13,242	17.36	7,575	32.99	37	96.44
Speech	6,187	25.64	740	56.59	9	299.73
Zoology and Entomology	10,251	23.68	3,245	34.05	1,058	91.43

TABLE 5

DEPARTMENT ORIENTED INSTRUCTIONAL COSTS PER STUDENT CREDIT HOUR
BY DEPARTMENT, BY COURSE LEVEL

COLLEGE OF PROFESSIONAL SCHOOLS

Department	LOWER DIVISION		UPPER DIVISION		GRADUATE	
	SCH Production	Cost/ SCH	SCH Production	Cost/ SCH	SCH Production	Cost/ SCH
Architecture	3,832	$31.10	2,022	$50.78	970	$94.55
Art	6,330	24.53	3,545	40.06	426	85.76
Commerce	12,054	23.13	10,293	27.41	608	84.54
Film and TV Production	3,437	28.52	1,725	47.70	14	29.65
Home Economics	14,122	17.88	4,121	32.24	390	90.45
Music	4,689	46.68	1,441	41.06	53	120.59
Nursing	6,935	32.47	10,071	52.60	469	164.08
MSU TOTALS	218,877	$27.22	125,875	$38.80	18,209	$91.09

The Induced Course Load Matrix

The ICLM computer program produced several voluminous reports on student registration patterns at Montana State University. Only the final report, consisting itself of several hundred pages, was directly used in this study and, hence, while the reports have been made available for internal management at MSU, only a sample from the major report is reproduced in this chapter.

The ICLM-05 report presents the courseload of an average student in each student major, at each student level, at each course level and in each subject area. The total ICLM-05 report consists of nine matrices; one for lower division students taking lower division courses, one for lower division students taking upper division courses, ...and one for graduate students taking graduate courses. The sample is labeled with the student majors being arranged horizontally and subject areas being arranged vertically.

Subject areas are related to, but not synonomous with academic departments. For example, the department of history, government, and philosophy offers instruction in each of the three individual subject areas, as discussed previously in Chapter 1.

TABLE 6

A SAMPLE REPORT FROM THE INDUCED COURSE
LOAD MATRIX PROGRAM

ICLM-C5 INDUCED COURSE LOAD MATRIX SYSTEM PAGE 25

ACHEMS ICLM/IWLM
JULY 1974 MONTANA STATE UNIVERSITY WINTER 74

STUDENT LEVEL = (1) FRESHMAN INSTRUCTION (COURSE) LEVEL = (1) LOWER ENROLLMENTS ARE FTE

-- MAJOR --	(081) E E	(082) EL FD	(083) EL ED	(085) EL ED	(086) EL FD-FLEM	(087) EL ED-JRHI	(088) EL ED-MUS	(089) ENG S	(090) ENGL
-- ENROL --	1	30	1	1	33	1	1	7	11
DEPT = 007		1	1		4				1
AN S		.03	1.00		.12				.09
DEPT = 008								4	4
ANTH								.57	.36
DEPT = 009								4	
ARCH								.57	
DEPT = 010		18	3		15				6
ART		.60	3.00		.45				.55
DEPT = 011		24							
BTCL		.80							
DEPT = 012		6			12				
BOT		.20			.36				
DEPT = 014								4	
CHEM								.57	
DEPT = 016		6			17			4	6
COM		.20			.52			.57	.55
DEPT = 017								4	
C S								.57	
DEPT = 020	4	36			28				
ECON	4.00	1.20			.85				

TABLE 6 (continued)

ICLM-CE — INDUCED COURSE LOAD MATRIX SYSTEM — PAGE 26

ACHEMS — ICLM/IWLM — WINTER 74

JULY 1974 — MONTANA STATE UNIVERSITY

STUDENT LEVEL = (1) FRESHMAN — INSTRUCTION (COURSE) LEVEL = (1) LOWER — ENROLLMENTS ARE FTE

== MAJOR ==	(C81) E E	(C82) EL ED	(C83) EL ED	(C85) EL ED	(C86) EL ED-FLEM	(C87) EL ED-JRHI	(C88) EL ED-MUS	(C89) ENG S	(C90) ENGL
== ENROL ==	1	30	1	1	33	1	1	7	11
DEPT = C21		4			8				8
ECON		.13			.24				.73
DEPT = C26		15			18		3		
EDFC		.50			.55		3.00		
DEPT = C29	1							1	
E E	1.00							.14	
DEPT = C32		48		4	64		4	8	34
ENGL		1.60		4.00	1.94		4.00	1.14	3.09
DEPT = C37		32			16				
GOVT		1.07			.48				
DEPT = C38									3
HLTH									.27
DEPT = C39		12			7			8	11
HIST		.40			.21			1.14	1.00
DEPT = C41		72	4	4	47	4			3
HE-F		2.40	4.00	4.00	1.42	4.00			.27
DEPT = C47	5	24			80	4		30	
MATH	5.00	.80			2.42	4.00		4.29	
DEPT = C48	2							16	
MECH	2.00							2.29	
DEPT = C55									4
ML-F									.36
DEPT = C56					4				
ML-C					.12				
DEPT = C57		4							
ML-S		.13							

TABLE 6 (continued)

ICLM-C5 INDUCED COURSE LOAD MATRIX SYSTEM PAGE 27

NCHEMS ICLM/IWLM
JULY 1974 MONTANA STATE UNIVERSITY WINTER 74

STUDENT LEVEL = (1) FRESHMAN	(C81)	(C82)	(C83)	(C85)	INSTRUCTION (COURSE) LEVEL = (1) LOWER (C86)	(C87)	(C88)	ENROLLMENTS ARE FTE (C89)	(C90)
** MAJOR ***	E F	EL ED	FL ED	EL ED	EL ED-ELEM	FL ED-JRHI	EL ED-MUS	ENG S	ENGL
** ENROL ***	1	30	1	1	33	1	1	7	11
DEPT = C58		4			2		3	2	1
MLS		.13			.06		3.00	.29	.09
DEPT = C60					4				8
PHIL					.12				.73
DEPT = C61		1		2	2	1			
PE		.03		2.00	.06	1.00			
DEPT = C62		11	1		17	3		3	7
PE-C		.37	1.00		.52	3.00		.43	.64
DEPT = C63								1	
PE-M								.14	
DEPT = C64		7			5		1		2
PE-W		.23			.15		1.00		.18
DEPT = C65		12			27			3	
PHYS		.40			.82			.43	
DEPT = C68		40	4	4	40	4	4	4	4
PSY		1.33	4.00	4.00	1.21	4.00	4.00	.57	.36
DEPT = C70					4				4
RELG					.12				.36
DEPT = C73		4			4			4	
SOC		.13			.12			.57	
DEPT = C74		41	2	9	36				13
SPCH		1.37	2.00	2.00	1.09				1.18
** TOTAL **	12	422	15	16	461	16	15	100	119
** TOTAL **	12.00	14.05	15.00	16.00	13.95	16.00	15.00	14.28	10.81

Instructional Costs Per Quarter
Per FTE Student

The matrices obtained from the ICLM program listed the average course registrations in various subject areas by an average FTE student in each major. These subject areas were then matched with the corresponding departments, allowing the use of the department oriented instructional costs per SCH obtained previously. Essentially, the ICLM program provided an itemized list of the course registrations of a typical student in any major and at any student level and a separate computer program was developed to multiply each entry in these itemized lists by the appropriate department oriented costs.

The resulting student major oriented instructional costs per quarter for the average FTE student (carrying 15 credits as an undergraduate and 12 as a graduate) are presented in Tables 7 - 12, with each table corresponding to an individual college within the University. For lower division students, the total cost for courses taken (at all three course levels) ranged from $332 in sociology-social justice to $577 in aerospace and mechanical engineering. At the upper division student level the costs per quarter ranged from $363 in sociology-social justice to $880 in physics, while at the graduate student level the lowest cost of $282 occurred in commerce while the highest cost of $2,159 occurred in physics. A lower total cost at the graduate student level as compared to an undergraduate within a major is possible since

the total number of courses taken by a FTE graduate student is fewer than that of an undergraduate student.

Costs per quarter were not reported in a student major area at a given level if, at the undergraduate levels, fewer than five students registered, or at the graduate level, fewer than three students registered in the given major. The number of student registrations occurring at each level within each major is listed in Table 7 through Table 12 above the corresponding costs per quarter.

TABLE 7

INSTRUCTIONAL COSTS PER QUARTER PER FTE STUDENT
BY STUDENT LEVEL, BY COURSE LEVEL, BY MAJOR

COLLEGE OF AGRICULTURE

Student Major	Agriculture	Agriculture Technology	Agriculture Business	Agriculture Economics (Graduate)	Agriculture Education	Agriculture Production
LOWER DIVISION STUDENTS	(350)	(43)	(141)		(81)	(328)
Lower Division Courses	398.47	311.53	336.94		344.19	300.30
Upper Division Courses	27.66	258.18	76.66		158.03	185.63
Graduate Courses	--	--	--		--	--
Total	426.13	569.71	413.60		502.22	485.93
UPPER DIVISION STUDENTS			(229)		(104)	(383)
Lower Division Courses			189.92		134.34	174.30
Upper Division Courses			291.43		447.14	355.11
Graduate Courses			--		29.96	121.98
Total			481.35		611.44	651.39
GRADUATE STUDENTS				(51)	(14)	
Lower Division Courses				31.38	--	
Upper Division Courses				221.03	159.31	
Graduate Courses				527.08	784.82	
Total				779.49	944.13	

TABLE 7 (continued

Student Major	Agriculture Production-Agronomy	Agriculture Production-Animal Science	Agriculture Production Range Management	Agriculture Production Recreation Area Management	Agricultural Science	Agricultural Science-Animal Science
LOWER DIVISION STUDENTS	(9)	(31)	(23)	(9)	(58)	(17)
Lower Division Courses	265.16	399.90	401.68	354.58	308.46	283.75
Upper Division Courses	181.99	70.67	64.12	82.19	159.03	180.54
Graduate Courses	--	--	--	--	--	--
Total	477.15	470.57	465.80	436.77	467.49	464.29
UPPER DIVISION STUDENTS		(12)		(6)	(136)	(6)
Lower Division Courses		319.99		152.86	145.24	235.58
Upper Division Courses		113.84		392.25	380.14	276.18
Graduate Courses		--		--	--	--
Total		433.83		545.11	551.86	511.76
GRADUATE STUDENTS						
Lower Division Courses						
Upper Division Courses						
Graduate Courses						
Total						

TABLE 7 (continued

Student Major	Agricultural Science-Crops	Agronomy (Graduate)	Animal Science (Graduate)	Crop and Soil Science (Graduate)	Economics	Plant Pathology (Graduate)	Pre-Veterinary Medicine
LOWER DIVISION STUDENTS					(40)		(271)
Lower Division Courses					291.24		359.72
Upper Division Courses					141.24		33.89
Graduate Courses					--		--
Total					432.48		393.61
UPPER DIVISION STUDENTS	(6)				(63)		(40)
Lower Division Courses	214.96				162.79		319.21
Upper Division Courses	223.65				360.99		123.62
Graduate Courses	--				--		--
Total	438.61				523.78		442.83
GRADUATE STUDENTS		(21)	(18)	(25)		(3)	(4)
Lower Division Courses		6.93	12.69	2.56		--	25.62
Upper Division Courses		223.18	220.85	78.40		--	170.62
Graduate Courses		584.46	680.23	877.42		926.74	1410.65
Total		814.57	913.77	958.38		926.74	1606.89

