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Canada
A SYSTEMS APPROACH TO
EXPANDING A PROGRAM IN HIGHER
EDUCATION

Lynn Raeburn

A Thesis
in
The Faculty
of
Education

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ABSTRACT

A SYSTEMS APPROACH TO EXPANDING A PROGRAM IN HIGHER EDUCATION

Lynn Raeburn

The theoretical intent of this research was to investigate the value of model building or modeling and the value of analysis of model outputs to instructional programs within structures of higher education. The operative aspect of using the aforementioned systems analysis techniques when applied to the instructional segment of a graduate level program was to determine the feasibility of expanding the instructional system through an increase in annual student admission rates.

The computer based model that was developed consisted of two interactive sub-models. The automated model designed represents the system's faculty (instructional) resource requirements in contact hours for three admission rates over a period of eight, three historical and five projected, years. A manual model was subsequently employed to represent both the financial resources and the faculty alternatives required to support the instructional resource "needs" identified in the automated model.
The analysis of model results clearly demonstrates that:

1) the instructional system could physically accommodate an "expanded" annual admissions rate,

2) the instructional system could support the additional faculty costs incurred by an expanded admissions rate, and

3) by NOT expanding the admissions rate, the instructional system's potential loss in tuition and grant monies alone lies in the order of $250,000 per annum.*

Therefore, the research conducted herein clearly demonstrates the value of applied modeling to instructional systems within structures of higher education, and as such, demonstrates the value of modeling in testing various faculty and admission rate hypotheses.

*averaged on a five year time span.
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TERMINOLOGY

An activity describes the various types of instruction contained within a program element of course, and is expressed in terms of contact hours required of a faculty member.

Note: an activity value can be either student dependent (i.e. exam) or independent of student numbers (i.e. lecture).

A program élément or course, is comprised of 2, 3 or 4 activity elements. The sum of which, in faculty contact hours represents the individual weight assigned to that course, given the nature of it's specific content.

- can have an academic value of 3, 15 or 36 credits.

A discipline refers to the eleven subject categories under which the courses have been grouped given the nature of their respective content.

Student program describes the mix of compulsory and elective courses chosen by a student in order to accumulate the 90 credit requirement for the degree offered.
I. INTRODUCTION

Systems Analysis is defined herein as an "approach to problems of decision making which proceed by ascertaining objectives; determining constraints, elaborating alternatives and estimating the costs, benefits and risks of feasible alternatives". (Judy, 1967 p. 2) The systems methodology gets us to the heart of a problem to identify major decision points in order to resolve the problem. The analytic techniques available in Systems Analysis provide us with the instrumentation to qualitatively and/or quantitatively assess the viability of alternative solutions to a decision problem.

One of the functions of an Educational Technologist is to manage resources contained within educational systems. The planning aspect of resource management and the means by which to provide adequate instructional resources within a particular type of educational system is the specific concern to which this research paper addresses itself.

In all educational systems the ability to adequately plan and utilize instructional resources requires a thorough and comprehensive grasp of both the system's component parts (inputs, processes and outputs), in order to ascertain the type, amount and location of the resource(s) needed and the resource(s) availability within the requisite time frame. In addition to the above it is submitted that perhaps the most important element is that these 'identified' resources are appropriately applied in an attempt to effect the aim(s) of the resource utilization decision.
Modeling techniques, or the building of models to represent a system's structure and functions, is fundamentally the construction of information systems. Planning is largely the use of present information in a simulative fashion in order to represent future events or situations for some intended purpose.

Therefore, it is the contention of this thesis that solutions to problems that arise in planning resource utilization of an instructional nature, are available through the appropriate employment of tools and techniques within the framework of Systems Analysis.

A. Problem Statement

The problem statement can therefore be formulated as follows:

"Can the model-building techniques from Systems Analysis be successfully applied in the planning and management of the instructional resource requirements of a faculty nature within institutions of higher education?"