TABLE 7 (continued)

Student Major	Pre-Forestry	Range Management (Graduate)	Soils (Graduate)
LOWER DIVISION STUDENTS	(12)		
Lower Division Courses	401.90		
Upper Division Courses	--		
Graduate Courses	--		
Total	401.90		
UPPER DIVISION STUDENTS			
Lower Division Courses			
Upper Division Courses			
Graduate Courses			
Total			
GRADUATE STUDENTS		(17)	(13)
Lower Division Courses		--	6.62
Upper Division Courses		171.70	111.41
Graduate Courses		743.26	863.42
Total		914.95	981.45

TABLE 8

INSTRUCTIONAL COSTS PER QUARTER PER FTE STUDENT
BY STUDENT LEVEL, BY COURSE LEVEL, BY MAJOR

COLLEGE OF EDUCATION

Student Major	Education (Graduate)	Elementary Education	Physical Education	Physical Education K-12	Physical Education Pre-Physical Therapy	Physical Education Secondary School	Secondary Education
LOWER DIVISION STUDENTS		(495)	(257)	(8)	(47)	(21)	(46)
Lower Division Courses		295.49	351.91	353.92	371.62	314.11	317.90
Upper Division Courses		121.79	43.84	87.57	19.43	74.37	106.58
Graduate Courses		.51	2.01	--	--	--	1.91
Total		417.79	397.76	441.49	391.05	388.48	426.39
UPPER DIVISION STUDENTS		(652)	(285)			(12)	(65)
Lower Division Courses		108.84	151.29			217.03	166.88
Upper Division Courses		369.29	256.13			161.71	332.11
Graduate Courses		3.57	10.54			--	1.05
Total		481.70	417.96			378.74	500.04
GRADUATE STUDENTS	(243)		(26)				
Lower Division Courses	6.06		2.56				
Upper Division Courses	81.18		42.79				
Graduate Courses	538.19		895.51				
Total	625.42		940.86				

TABLE 9

INSTRUCTIONAL COSTS PER QUARTER PER FTE STUDENT
BY STUDENT LEVEL, BY COURSE LEVEL, BY MAJOR

COLLEGE OF ENGINEERING

Student Major	Agricultural and Mechanical Engineering	Agricultural Engineering	Chemical Engineering	Civil Engineering	Computer Science	Construction Technology
LOWER DIVISION STUDENTS	(10)	(90)	(272)	(285)	(38)	(110)
Lower Division Courses	247.08	378.35	429.36	386.15	411.41	441.21
Upper Division Courses	330.34	88.45	72.69	91.66	101.12	38.45
Graduate Courses	--	--	--	--	--	--
Total	577.42	466.80	502.05	477.81	512.53	479.66
UPPER DIVISION STUDENTS		(56)	(298)	(287)	(23)	(145)
Lower Division Courses		91.74	63.54	81.39	154.37	180.85
Upper Division Courses		573.41	610.61	571.50	495.26	459.33
Graduate Courses		--	27.25	56.75	--	5.22
Total		665.15	701.40	709.64	649.63	645.40
GRADUATE STUDENTS	(9)	(6)	(64)	(46)		
Lower Division Courses	--	75.02	5.93	7.00		
Upper Division Courses	43.09	273.57	131.74	159.82		
Graduate Courses	1086.71	269.89	983.70	1295.72		
Total	1129.80	618.47	1121.37	1462.54		

TABLE 9 (continued)

Student Major	Electrical Engineering	Engineering Science	Industrial Arts	Industrial and Mechanical Engineering	Mechanical Engineering	Mechanical Technology
LOWER DIVISION STUDENTS	(316)	(12)	(73)	(67)	(198)	(75)
Lower Division Courses	433.50	370.54	390.27	336.54	315.63	359.91
Upper Division Courses	118.36	185.35	165.75	174.21	204.35	170.29
Graduate Courses	1.18	--	2.62	--	--	--
Total	553.04	555.89	558.64	510.75	519.98	530.20
UPPER DIVISION STUDENTS	(305)	(10)	(79)	(77)	(176)	(105)
Lower Division Courses	85.72	103.78	145.17	65.98	56.89	112.50
Upper Division Courses	667.96	570.88	538.16	606.39	732.88	634.35
Graduate Courses	33.39	35.43	--	58.71	1.76	--
Total	787.07	710.09	683.33	731.08	791.53	746.85
GRADUATE STUDENTS	(46)			(40)	(26)	
Lower Division Courses	3.08			15.33	5.98	
Upper Division Courses	131.26			225.73	173.95	
Graduate Courses	1130.16			680.79	817.40	
Total	1264.50			921.85	997.33	

TABLE 10

INSTRUCTIONAL COSTS PER QUARTER PER FTE STUDENT
BY STUDENT LEVEL, BY COURSE LEVEL, BY MAJOR

COLLEGE OF LETTERS AND SCIENCE

Student Major	Bio-Chemistry (Graduate)	Botany	Botany Biology Teaching	Chemistry	Earth Science	Earth Science Geography	Earth Science Geology	Earth Science Geophysics
LOWER DIVISION STUDENTS		(51)	(17)	(106)	(71)	(13)	(11)	(6)
Lower Division Courses		343.06	346.40	337.01	353.96	374.02	404.67	371.01
Upper Division Courses		59.30	22.73	106.57	66.96	66.09	--	32.36
Graduate Courses		--	--	--	--	--	--	--
Total		402.36	369.13	443.58	420.92	440.11	404.67	403.37
UPPER DIVISION STUDENTS		(80)	(5)	(69)	(119)	(5)		
Lower Division Courses		173.28	264.36	186.67	181.78	193.10		
Upper Division Courses		319.69	176.05	354.14	413.53	335.59		
Graduate Courses		5.48	--	71.43	12.11	--		
Total		498.45	440.41	612.24	607.42	528.69		
GRADUATE STUDENTS	(4)	(35)		(91)	(23)	(3)	(4)	
Lower Division Courses	--	9.80		3.91	--	--	--	
Upper Division Courses	37.52	129.25		55.11	212.84	164.16	238.78	
Graduate Courses	1054.17	808.84		1054.60	1064.85	1255.36	1029.47	
Total	1091.69	947.89		1113.62	1277.69	1419.52	1268.25	

TABLE 10 (continued)

Student Major	Earth Science Meteorology	English	English Literature and Composition	Entomology	Fish and Wildlife Management	Genetics (Graduate)	Government
LOWER DIVISION STUDENTS	(6)	(189)	(17)		(353)		(201)
Lower Division Courses	397.09	303.67	333.78		349.58		313.74
Upper Division Courses	--	115.45	38.61		36.95		67.07
Graduate Courses	--	1.00	--		--		--
Total	397.09	420.12	372.39		386.53		380.81
UPPER DIVISION STUDENTS		(206)			(257)		(143)
Lower Division Courses		136.09			204.96		138.47
Upper Division Courses		330.47			238.90		258.57
Graduate Courses		6.86			10.93		2.67
Total		473.42			454.79		399.71
GRADUATE STUDENTS				(7)	(50)	(8)	
Lower Division Courses				26.75	4.44	--	
Upper Division Courses				70.54	57.46	189.40	
Graduate Courses				884.66	974.25	703.78	
Total				981.95	1035.85	893.18	

TABLE 10 (continued)

Student Major	Government Pre-Law	History	History Teaching	Mathematics	Mathematics-Statistics	Mathematics-Teaching	Micro-Biology
LOWER DIVISION STUDENTS	(15)	(103)	(6)	(134)	(5)	(18)	(257)
Lower Division Courses	287.09	321.43	371.70	384.56	496.23	392.35	325.12
Upper Division Courses	96.95	88.32	130.09	41.39	--	18.07	75.14
Graduate Courses	--	--	--	--	--	--	--
Total	384.04	409.75	501.79	425.95	496.23	410.42	400.26
UPPER DIVISION STUDENTS		(169)		(191)		(6)	(351)
Lower Division Courses		145.02		209.27		333.72	169.30
Upper Division Courses		283.52		411.51		158.68	384.07
Graduate Courses		2.73		3.28		--	2.62
Total		431.27		624.06		492.40	555.99
GRADUATE STUDENTS		(13)	(3)	(59)			(59)
Lower Division Courses		7.50	--	31.25			57.17
Upper Division Courses		129.04	97.99	218.02			186.09
Graduate Courses		226.67	232.35	1095.37			660.70
Total		363.21	330.34	1344.64			903.96

TABLE 10 (continued)

Student Major	Microbiology Environmental Health	Microbiology Medical Technology	Modern Languages	Philosophy	Physics	Physics Professional	Pre-Medicine
LOWER DIVISION STUDENTS	(12)	(158)	(75)	(18)	(65)	(21)	(424)
Lower Division Courses	356.31	363.33	302.99	248.82	334.62	376.62	367.19
Upper Division Courses	5.13	16.13	186.53	163.87	195.43	76.42	23.15
Graduate Courses	--	1.53	3.11	--	--	--	1.13
Total	361.44	380.99	492.63	412.69	530.06	453.04	391.47
UPPER DIVISION STUDENTS		(17)	(46)	(18)	(50)		(120)
Lower Division Courses		203.63	154.02	176.52	93.02		214.84
Upper Division Courses		319.37	414.97	255.89	728.80		280.04
Graduate Courses		--	--	--	58.07		--
Total		523.00	568.99	432.41	879.89		494.88
GRADUATE STUDENTS	(3)				(41)		
Lower Division Courses	17.07				5.59		
Upper Division Courses	236.54				67.46		
Graduate Courses	451.05				2085.78		
Total	704.66				2158.83		

TABLE 10 (continued)

Student Major	Psychology	Sociology-Sociology	Sociology-Social Justice	Sociology-Social Welfare	Speech	Theatre Arts	Zoology
LOWER DIVISION STUDENTS	(163)	(459)	(28)	(27)	(40)	(38)	(78)
Lower Division Courses	286.62	259.55	298.36	282.43	300.44	285.33	352.95
Upper Division Courses	105.02	111.94	33.93	65.26	147.90	133.62	49.88
Graduate Courses	1.44	--	--	--	--	--	--
Total	393.08	371.49	332.29	347.69	448.34	418.95	402.83
UPPER DIVISION STUDENTS	(126)	(371)		(10)	(44)	(24)	(106)
Lower Division Courses	183.25	161.44		191.82	142.60	152.55	222.44
Upper Division Courses	259.80	264.60		171.55	408.58	303.56	222.85
Graduate Courses	22.63	3.91		--	9.95	--	27.34
Total	465.68	429.95		363.37	561.13	456.11	472.63
GRADUATE STUDENTS	(16)						(41)
Lower Division Courses	7.34						24.98
Upper Division Courses	52.59						115.30
Graduate Courses	807.70						761.43
Total	867.63						901.71