B. Purpose of the Research

The thesis embodies issues and concerns of both a theoretical and an operative nature. The actual significance of both is substantiated in the findings and recommendations of this thesis presentation. The theoretical aspect hinges heavily on the assumption that some applications from the field of Systems Analysis can
be appropriately and successfully used for the planning and utilization of academic resources generally; and specifically, for planning resource utilization of an instructional (faculty) nature within institutions of higher education. The operative component examines an existing instructional system at the program level of the University's educational structure and determines the amount and type of faculty required to provide adequate instructional resources for both the system's current, and potentially expanded, states.

The Educational Technology program at Concordia University in Montreal is the specific system studied. This graduate level program may be attended on a full-time or part-time basis, over a period of a minimum residency of two years or a maximum residency of five years. The program offers the student two fields of concentration from which he/she must successfully complete five compulsory courses, two major projects (a thesis and an internship), and eight elective courses of his/her choosing, in order to meet the degree's academic requirements. In the recent past, the program has graduated approximately twenty students per academic year. Admissions, set at thirty students per year, are based on the number of thesis projects that could be adequately supervised by the current faculty members. At the curriculum level, the program offers the student a
relatively large and varied "menu" of courses from which to choose his/her individually selected course of study. In excess of thirty courses are available and are arranged within twelve subject or discipline groups. There is not, therefore, a specific or set curriculum that all students must follow. This particular graduate program is very much geared to the student's individual interests and background, as well as the goal of facilitating the active practitioner's growth in the field of Educational Technology. Given the sizable (in excess of one hundred) number of student applications per year and in consideration of the job positions in this field that remain unfilled (Mitchell, 1977), it has been proposed that the present enrollment be expanded to include some twenty to twenty-five additional students per year. One of the obvious considerations in this proposed expansion is planning for the instructional resources required to meet the newly generated instructional load; as well as, the availability of financial means by which to support these teaching resources. Of perhaps a less obvious nature are the following considerations:

a) the actual faculty teaching load, in "contact hours", generated by both the present and the potentially expanded student enrollment.

b) the system's (program's) present ability to meet that teaching load for both the current and the
expanded enrollment.

c) the research interests and academic background of the present faculty, and the time available to pursue such related activities as thesis supervision, independently funded research, and writing for learned publications.

d) the financial implications of the aforementioned items to the Educational Technology program under the specific headings of:

i) the annual salary cost of the present and "required" faculty members, and

ii) the annual income generated by the system's input resources.

This researcher will consider these items in the examination and assessment of this program's instructional system and it's instructional resource requirements.

C. Objectives

The objectives of this research are as follows:

a) To demonstrate that some aspects of Systems Analysis, specifically model building and analytic techniques, can be applied to an instructional system in order to facilitate planning situations specific to the utilization of instructional resources.

b) To construct and employ a model that will represent the faculty required to meet an instructional load for the system's current and potentially expanded
states.

c) To provide information on the staffing and financial implications of providing adequate instructional resources for the system's current and expanded states.

d) To describe:

i) some of the problems encountered when analyzing educational systems, wherein the allocation of required instructional resources is limited by budget allocations or policy constraints.

ii) the significance of the above to both the functioning of the system studied and the student as a product (output) of that system.

e) To demonstrate how an Educational Technologist can contribute to resolving planning problems related to resource allocation within educational systems.
II. RELATED RESEARCH

Given both the theoretical and the operative research concerns and the outlined objectives, the "literature" was approached on the basis of:

a) identifying a suitable model type,

b) establishing an analytical approach that would be relevant to the parameters of the system under investigation, and

c) clearly identifying both the relevant planning factors involved and their interrelationships and establishing a valid means by which to measure these planning factors.

A. Model Classifications

A model is herein defined as "a mathematical formula or some other abstract representation which behaves in a similar way to the system being studied" (Duckworth, 1965, pp. 19).

Models can be classified by their degree of abstraction, their dimensionality, the problem type or subject area to which they are applied, and by the degree of model development. A brief, but descriptive outline (Miller & Starr, 1960) of models by their degree of model development would be that models are employed:

i) to convey information

ii) for measurement and observation

iii) as transformation models
iv) as test models (to confirm or reject the theory on which the model was built)

v) to discover which variables are most relevant to a system's function (i.e. sensitivity analysis)

vi) to investigate relationships or, in the instance that the relationships and outcomes are known over a short range, to determine the outcomes outside or beyond that range.