TABLE 11

INSTRUCTIONAL COSTS PER QUARTER PER FTE STUDENT
BY STUDENT LEVEL, BY COURSE LEVEL, BY MAJOR

COLLEGE OF PROFESSIONAL SCHOOLS

Student Major	Architecture	Art	Art-Professional Design	Business Education (Graduate)	Commerce	Commerce-Accounting	Commerce-Business Education	Commerce-Distributive Education
LOWER DIVISION STUDENTS	(461)	(358)	(12)		(904)	(91)	(21)	(14)
Lower Division Courses	423.00	318.52	281.05		301.69	345.62	349.64	288.97
Upper Division Courses	15.51	107.07	138.96		71.06	24.65	9.49	92.88
Graduate Courses	--	.91	--		--	--	--	--
Total	438.51	426.50	420.01		372.75	370.27	359.13	381.85
UPPER DIVISION STUDENTS	(274)	(242)			(836)	(19)		
Lower Division Courses	108.43	124.92			110.88	191.93		
Upper Division Courses	390.15	398.30			301.68	176.10		
Graduate Courses	336.02	6.86			8.45	--		
Total	834.60	530.08			421.01	368.03		
GRADUATE STUDENTS		(32)		(42)	(31)			
Lower Division Courses		6.95		11.02	61.62			
Upper Division Courses		58.18		126.62	220.61			
Graduate Courses		880.95		611.48	--			
Total		946.08		749.12	282.22			

TABLE 11 (continued)

Student Major	Commerce-Finance	Commerce-Management	Commerce-Marketing	Commerce-Secretarial	Film and Television	Film and Television-Motion Pictures	Film and Television-Photography
LOWER DIVISION STUDENTS	(20)	(49)	(20)	(29)	(301)	(9)	(36)
Lower Division Courses	318.44	343.50	369.71	324.45	346.36	346.46	374.90
Upper Division Courses	43.43	26.57	12.10	23.68	77.15	58.22	32.18
Graduate Courses	--	--	--	--	--	--	--
Total	361.87	370.07	381.81	348.13	423.51	404.68	407.08
UPPER DIVISION STUDENTS		(13)			(242)		
Lower Division Courses		148.46			192.51		
Upper Division Courses		236.74			340.99		
Graduate Courses		--			1.78		
Total		385.20			535.28		
GRADUATE STUDENTS							
Lower Division Courses							
Upper Division Courses							
Graduate Courses							
Total							

TABLE 11 (continued)

Student Major	Film and Television-Television	Home Economics	Home Economics-Family Life	Music	Music Education K-12	Nursing
LOWER DIVISION STUDENTS	(5)	(560)	(8)	(175)	(6)	(1367)
Lower Division Courses	334.33	302.89	308.57	509.36	475.37	343.66
Upper Division Courses	82.30	52.77	27.63	67.54	30.78	65.92
Graduate Courses	--	.90	--	--	--	--
Total	416.63	356.56	336.20	576.90	506.15	409.58
UPPER DIVISION STUDENTS		(507)		(101)		(879)
Lower Division Courses		126.80		279.43		57.65
Upper Division Courses		319.43		301.58		620.20
Graduate Courses		4.26		5.18		4.56
Total		450.49		586.19		682.41
GRADUATE STUDENTS		(33)				(50)
Lower Division Courses		4.74				1.64
Upper Division Courses		94.05				82.58
Graduate Courses		717.66				1353.46
Total		816.45				1437.68

TABLE 12

INSTRUCTIONAL COSTS PER QUARTER PER FTE STUDENT
BY STUDENT LEVEL, BY COURSE LEVEL, BY MAJOR

OTHER DEPARTMENTS WITHIN THE UNIVERSITY

Student Major	Non-Degree (Graduate)	General Studies
LOWER DIVISION STUDENTS		(1651)
Lower Division Courses		346.29
Upper Division Courses		33.86
Graduate Courses		--
Total		380.15
UPPER DIVISION STUDENTS		(17)
Lower Division Courses		163.48
Upper Division Courses		268.02
Graduate Courses		89.23
Total		520.73
GRADUATE STUDENTS	(388)	(6)
Lower Division Courses	53.56	74.30
Upper Division Courses	199.20	382.83
Graduate Courses	339.82	119.73
Total	592.58	576.86

Student Oriented Instructional
Costs Per Bachelor's Degree Granted

The following tables present, by student major, the student oriented instructional costs per bachelor's degree. This might seem to follow obviously from the preceding results, with the cost of a particular degree being obtained by simply multiplying both the corresponding lower division and upper division costs per quarter by approximately six (quarters) and summing the product to obtain the total cost for a normal (generally twelve quarter) baccalaureate program. In practice, however, a complication arose. The previous table listed 350 lower division students majoring in agriculture with essentially no upper division (or graduate) student enrolled in this major. Such patterns were not uncommon and will occur whenever departments encourage lower division students to register in a general discipline area before deciding upon a more specific student major. It would seem reasonable to assume that for a student graduating in one of the more specific agricultural majors, it would be possible to compute the cost of his degree on the basis of two years in the general area and two years in the specific area. However, a problem would still remain since, apparently, not all such students initially register under the general major, or the individual students decide on specific majors at different points in their academic careers. For these reasons, a weighted (by student enrollment) average lower division cost per quarter was

computed for agriculture in general from the lower division costs per quarter listed for the various specific agricultural majors. Thus, some lower division costs per quarter listed in Tables 7 - 12 will not appear individually in Tables 13 - 18.

A further refinement was made in that the total cost per quarter, by student level, was divided by the corresponding number of credits taken by an FTE student at each level. The resulting student major oriented costs per student credit hour were then multiplied by the number of credits required for graduation as described in Chapter 3.

In considering the course load for only one typical FTE student the terms student credit hour and credit hour are interchangeable (since the number of credit hours is multiplied by one to obtain the SCH). Thus the cost per degree corresponds to one-half of the required number of credits needed for graduation multiplied by the lower division cost per SCH and plus one-half of the required number multiplied by the upper division cost per SCH.

The student major oriented costs per SCH at the lower division student level ranged from $23.18 in sociology-social welfare to $38.46 in music. At the upper division student level, the range was from $24.22 in sociology-social welfare to $58.66 in physics.

The total cost per bachelor's degree granted ranged from $4,730 in commerce-accounting to $9,210 in physics for a four year program. The five year program in architecture was found to have an

instructional cost of $10,270 per degree granted.

Tables 13 through 18 present student major oriented costs by college and by student major.

TABLE 13

STUDENT ORIENTED INSTRUCTIONAL COSTS PER BACHELOR'S DEGREE GRANTED

COLLEGE OF AGRICULTURE

Student Major	Lower Division Costs		Upper Division Costs		Credits Needed for Graduation	Cost Per Degree
	Per Quarter*	Per SCH	Per Quarter	Per SCH		
Agriculture Business	[454.49]	30.30	481.35	32.09	192	$5990
Agriculture Education	454.49	30.30	611.44	40.76	192	$6820
Agriculture Production	454.49	30.30	651.39	43.43	192	$7080
Agriculture Production-Animal Science	454.49	30.30	433.83	28.92	192	$5690
Agriculture Production-Recreation Area Management	454.49	30.30	545.11	36.34	192	$6400
Agricultural Science	454.49	30.30	551.86	36.79	192	$6440
Agricultural Science-Animal Science	454.49	30.30	511.76	34.11	192	$6180
Agricultural Science-Crops	454.49	30.30	438.61	29.24	192	$5720
Economics	432.48	28.83	523.78	34.92	192	$6120
Pre-Veterinary	393.61	26.24	442.83	29.52	192	$5353

*The lower division costs in brackets represent a weighted average of the costs for the corresponding student majors.

TABLE 14

STUDENT ORIENTED INSTRUCTIONAL COSTS PER BACHELOR'S DEGREE GRANTED

COLLEGE OF EDUCATION

Student Major	Lower Division Costs		Upper Division Costs		Credits Needed for Graduation	Cost Per Degree
	Per Quarter	Per SCH	Per Quarter	Per SCH		
Elementary Education	417.79	27.85	481.70	32.11	192	$5760
Physical Education	397.76	26.52	417.96	27.86	198	$5380
Physical Education-Secondary School	388.48	25.90	378.74	25.24	198	$5060
Secondary Education	426.39	28.43	500.04	33.34	192	$5230

TABLE 15

STUDENT ORIENTED INSTRUCTIONAL COSTS PER BACHELOR'S DEGREE GRANTED

COLLEGE OF ENGINEERING

Student Major	Lower Division Costs		Upper Division Costs		Credits Needed for Graduation	Cost Per Degree
	Per Quarter	Per SCH	Per Quarter	Per SCH		
Agricultural Engineering	466.80	31.12	665.15	44.34	192	$7240
Chemical Engineering	502.05	33.47	701.40	46.76	192	$7700
Civil Engineering	477.81	31.85	709.64	47.31	192	$7600
Computer Science	512.53	34.17	649.63	43.31	192	$7440
Construction Technology	479.66	31.98	645.40	43.03	192	$7200
Electrical Engineering	553.04	36.87	787.07	52.47	192	$8580
Industrial Arts	558.64	37.24	683.33	45.56	192	$7950
Industrial and Mechanical Engineering	510.75	34.05	731.08	48.74	192	$7950
Mechanical Engineering	519.98	34.67	791.53	52.77	192	$8390
Mechanical Technology	530.20	35.35	746.85	49.79	192	$8170
Engineering Science	555.89	37.06	710.09	47.34	192	$8100

TABLE 16

STUDENT ORIENTED INSTRUCTIONAL COSTS PER BACHELOR'S DEGREE GRANTED

COLLEGE OF LETTERS AND SCIENCE

Student Major	Lower Division Costs		Upper Division Costs		Credits Needed for Graduation	Cost Per Degree
	Per Quarter	Per SCH	Per Quarter	Per SCH		
Botany	402.36	26.82	498.45	33.23	192	$5770
Botany-Biology Teaching	369.13	24.61	440.41	29.36	192	$5180
Chemistry	443.48	29.57	612.24	40.82	200	$7040
Earth Science	420.92	28.06	607.42	40.49	192	$6580
Earth Science-Geography	440.11	29.34	528.69	35.25	192	$6200
English	420.12	28.00	473.42	31.56	192	$5720
Fish and Wildlife Management	386.53	25.77	454.79	30.32	192	$5380
Government	380.81	25.39	399.71	26.65	192	$5000
History	409.75	27.32	431.27	28.75	192	$5380
Mathematics	425.95	28.40	624.06	41.60	198	$6930
Mathematics-Teaching	410.42	27.36	492.40	32.83	192	$5780
Micro-biology	400.26	26.68	555.99	37.07	192	$6120

TABLE 16 (continued)

Student Major	Lower Division Costs		Upper Division Costs		Credits Needed for Graduation	Cost Per Degree
	Per Quarter	Per SCH	Per Quarter	Per SCH		
Micro-biology - Medical Technology	380.99	25.40	523.00	34.87	192	$5790
Modern Languages	492.63	32.84	568.99	37.93	192	$6790
Philosophy	412.69	27.51	432.41	28.82	192	$5410
Physics	530.06	35.34	879.89	58.66	196	$9210
Pre-Medicine	391.47	26.10	494.88	32.99	192	$5670
Psychology	393.08	26.20	465.68	31.05	192	$5500
Sociology	371.49	24.77	429.95	28.66	192	$5130
Sociology - Social Welfare	347.69	23.18	363.37	24.22	192	$4550
Speech	448.34	29.89	561.13	37.41	192	$6460
Theatre Arts	418.95	27.93	456.11	30.41	192	$5600
Zoology	402.83	26.86	472.63	31.51	192	$5600

TABLE 17

STUDENT ORIENTED INSTRUCTIONAL COSTS PER BACHELOR'S DEGREE GRANTED

COLLEGE OF PROFESSIONAL SCHOOLS

Student Major	Lower Division Costs		Upper Division Costs		Credits Needed for Graduation	Cost Per Degree
	Per Quarter	Per SCH	Per Quarter	Per SCH		
Architecture*	438.51	29.23	834.60	55.64	242	$10,270
Art	426.50	28.43	530.08	35.34	192	$ 6,120
Commerce	372.75	24.85	421.01	28.07	192	$ 5,080
Commerce-Accounting	370.27	24.68	368.03	24.53	192	$ 4,730
Commerce-Management	370.07	24.67	385.20	25.68	192	$ 4,830
Film and Television	423.51	28.23	535.28	35.68	192	$ 6,140
Home Economics	356.56	23.77	450.49	30.03	192	$ 5,170
Music	576.90	38.46	586.19	39.08	199	$ 7,720
Nursing	409.58	27.31	682.41	45.49	192	$ 6,990

*Five Year Program

TABLE 18

STUDENT ORIENTED INSTRUCTIONAL COSTS PER BACHELOR'S DEGREE GRANTED

OTHER DEPARTMENTS WITHIN THE UNIVERSITY

Student Major	Lower Division Costs		Upper Division Costs		Credits Needed for Graduation	Cost Per Degree
	Per Quarter	Per SCH	Per Quarter	Per SCH		
General Studies	380.15	25.34	520.73	34.72	No Degree Awarded	

Student Oriented Instructional
Costs Per Master's Degree Granted by Field of Knowledge

Tables 19 through 27 present the student oriented costs per student credit hour at the graduate level, obtained by dividing the previously presented costs per FTE student per quarter by the defined FTE credit hour load (12 credits at the graduate level). These graduate level costs per SCH (or per credit in the case of only one average student) were used for both master's degree and doctoral degree cost computation, and are accompanied in the tables by the number of student registrations (in parentheses) on which each was based. Similarly, the average number of credits taken in pursuit of a master's degree are presented with the number of degrees, upon which the averages were based, appearing in parentheses.

Since the reliability of the resulting costs per degree is dependent upon both these figures, a reliability index ranging from 0 to 100, has been included for the benefit of the reader. This index was obtained by multiplying the number of degrees and the number of student registrations, for each field of knowledge considered in the study, and by then dividing each product by the largest product so obtained. For convenience, the decimal point was omitted and the index for each field was inserted in parentheses following the cost for that degree.

The highest index rating occurred for master's degrees in

business education with registration data based on forty two student registrations and program length based on fifteen degrees actually awarded. The lowest index rating occurred for master's degrees costs in commerce, being based on only three student registrations and one degree awarded.

The average number of credits taken in the pursuit of a master's degree varied from forty six in electrical engineering and English to eighty in fish and wildlife with zoology and nursing also requiring comparatively long program lengths. Notable variations in the program lengths of individual students were also found within fields of knowledge.

The lowest student oriented instructional cost per master's degree; $1,210; occurred in the field of commerce with the highest cost; $9,170; appearing for a degree in physics. Large variations occurred within the College of Letters and Science while costs per master's degree in the College of Education were uniformly low.

TABLE 19

STUDENT ORIENTED INSTRUCTIONAL COSTS PER MASTER'S DEGREE GRANTED

COLLEGE OF AGRICULTURE

Field of Knowledge	Cost per 12 cr. Quarter[1]	Cost per Credit Taken	Average Credit Per Degree[2]	Cost per Degree[3]
Agricultural Economics	779.49 (51)	64.96	50 (4)	$3250 (32)
Agriculture Education	944.13 (14)	78.68	53 (5)	$4170 (11)
Agronomy	814.57 (21)	67.88	67 (2)	$4550 (6)
Animal Science	913.77 (29)	76.15	58 (6)	$4420 (27)
Range Management	914.95 (17)	76.25	67 (4)	$5110 (10)
Soils	981.45 (13)	81.79	67 (5)	$5480 (10)

1. Each cost per quarter is followed, in parentheses, by the number of graduate student registrations on which it was based.
2. Each average number of credits taken per degree is followed, in parentheses, by the number of Master's degrees on which it was based.
3. Each cost per degree granted is followed, in parentheses, by a reliability index, discussed in the text, ranging from 0 to 100.

TABLE 20

STUDENT ORIENTED INSTRUCTIONAL COSTS PER MASTER'S DEGREE GRANTED

COLLEGE OF EDUCATION

Field of Knowledge	Cost Per 12 Credit Quarter[1]	Cost Per Credit Taken	Average Credit Per Degree[2]	Cost Per Degree[3]
Education Administration	625.42 (8)*	52.12*	59 (6)	$3080 (8)
Education Adult	625.42 (8)	52.12	59 (1)	$3080 (2)
Education Counseling	625.42 (8)	52.12	61 (18)	$3180 (23)
Education Elementary	625.42 (8)	52.12	55 (7)	$2870 (9)
Education Higher	625.42 (8)	52.12	60 (2)	$3130 (2)
Education - Physical Education	940.86 (26)	78.41	49 (4)	$3840 (17)
Education Secondary	625.42 (8)	52.12	53 (8)	$2760 (10)

*Except for Physical Education, all graduate students in education registered in one general major. For purposes of the index, all component areas within education were assigned an equal portion of the total enrollment.

1. Each cost per quarter is followed, in parentheses, by the number of graduate student registrations on which it was based.
2. Each average number of credits taken per degree is followed, in parentheses, by the number of Master's degrees on which it was based.
3. Each cost per degree granted is followed, in parentheses, by a reliability index, discussed in the text, ranging from 0 to 100.

TABLE 21

STUDENT ORIENTED INSTRUCTIONAL COSTS PER MASTER'S DEGREE GRANTED

COLLEGE OF ENGINEERING

Field of Knowledge	Cost Per 12 Credit Quarter[1]	Cost Per Credit Taken	Average Credit Per Degree[2]	Cost Per Degree[3]
Agricultural and Mechanical Engineering	1129.80 (9)	94.15	51 (7)	$4800 (10)
Agricultural Engineering	618.47 (6)	51.54	59 (1)	$3040 (1)
Chemical Engineering	1121.37 (64)	93.45	52 (7)	$4860 (71)
Civil Engineering	1462.54 (46)	121.88	52 (11)	$6340 (80)
Electrical Engineering	1264.50 (46)	105.39	46 (6)	$4850 (44)
Industrial and Mechanical Engineering	941.85 (40)	76.82	58 (8)	$4460 (51)

1. Each cost per quarter is followed, in parentheses, by the number of graduate student registrations on which it was based.
2. Each average number of credits taken per degree is followed, in parentheses, by the number of Master's degrees on which it was based.
3. Each cost per degree granted is followed, in parentheses, by a reliability index, discussed in the text, ranging from 0 to 100.

TABLE 22

STUDENT ORIENTED INSTRUCTIONAL COSTS PER MASTER'S DEGREE GRANTED

COLLEGE OF LETTERS AND SCIENCE

Field of Knowledge	Cost Per 12 Credit Quarter[1]	Cost Per Credit Taken	Average Credit Per Degree[2]	Cost Per Degree[3]
Botany	947.89 (35)	78.99	57 (3)	$4500 (17)
Chemistry	1113.62 (91)	92.80	54 (4)	$5010 (58)
Earth Science	1290.85 (30)	107.57	51 (4)	$5490 (19)
Entomology	981.95 (7)	81.83	63 (1)	$5160 (1)
Fish and Wildlife	1035.85 (50)	86.32	80 (9)	$6910 (71)
History	363.21 (13)	30.27	49 (4)	$1480 (8)
Mathematics	1344.64 (59)	112.05	58 (5)	$6500 (47)
Micro-Biology	903.96 (62)	75.33	61 (7)	$4600 (69)
Physics	2158.83 (41)	179.86	51 (1)	$9170 (6)
Psychology	867.63 (16)	72.30	50 (2)	$3620 (5)
Zoology	901.71 (41)	75.14	74 (4)	$5560 (26)

1. Each cost per quarter is followed, in parentheses, by the number of graduate student registrations on which it was based.
2. Each average number of credits taken per degree is followed, in parentheses, by the number of Master's degrees on which it was based.
3. Each cost per degree granted is followed, in parentheses, by a reliability index, discussed in the text, ranging from 0 to 100.

TABLE 23

STUDENT ORIENTED INSTRUCTIONAL COSTS PER MASTER'S DEGREE GRANTED

COLLEGE OF PROFESSIONAL SCHOOLS

Field of Knowledge	Cost Per 12 Credit Quarter[1]	Cost Per Credit Taken	Average Credit Per Degree[2]	Cost Per Degree[3]
Art	946.08 (32)	78.84	47 (7)	$3710 (35)
Business Education	749.12 (42)	62.43	53 (15)	$3310 (100)
Commerce	282.22 (3)	23.52	52 (1)	$1210 (1)
Home Economics	816.45 (33)	68.04	52 (7)	$3540 (37)
Nursing	1437.68 (50)	119.81	72 (9)	$8630 (71)

1. Each cost per quarter is followed, in parentheses, by the number of graduate student registrations on which it was based.
2. Each average number of credits taken per degree is followed, in parentheses, by the number of Master's degrees on which it was based.
3. Each cost per degree granted is followed, in parentheses, by a reliability index, discussed in the text, ranging from 0 to 100.

Instructional Costs Per Doctoral Degree Granted by Field of Knowledge

The instructional costs per doctoral degree, listed in Tables 24 through 27, were computed in the same manner as those for master's degrees but the reader should be cautioned that for a variety of reasons, the results for doctoral degrees possess less reliability than the results for master's degrees. In particular, it should be noted that, in any field of knowledge, graduate students are reported as a whole and, while fifty graduate student registrations may have been considered in the ICLM, it is possible that only five of these were at the doctoral level and, hence, this portion of the reliability index as it applies to the doctoral degrees may overstate the reliability in comparison to that for master's degrees. The following tables include results based only on students who obtained a doctoral degree after having first completed a master's degree. Results for those persons who obtained a doctorate directly following their baccaluareate degree (as sometimes occurred in chemistry) are not reported in this study.

The average program lengths at the doctoral level varied from 73 credits in microbiology (not considering the one student program in secondary education with 60 credits) to 117 credits in chemistry.

A wide variation, relative to the variations in costs for baccalaureate and master's degrees, was found in the student oriented instructional costs per doctoral degree granted. A doctorate in

secondary education was found to have an average cost of $3,130 while doctorates in physics cost an average of $16,370. As at the master's degree level, the College of Education showed little variation in costs per doctoral degrees awarded with generally low costs as compared to costs per degrees in other colleges.

TABLE 24

STUDENT ORIENTED INSTRUCTIONAL COSTS PER DOCTORAL DEGREE GRANTED

COLLEGE OF AGRICULTURE

Field of Knowledge	Cost Per 12 Credit Quarter[1]	Cost Per Credit Taken	Average Credit Per Degree[2]	Cost Per Degree[3]
Agriculture Economics	779.49 (51)	64.96	112 (3)	$7280 (24)
Crop and Soil Science	958.38 (25)	79.87	95 (14)	$7590 (55)

1. Each cost per quarter is followed, in parentheses, by the number of graduate student registrations on which it was based.

2. Each average number of credits taken per degree is followed, in parentheses, by the number of Doctoral degrees on which it was based.

3. Each cost per degree granted is followed, in parentheses, by a reliability index, discussed in the text, ranging from 0 to 100.

TABLE 25

STUDENT ORIENTED INSTRUCTIONAL COSTS PER DOCTORAL DEGREE GRANTED

COLLEGE OF EDUCATION

Field of Knowledge	Cost Per 12 Credit Quarter[1]	Cost Per Credit Taken	Average Credit Per Degree[2]	Cost Per Degree[3]
Education Administration	625.42 (8)*	52.12	107 (8)	$5580 (10)
Education Elementary	625.42 (8)	52.12	107 (5)	$5580 (6)
Education Higher	625.42 (8)	52.12	101 (14)	$5260 (11)
Education Secondary	625.42 (8)	52.12	60 (1)	$3130 (2)
Education Student Personnel	625.42 (8)	52.12	79 (2)	$4120 (2)

*All graduate students in education were classified in one category. For purposes of the index, all areas within education were assigned an equal number.

1. Each cost per quarter is followed, in parentheses, by the number of graduate student registrations on which it was based.
2. Each average number of credits taken per degree is followed, in parentheses, by the number of Doctoral degrees on which it was based.
3. Each cost per degree granted is followed, in parentheses, by a reliability index, discussed in the text, ranging from 0 to 100.

TABLE 26

STUDENT ORIENTED INSTRUCTIONAL COSTS PER DOCTORAL DEGREE GRANTED

COLLEGE OF ENGINEERING

Field of Knowledge	Cost Per 12 Credit Quarter[1]	Cost Per Credit Taken	Average Credit Per Degree[2]	Cost Per Degree[3]
Aerospace and Mechanical Engineering	1129.80 (9)	94.15	86 (2)	$ 8,100 (3)
Chemical Engineering	1121.37 (64)	93.45	137 (4)	$12,800 (41)
Civil Engineering	1462.54 (46)	121.88	111 (4)	$13,530 (29)
Electrical Engineering	1264.50 (46)	105.38	86 (7)	$ 9,060 (51)

1. Each cost per quarter is followed, in parentheses, by the number of graduate student registrations on which it was based.

2. Each average number of credits taken per degree is followed, in parentheses, by the number of Doctoral degrees on which it was based.

3. Each cost per degree granted is followed, in parentheses, by a reliability index, discussed in the text, ranging from 0 to 100.

TABLE 27

STUDENT ORIENTED INSTRUCTIONAL COSTS PER DOCTORAL DEGREE GRANTED

COLLEGE OF LETTERS AND SCIENCE

Field of Knowledge	Cost Per 12 Credit Quarter[1]	Cost Per Credit Taken	Average Credit Per Degree[2]	Cost Per Degree[3]
Chemistry	1113.62 (91)	92.80	117 (5)	$10,860 (72)
Fish and Wildlife	1035.85 (50)	86.32	102 (1)	$ 8,800 (8)
Mathematics	1344.64 (59)	112.05	104 (8)	$11,650 (75)
Microbiology	903.96 (59)	75.33	73 (8)	$ 5,500 (75)
Physics	2158.83 (41)	179.90	91 (3)	$16,370 (19)
Zoology	901.71 (41)	75.14	74 (4)	$ 5,560 (26)

1. Each cost per quarter is followed, in parentheses, by the number of graduate student registrations on which it was based.
2. Each average number of credits taken per degree is followed, in parentheses, by the number of Doctoral degrees on which it was based.
3. Each cost per degree granted is followed, in parentheses, by a reliability index, discussed in the text, ranging from 0 to 100.

Department Oriented Compared to
Student Major Oriented Instructional Costs Per Student Credit Hour

In Table 5 of this chapter, the department oriented lower division instructional cost per SCH taught by the music department was reported to be a relatively high $46.68. However, in Table 17, the student oriented instructional cost per SCH for courses taken by a lower division music major was reported as $38.46. This apparent discrepancy is due to the fact, as discussed in Chapter 3 with student majors (a) and (b) that, while costs for music instruction are found to be relatively high, students majoring in music take a significant portion of their coursework in other (less expensive) departments. Table 5 also lists a comparatively low department oriented lower division cost of $17.88 per SCH offered by the department of home economics, while in Table 17 the cost per SCH for a lower division student majoring in home economics is $23.77. Thus, while the department oriented costs at this level in the College of Professional Schools have a total variation of $28.80, the total variation for the corresponding student major oriented costs per SCH is only $14.69. This dampening effect will generally prevail at the lower division and upper division levels, but with less effect (since graduate students tend to take courses only in their own department) at the graduate level. The following illustrations, based on ten randomly chosen departments and student majors portray this effect. The departments and student majors

were chosen independently and do not necessarily correspond to the same field of knowledge.

The illustrations and the table of arithmetic means and standard deviations following them illustrate two tendencies. First, a dampening effect does occur (as it theoretically must) on the differences in costs by field when a student oriented method of computing costs per SCH is used. Secondly, the mean student oriented cost per SCH is higher than the mean department oriented cost per SCH at the lower division and upper division levels with the reverse being true at the graduate level. While the cause for this trend may not appear to follow intuitively, it is actually simply the result of the same dampening process operating on course levels in addition to subject areas, i.e., lower division students do not take only relatively inexpensive lower division courses while graduate students do not take only relatively expensive graduate courses.

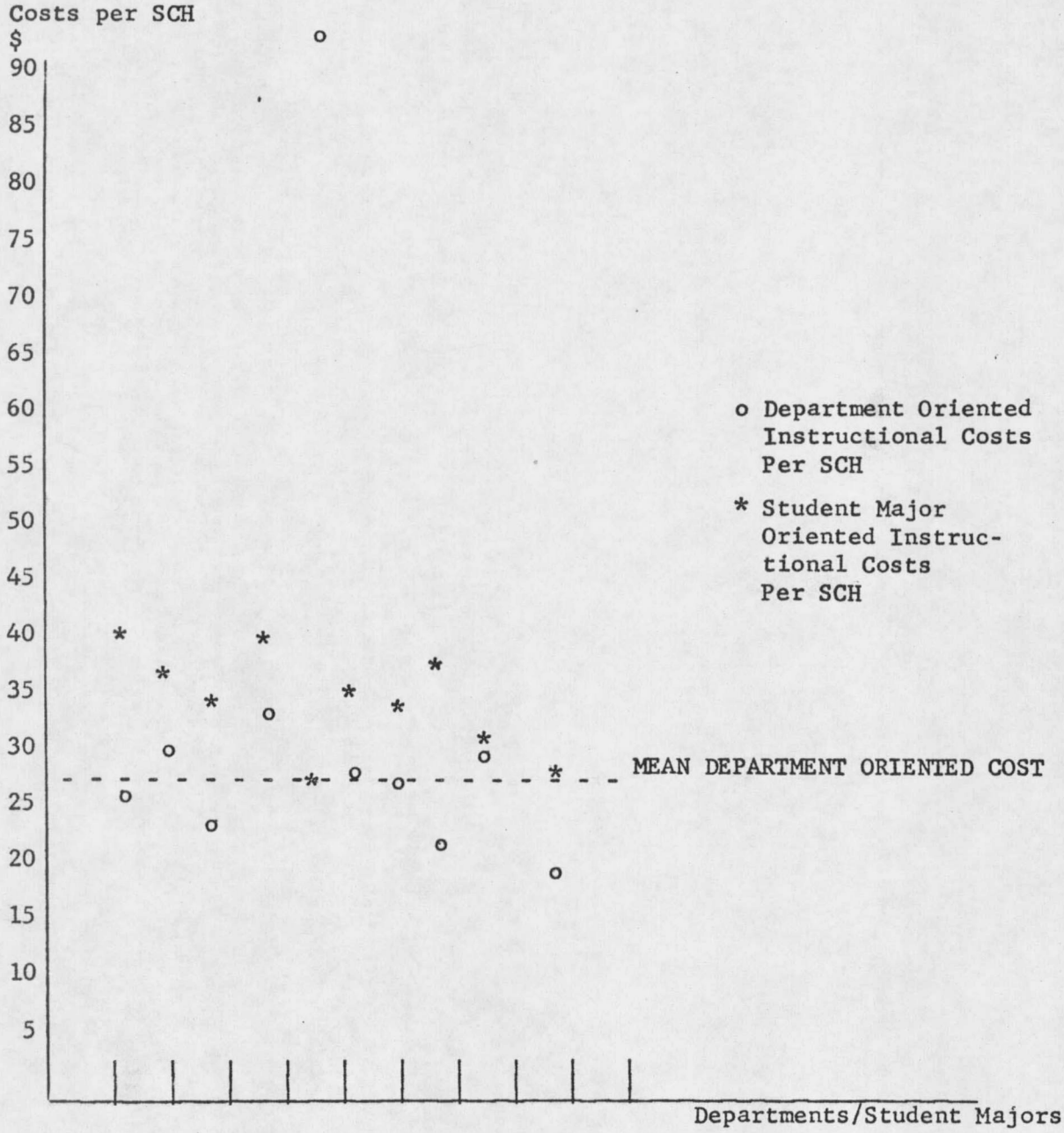

FIGURE 9

COMPARISON OF LOWER DIVISION DEPARTMENT ORIENTED AND STUDENT MAJOR ORIENTED INSTRUCTIONAL COSTS PER SCH

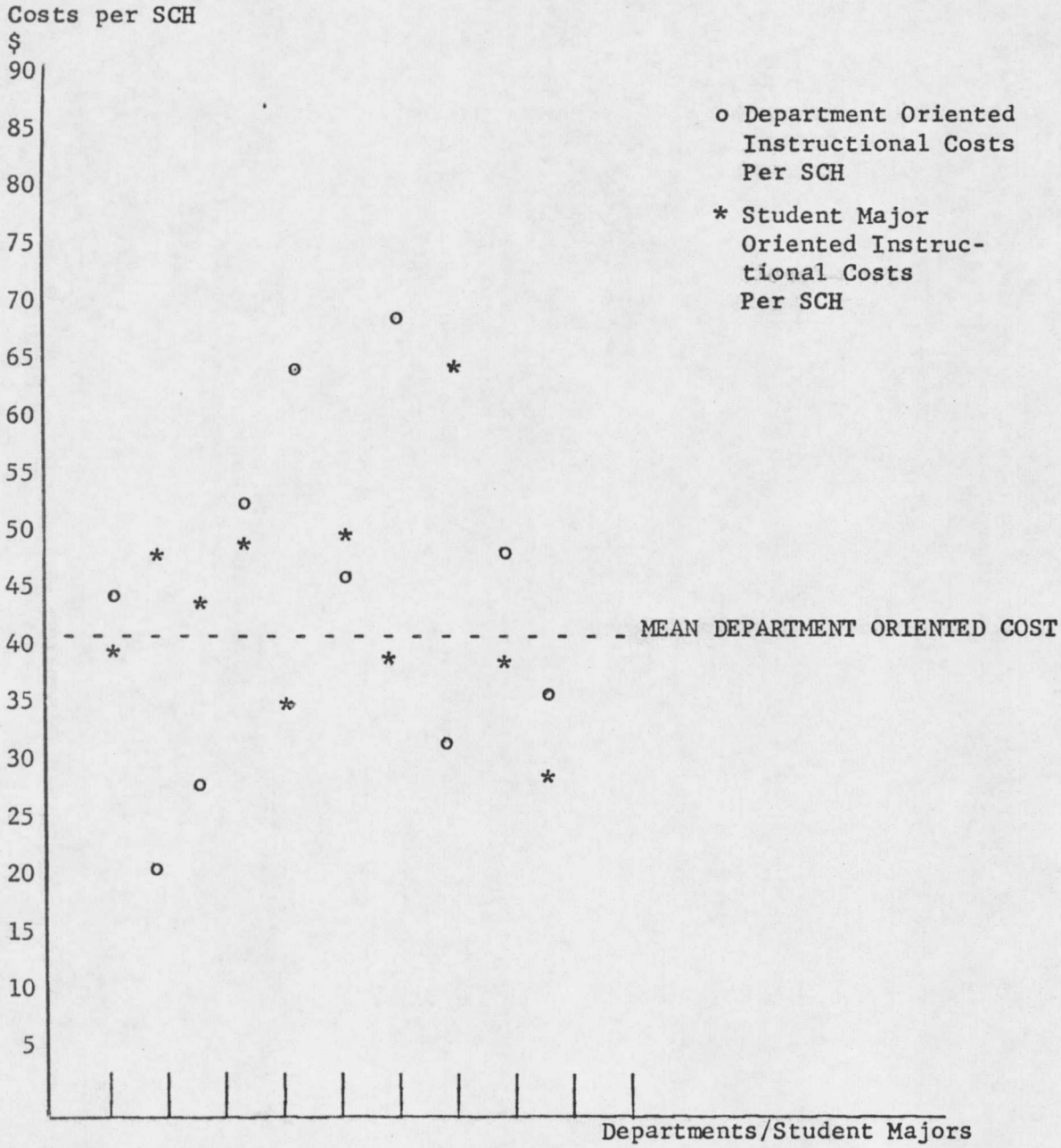

FIGURE 10

COMPARISONS OF UPPER DIVISION DEPARTMENT ORIENTED AND STUDENT MAJOR ORIENTED INSTRUCTIONAL COSTS PER SCH

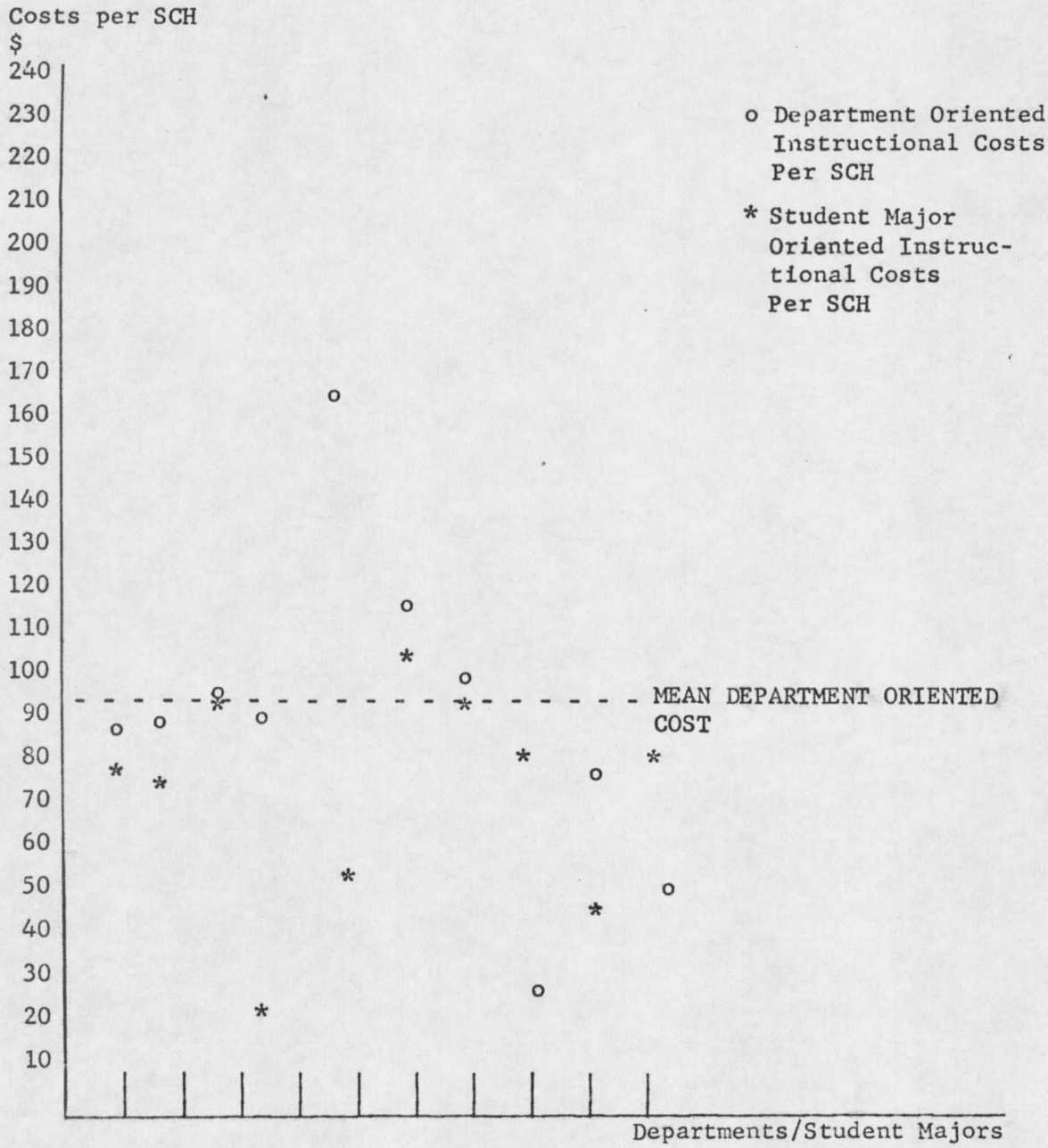

FIGURE 11

COMPARISONS OF GRADUATE DEPARTMENT ORIENTED AND STUDENT MAJOR ORIENTED INSTRUCTIONAL COSTS PER SCH

The arithmetic means in Table 28 represent the weighted averages of costs presented in previous tables. Student major oriented costs were weighted by the number of student registrations reported in each major while the department oriented costs were weighted by the number of student credit hours produced by each department. Since costs for a few departments (i.e., those reorganized during the fiscal year) were not reported individually in earlier tables, but were used in total MSU computations, a minor variation occurs between the averages reported in Table 28 and those reported as MSU totals in Table 5.

The fact that, at the lower division level, the average student major oriented cost ($27.87) is higher than the average department oriented cost ($26.46) demonstrates that lower division students take a portion of their coursework in the more expensive higher levels. The reverse situation is found at the graduate level.

The dampening effect across student majors or departments is demonstrated by the lower standard deviations of the student major oriented costs. These lower standard deviations are the result of fewer extremes in costs per SCH among the student majors which are in turn due to considerations of student courseloads through the use of the ICLM.

TABLE 28

ARITHMETIC MEANS AND STANDARD DEVIATIONS OF STUDENT MAJOR ORIENTED AND DEPARTMENT ORIENTED INSTRUCTIONAL COSTS PER SCH

	Lower Division	Upper Division	Graduate
Arithmetic Means			
Student Major Oriented	$27.87	$37.51	$74.95
Department Oriented	$26.46	$40.15	$93.39
Standard Deviations			
Student Major Oriented	$ 3.44	$ 8.44	$28.13
Department Oriented	$ 7.92	$12.36	$36.38

The dampening effects in costs per SCH displayed in the preceding illustrations would become magnified if those costs were used to compute costs per degree. Although a detailed department oriented investigation of the costs per degrees granted was not included in this study, several approximate department oriented costs per degree have been estimated. These are provided for the purpose of illustrating differences in the range of costs likely to be produced by the two methods. As listed earlier, the cost per bachelor's degree using student major oriented costs per SCH ranged from $4,730 in commerce-accounting to $9,210 in physics. If program lengths had simply been

applied to the lowest and highest department oriented costs per SCH, the range would have been from $4,810 in psychology to $14,660 in electrical engineering. The assumption of equal amounts of lower division and upper division coursework used in this second method apparently resulted in an increase in the cost of an accounting degree, ranking it slightly above that for psychology.

Student major oriented costs per master's degree granted ranged from $1,210 in commerce to $9,170 in physics. The use of a department oriented method would have resulted in instructional costs per master's degree of $1,640 in history and $11,810 in nursing.

Finally, student major oriented doctoral degree costs ranged from $3,130 in secondary education to $16,370 in physics, while the department oriented costs per doctoral degree would have been $3,140 in secondary education and $17,610 in physics.

CHAPTER 5

SUMMARY

This study was undertaken as a result of increased attention being focused at the local, state, and national levels on the costs of higher education. The purpose of this study was to provide relatively objective information on the instructional costs of degrees for consideration in making internal and external decisions regarding the operation of Montana State University.

PROBLEM OF THE STUDY

The specific problem of this study was to develop a method of cost analysis which could provide answers to the following questions: (1) What are the instructional costs per quarter for a full-time equivalent student in each academic major at the baccalaureate, master's and doctoral levels? and (2) What are the total instructional costs per student for the baccaluareate, master's and doctoral degrees in each academic major?

REVIEW OF RELATED LITERATURE

A review of the related literature revealed a great deal of current interest in unit costs in higher education, but no standard or uniform methodologies for cost analyses were found. While references were found which indicated that many studies of faculty workloads and

unit costs have been undertaken at individual campuses, few of these studies have been widely published. Cost studies which employed unique methods or which considered certain aspects in detail were described in Chapter 2 of this study. Recent developments in related applications of computer technology were prominent in the literature as were articles related to interest in increased "accountability" for higher education institutions.

DESIGN OF THE STUDY

The study centered on an examination of the costs incurred during the 1972-1973 fiscal year by the University and arising from activities funded through the instructional budget. Capital expenditures and costs of auxiliary operations were excluded from consideration. Many portions of the study were designed to be in conformance with studies requested by the Montana Commission on Postsecondary Education, thereby providing requested information while simultaneously developing a more detailed costing procedure for MSU.

Faculty salaries, being the largest single item of instructional costs, were given the most prominent attention in this study. From workload reports and academic records, each faculty member's teaching load was compiled for the 1974-1973 fiscal year. Each faculty member's salary was then apportioned by course level on the basis of credits taught. These salary costs were then summed, for each level and for

each department and were then augmented to reflect fringe benefits. Other support salaries were apportioned by course level within each department by applying the percentage breakdown, by level, of faculty salaries to the total support salaries.

Other instructional costs were allocated to departments and to levels on the basis of student credit hours taught. Library costs were distributed on the basis of weighted (1:2:4) student credit hours, while for all other such indirect costs non-weighted student credit hours were used. In this manner, if two percent of the total university production of student credit hours were taught by a given department, then that department would be allocated two percent of the specific total University indirect or "overhead" cost under consideration.

The sum, by course level, for each department of the direct salary costs and the indirect instructional costs was then divided by the number of student credit hours produced, by level, for each department thereby obtaining the "department oriented" costs per student credit hour.

In the second phase of the study an Induced Course Load Matrix (ICLM) computer program was used to examine the actual patterns of student course registrations by student major and by student level. This process determined the average "mix" of courses (by course level and by department) for each classification of students (by student level and by student major) considered. This "mix" was combined with

the "department oriented" costs previously obtained to compute an instructional cost "invoice" for each type of full-time equivalent (FTE) student. Each "invoice" was defined to be the "student major oriented" instructional cost per quarter per FTE student and its division by the average number of credits taken (by an FTE student) resulted in the student major oriented costs per SCH.

The "student major oriented" costs thus obtained were combined with the lengths (in terms of numbers of credits) of student programs, as determined from stated minimum requirements or from the individual examination of graduate student records, to obtain the student major oriented costs per degree awarded.

RESULTS OF THE STUDY

The student major oriented instructional costs per quarter per FTE student were found to range from $332 in sociology-social justice to $577 in aerospace and mechanical engineering at the lower division student level. At the upper division level, the instructional costs per quarter ranged from $363 in sociology-social justice to $880 in physics, while at the graduate student level the lowest cost of $282 occurred in commerce while the highest cost of $2,159 occurred in physics.

Student oriented instructional costs per degree granted were found to vary widely. Costs for bachelor's degrees ranged from $4,730

in commerce-accounting to $9,210 in physics. The range for master's degrees was from $1,210 in commerce to $9,170 in physics, while the range for doctoral degrees was from $3,130 in secondary education to $16,370 in physics.

Significant differences were found between "student major oriented" and "department oriented" costs per student credit hour, with a dampening effect occurring on the variations in student major oriented cost as compared to the variations in the department oriented costs. This dampening effect was due to the registration by students in courses other than their major and at other course levels. Thus, the instructional cost to the state in offering a degree in a high cost area is, in reality, less than would be supposed if only a department oriented costing method were used. Conversely, degrees in traditionally low cost areas are not as inexpensive as would be indicated by the use of only the department oriented costing method. This conclusion is applicable to considerations of relative costs both by major and by level. Comparisons of the ranges in the costs of degrees, as calculated by the two methods, showed wide differences with the dampening effect even more noticeable than in comparisons of costs per student credit hour.

In addition to obtaining the computed costs per degree, this study also established a process for continuing such inquiries into instructional costs at MSU. Consequently, several comments regarding

the initiation of that process are included in this chapter.

Relatively few complications were encountered in obtaining SCH information and in allocating faculty salaries, although the latter process required a great amount of time since only written, rather than computerized, data was available. If the administration at MSU decides to replicate this study at a future date, the computerization of faculty teaching load records is strongly suggested.

Several problems arose with definitions when the ICLM was implemented. The distinctions between academic departments, student majors, and subject areas, and fields of knowledge in which degrees were granted required more than simple matching in a number of cases. The student major pre-medicine, for example, is offered at MSU through a department entitled zoology and entomology. As might be expected, one department may have several student majors associated within it (e.g., the mathematics department has students majoring in statistics and mathematics education as well as in mathematics). Some students take a course in a subject area called agriculture which is taught through the office of the Dean of the College of Agriculture and not by any single department at MSU.

The field of knowledge in which a degree is granted was closely associated with, but did not always exactly correspond to, student majors, such as the now discontinued Master of Science in Applied Science Degree. Finally, a university is a dynamic place, with new

majors being introduced or old ones deleted and departments being reorganized (occasionally within a fiscal year), rather than providing a static environment in which to pursue a study covering the entire year.

RECOMMENDATIONS

The major recommendation of this study is that student major oriented costs be given serious consideration in decisions requiring information on the instructional costs of degrees.

Persons at other institutions may wish to replicate this study to ascertain the instructional cost variations unique to their campuses.

A detailed cost analysis of library expenditures would be of assistance in future cost studies at this and other universities. Such an analysis should seek to investigate library usage by students either from a standpoint of courses in which students are enrolled (using subject areas and course levels) or from a standpoint of students without regard to specific courses (using student majors and student levels). The former method would fit more closely with the assignment of overhead costs to department oriented costs per SCH, while the latter method may be more feasible. If a preliminary investigation indicated that variations in costs of library holdings by subject area were more significant than patterns of student usage, then an abbreviated student usage investigation could be coupled with these costs to provide an

improved basis for the allocation of library costs in a university-wide cost analysis study.

The determination of program lengths at the graduate level is another area in which further investigation for cost analysis purposes would be of significant value. Although this is a difficult area to study, a longitudinal study in the impact of changes in degree requirements (language requirements, credit for work experience, etc.) would be quite valuable.

A longitudinal study of student registration at Montana State University, using the ICLM over a period of several years, might be of research interest in itself as well as providing a larger data base on which more detailed (master's and doctoral levels rather than a graduate level) cost analyses of graduate instruction could be based.

Investigations of physical plant operating costs and of variations in instructional costs within programs may be worthwhile.

In future cost studies, the researcher should consider using the latest products available from NCHEMS. In particular, the Cost Finding Principles and the Information Exchange Procedures systems have undergone further development since this study was undertaken.

With these comments and recommendations, the instructional costs derived and the methods developed are now made available for the internal management at Montana State University and to researchers outside of the University.

APPENDIX

COST ALLOCATION FORMS

FORM
P.S.-1

POST-SECONDARY STUDY
INDICES OF INSTRUCTIONAL PRODUCTION

UNIT: _____
DEPARTMENT or DISCIPLINE: _____

I. DEGREES AWARDED

YEARS:	1968	1969	1970	1971	1972
Two-Year Certificates					
Associate Degrees					
Bachelors					
Masters					
Doctorates					

II. STUDENT CREDIT HOURS

	1972 FALL	1973 WINTER	1973 SPRING	1972 SUMMER	TOTAL
100 - 200 LD					
300 - 400 UD(1)					
500 - 600 G					
TOTAL					

(1) - Include Small G

III. WEIGHTED CREDIT HOURS(1)

	1972 FALL	1973 WINTER	1973 SPRING	1972 SUMMER	TOTAL
100 - 200 LD					
300 - 400 UD					
500 - 600 G					
TOTAL					

(1) - Lower Division = 1
Upper Division = 2
Graduate = 4

Form
P.S.-1
(continued)

IV. NUMBER OF COURSES AND CREDIT HOURS OFFERED

	1972 FALL		1973 WINTER		1973 SPRING		1972 SUMMER	
	Courses	Credits	Courses	Credits	Courses	Credits	Courses	Credits
Lower Division								
Upper Division								
Graduate								
Thesis (Doctorate only)								
TOTAL								

SIGNATURE_____

P.S.-2

POST-SECONDARY STUDY
FACULTY ACTIVITY WORKSHEET

UNIT: _____
DEPARTMENT or DISCIPLINE: _____
NAME: _____ RANK: _____

Academic Year Assignment 1972-1973	Instruction and Departmental Research	Organized Research	Other	Total AY Salary Expenditure	Total FY Salary Expenditure
_._ _ FTE(1)	_._ _ FTE	_._ _ FTE	_._ _	$_____	$_____

Summer Session 1972	Instruction and Departmental Research	Organized Research	Other		Additional Summer Compensation
_._ _ FTE(2)	_._ _ FTE	_._ _ FTE	_._ _		$_____
TOTAL					$

(1) - 1.00 Maximum FTE
(2) - .22 Maximum FTE

INSTRUCTIONAL LOAD

Course Number	Course Title	Credit Hours	Student Enrollment	Student Credit Hours	Quarter Taught

Form P.S.-2
(continued)

DIRECT INSTRUCTIONAL FACULTY SALARY COST

	Credit Hours	% Per Cent	Prorated Cost
Lower Division			
Upper Division			
Graduate			
TOTAL		100%	

DEPARTMENT CHAIRMAN SIGNATURE_____

FORM
P.S.-3

POST-SECONDARY STUDY
GRADUATE ASSISTANT SUMMARY

UNIT: _____
DEPARTMENT or DISCIPLINE: _____

A	B	C	D	E
Total Number of Graduate Assistants	PERCENTAGE ASSIGNMENT			Total Salaries Paid
	Instruction	Research	Other	

Average Salary (Column E ÷ A) = $_____

Amount Assigned to Instruction (Average X B) = $_____

INSTRUCTIONAL PRODUCTION SUMMARY

Level	Lab Hours	Credit Hours	Enrollment	Student Credit Hours	Percentage Credit Hours	Prorated Cost
Lower Division						
Upper Division						
Graduate						
TOTAL					100%	

SIGNATURE_____

FORM
P.S.-4

POST-SECONDARY STUDY
COST COMPILER WORKSHEET

DEPARTMENTAL INSTRUCTION AND RESEARCH

UNIT: _____
DEPARTMENT or DISCIPLINE: _____

1. FACULTY SALARIES $_____ (Instruction Only)

Add: Graduate Assistants _____

TOTAL _____

Add: Direct Support Salaries _____

TOTAL DEPARTMENT SALARIES _____

Add: Fringe Benefits _____

TOTAL SALARIES & FRINGE BENEFITS $

2. OPERATING COSTS

Supplies _____
Travel _____
Other _____

TOTAL $

3. DEAN'S OFFICE EXPENSES (Prorated SCH) $

4. COMPUTER COSTS

Type A) Directly Budgeted $
Type B) Prorated $

Form
P.S.-4
(continued)

5. EQUIPMENT $

TOTAL DIRECT INSTRUCTIONAL COST $

INDIRECT INSTRUCTIONAL COST: (Prorated)

Administrative & General (SCH) _____
Physical Plant (SCH) _____
Library (WSCH) _____
Other (SCH) _____

TOTAL ALLOCATED INSTRUCTIONAL COST $_____

SIGNATURE_____

FORM
P.S.-5

POST-SECONDARY STUDY
INSTRUCTIONAL COST PER STUDENT CREDIT HOUR

UNIT: _____
DEPARTMENT or DISCIPLINE: _____

I. STUDENT CREDIT HOURS: (FORM P.S.-1) SCH INDEX _____

Lower Division _____
Upper Division _____
Graduate _____

DEPARTMENT TOTAL (SCH) INSTITUTIONAL TOTAL _____

II. DIRECT INSTRUCTIONAL COST PER STUDENT CREDIT HOUR:

A) Total Direct Instructional Cost (Department) $_____ (FORM P.S. 4)
B) Total Direct Instructional Cost (Institution) $_____ R.A. Index_____

(A) ABOVE ÷ TOTAL SCH = DIRECT COST PER STUDENT CREDIT HOUR
$_____ ÷ _____ = $_____

III. INDIRECT INSTRUCTIONAL COST PER STUDENT CREDIT HOUR:

A) Total Indirect Instructional Cost $_____ (FORM P.S. 4)

(A) ABOVE ÷ TOTAL SCH = INDIRECT COST PER STUDENT CREDIT HOUR
$_____ ÷ _____ = $_____

IV. TOTAL INSTRUCTIONAL COST PER STUDENT CREDIT HOUR:

DIRECT SCH COST $_____

INDIRECT SCH COST $_____

TOTAL $_____

SIGNATURE_____

FORM
P.S.-6

POST-SECONDARY STUDY
INSTRUCTIONAL COST PER LEVEL OF ENROLLMENT

UNIT: _____ _____
DEPARTMENT or DISCIPLINE: _____ _____

F O R M U L A M E T H O D

I. TOTAL WEIGHTED STUDENT CREDIT HOURS: (FORM P.S.-1)

Lower Division _____ WEIGHTED SCH INDEX _____
Upper Division _____
Graduate _____

DEPARTMENT TOTAL (WSCH) _____ INSTITUTIONAL TOTAL _____

II. TOTAL DIRECT INSTRUCTIONAL COST ÷ TOTAL WSCH = DIRECT COST PER WEIGHTED UNIT

$_____ ÷ _____ = $_____

TOTAL INDIRECT INSTRUCTIONAL COST ÷ TOTAL WSCH = INDIRECT COST PER WEIGHTED UNIT

$_____ ÷ _____ = $_____

III. FORMULA COST BY LEVEL:

DIRECT:

Weighted LD $_____ X _____ = $_____
Weighted UD $_____ X _____ = $_____
Weighted G $_____ X _____ = $_____

INDIRECT:

Weighted LD $_____ X _____ = $_____
Weighted UD $_____ X _____ = $_____
Weighted G $_____ X _____ = $_____

IV. TOTAL FORMULA COST BY LEVEL:

Lower Division $_____ + _____ = $_____
Upper Division $_____ + _____ = $_____
Graduate $_____ + _____ = $_____

SIGNATURE_____

UNIT_____ DEPARTMENT_____ Form PS7 (MSU)

	(1) Faculty Salaries	(2) GTA Salaries	(3) Instructional Total Salaries	(4) Percentage	(5) Prorated Total Salaries & Fringe Benefits
Lower Division					
Upper Division					
Graduate					
TOTALS					

	(6) SCH	(7) Percentage	(8) Prorated Direct Costs Other Than (5)	(9) Prorated Total Direct Costs	(10) Prorated (SCH) Indirect Costs
Lower Division					
Upper Division					
Graduate					
TOTALS					

	(11) Direct Costs Per SCH	(12) Indirect Costs Per SCH	(13) Total Costs Per SCH
Lower Division			
Upper Division			
Graduate			

DIRECTIONS FOR FORM PS-7 (MSU)

It might well be more efficient to first transfer the data necessary to this form and then, secondly, to run through all of the calculations at one time.

I. Data Gathering

1. From Form PS-2 obtain the total faculty salaries for each department by level. Check these sums against the total as listed on the first line of Form PS-4. If the totals do not quite agree, allocate the difference (into three equal parts if nothing else) and add this to the totals obtained from PS-2.

   Example: For Ag Econ at MSU the total faculty salaries paid as shown on PS-2 amounted to $169,413.73 while the total on PS-4 showed $170,388.31. The difference of $924.58 was due to persons who assisted but did not actually teach any classes. Thus we calculate

From PS-2	Lower Division	68,154.67	+ 308.19	=	68,462.86
	Upper Division	80,401.84	+ 308.19	=	80,710.03
	Graduate	20,857.22	+ 308.20	=	21,165.42
		169,413.73	+ 924.58	=	170,338,31

   and enter the resulting figures in column (1).

2. From PS-3 take the total GTA salaries and enter this number in an appropriate level. This would almost always be lower division. The College of Education is the exception at MSU.

3. Enter the Total Salaries and Fringe Benefits from PS-4 to the total blank of column (5).

4. From PS-4 take the Total Direct Instructional Cost, subtract the Total Salaries and Fringe Benefits and enter this result into the total blank of column (8).

5. Enter the total of the Indirect Instructional Costs from PS-4 into the total blank of column (10).

6. From PS-6 enter the Student Credit Hours into column (6).

II. Calculations

1. Add columns (1) and (2) to obtain column (3).

2. Calculate the percentage distribution of column (3) (with a total of 100%).

3. Multiply the total in column (5) by each percentage to obtain the other entries in column (5).

4. Calculate the percentage distribution of SCH in column (6) and enter this in column (7).

5. Multiply the total in column (8) by each percentage in (7) to obtain the other entries in column (8).

6. Add columns (5) and (8) and enter the sums in column (9). (The total in column (9) should agree with the total direct costs on PS-4.)

7. Multiply the total in column (10) by each percentage in (7) to obtain the other entries in column (8).

8. Divide each entry in (9) by the corresponding entry in (6) and record this in column (11).

9. Similarly, divide (10) by (6) and enter in (12).

10. Add (11) and (12) to obtain column (13).

Note: With this method, the library costs are not apportioned strictly on the basis of the WSCH, but this short cut employed should alter the Indirect Costs per SCH by only a few cents, if at all.

POST-SECONDARY STUDY
FISCAL AND BUDGETARY COMMITTEE
Charge #2

Statement of Purpose, Definitions and Suggested Methodology for Instructional Cost Study

The 43rd legislative assembly in enacting the Blue Ribbon Study of Post-Secondary Education included the following language:

"The commission shall further devise a system of accountability that will accurately measure educational output in relation to financial input."

One aspect of the above charge is to survey the current costs of instructional activity in the post-secondary institutions in Montana. The general purposes of the cost analysis can be stated as follows:

1. To examine the comparative costs of lower division, upper division and graduate curricula.

2. To provide data that will aid in budget development, preparation, and justification.

3. To formulate a general procedure for evaluating faculty activities, instructional program costs, and degree utilization on a continuing basis.

The following list of definitions are relative to the Committee's task:

1. TOTAL INSTITUTIONAL EXPENDITURE: Total Current Fund - Education and General Expenditures for the fiscal year.

2. TOTAL RESIDENT INSTRUCTION EXPENDITURE: Total institutional expenditure less expenditures for Organized Research and Public Service.

3. ASSIGNED DEPARTMENTAL COSTS: Total of current fund costs charged directly to a departmental unit by an institutional accounting system plus those costs that are prorated to the department.

4. ASSIGNED DEPARTMENTAL COSTS OF INSTRUCTION BY LEVEL: Those assigned departmental costs attributed to instruction and disaggregated to the following levels of instruction:

Lower Division	- 100-200 level series (Freshman, Sophomore)
Upper Division	- 300-400 level series (Junior, Senior)
Graduate	- 500-600 level series

5. DIRECT INSTRUCTIONAL COST shall include the following:

   Faculty Salaries (Instruction Only)
   Support Staff Salaries
   Fringe Benefits
   Operating Costs (Supplies, travel, publications, etc.)
   Dean's Office (Prorated)
   Computer Costs (Instructional Use Only)
      Type A) Directly budgeted to department
      Type B) Prorated to department
   Equipment

6. INDIRECT INSTRUCTIONAL COST shall include the following: All related institutional overhead and academic support costs such as libraries, physical plant, administrative and general, student services, etc. Indirect instructional cost will not include organized research or public service.

7. CREDIT HOUR: A unit of instructional service.

8. DIRECT COST PER CREDIT HOUR: The unit cost derived by dividing the total direct cost per department by the total credit hours offered per year.

9. DIRECT INSTRUCTIONAL COST PER STUDENT CREDIT HOUR: A unit value obtained by dividing the total student credit hours produced in a department into the total direct instructional costs.

10. DIRECT COST PER STUDENT CREDIT HOUR BY INSTRUCTIONAL LEVEL: The unit value derived by dividing the assigned direct instructional costs by level by the student credit hours produced by level.

11. INDIRECT COST PER FTE STUDENT: A value derived by dividing the total indirect costs by the total full-time equivalent students.

12. INDIRECT COST PER STUDENT CREDIT HOURS: A value obtained by dividing the indirect costs by the total student credit hours generated.

13. TOTAL INSTRUCTIONAL COST PER STUDENT CREDIT HOUR: The total direct cost per credit hour plus the indirect cost per credit hour.

14. FULL-TIME EQUIVALENT STUDENT (FTE):

    A) Undergraduate - 15 credit hours
    B) Graduate - 12 credit hours

15. WEIGHTED FULL-TIME EQUIVALENT STUDENT:

Lower Division	= 1 X FTE Enrollment
Upper Division	= 2 X FTE Enrollment
Graduate	= 4 X FTE Enrollment

16. RESOURCE ALLOCATION (R.A.) INDEX: Relationship of direct instructional cost per department to total direct instructional cost for the institution expressed as a percentage.

17. SCH PRODUCTIVITY INDEX: The relationship of the student credit hours generated within a department to the total student credit hours generated for the institution expressed as a percentage.

18. WEIGHTED SCH PRODUCTIVITY INDEX: The relationship of weighted student credit hour production per department to the total weighted student credit hour production of the institution expressed as a percentage.

19. FISCAL YEAR - POST-SECONDARY COST STUDY:

Summer Session, 1972
Fall Quarter, 1972
Winter Quarter, 1973
Spring Quarter, 1973

C O M M E N T S.

FORM P.S.-1

I. The cost study will utilize academic departments as "cost centers" where appropriate. If an academic department contains many unrelated and dissimilar disciplines, the institution should then break out the degree and credit hour production and costs for these disciplines separately.

II. This data should be provided by the Registrar at each institution and cross checked by the enrollment reports in the Commissioner's Office.

III. The weighted credit hour calculation should be completed by the committee member or his designated representative.

IV. This section should be completed by the unit registrar or the designated research representative.

The individual who has filled out the P.S.-1 Form and is responsible for the accuracy of the data should sign the form.

C O M M E N T S:

FORM P.S.-2

I. The academic year assignment cannot be greater than 1.00 FTE.

II. If the academic production is going to be analyzed by discipline rather than by department, the faculty members teaching FTE will have to be prorated accordingly.

III. The total AY or FY salary expenditures should agree with the unit's financial records.

IV. The courses taught should be listed in the same sequence that they were taught beginning with summer session of 1972.

V. The following conversion factors should be used to equate faculty involved in independent study courses with regular credit hour instruction:

1. Student teaching - divide student credit hours by 12 to obtain equivalent credits taught.

2. Other independent course work or thesis direction - divide student credit hours by 6 to obtain equivalent credits taught.

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REFERENCES CITED

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