A model that produces an outcome that varies with time, or that produces an outcome dependent on inputs received, falls into a general class of models which function as simulation models. Simulation models, or models used for simulative purposes can exist in various physical forms, at various levels of complexity and are employable for various objective functions. One value of simulation models in planning and allocation of resources lies in their ability to compress time, thereby facilitating the assessment of a system's future resource requirements well in advance of the time when those resources are a necessity.

Therefore, given the specific objectives outlined, (p. 5 & 6) and the model classifications described above the research model to be developed for this study must functionally establish the system's "processes" over a known range of time and, by extension, establish its outcomes outside of or beyond that known range of time.
B. Resource Allocation Studies

Judy (1967) describes both the analytical approach used to develop the J.C.L.3.W. Model and the model's basic structure and functions. Initially designed as an input/output analysis model, J.C.L.3.W. was used by the University of Toronto Health Sciences Program to assist in the assessment of the resource implications of expanding and improving their instructional programs. This computerized model accepts descriptions of the system's processes (activities) and output levels and from there computes the quantities of inputs, in terms of a "resource hour" measurement, required to produce the outputs.

Of interest to this researcher were both the planning problems encountered in the specific area of curriculum changes and the analytical approach employed for purposes of assessment of resources required when the Faculty of Medicine considered expanding its annual enrollment from 175 to 250 students. Through a comparative analysis of "resource hour" and space requirements for three curriculae and the two enrollment alternatives under study, the appointed 'Board' opted, on the basis of financial feasibility, to retain the original curriculum (both for its content and sequence) and expand the enrollment to 250 students.

Thompson (1970) views a total university system through an industrial dynamics framework. Unlike Judy,
a great deal of detail on the technical development of the model was not included. However, the behavioral approach used to develop the resultant computer simulation model, as well as both the aggregates of planning factors and their interrelationships and functioning interfaces were of note to this researcher. The model was developed to gain an understanding of the dynamic behavior exhibited by universities. Thompson maintained that through simulative forecasting of the system's responses one could facilitate the assessment of variations in educational policies within the system. The operative model represents, in aggregate terms, interacting flows of students and faculty; information; money and capital assets. The model begins with a student instructional demand by degree level, and from there in a sequential fashion "hires" the required faculty, generates expenditures and accumulates capital assets. Although the scope of Thompson's model is significantly large it was interesting to note that having previously and separately defined the university's goals as functions of an instructional, research and service nature, that when orchestrating the student-faculty interface, it was assumed that related research and service functions were not separate but in fact assumed to be 'carried' by the instructional faculty.

Pasquir and Sache (1975) describe a model developed to estimate unit (per student) costs and their component factors for instructional inputs, processes and outputs.
at the Fribourg University-Netherlands. The study represented one third of the university's populace for the academic year 1975. The study's intent was to monitor and improve management's resource utilization decisions. The model/information system that was developed was based on a management cost unit called un unite elementaire d'activite (U.E.A.). The concept of the U.E.A. assumed that all the system's activities were interdependent at the teacher or instructional level. Therefore all costs, identified under four subheadings of i) student enrollment, ii) faculty time/budget allocation, iii) indirect staff costs, and iv) personnel costs, are assignable to an identifiable cost center(s) or U.E.A. From this point a unit (i.e. student) cost is identifiable. Additionally, factor costs can be separately calculated or cumulatively summed to the desired system (department, program, year) level. Given the interim nature of this report, data was not available on amortized costs of capital assets and space considerations. The actual figures reported had been altered, so stated, in the "interests of confidentiality". However, notwithstanding the latter, of greatest interest to this researcher was the means used to identify a cost unit and the flexibility of the U.E.A.'s application at the various cost levels encountered within a university system. Also of note, the general applicability/generalizable nature of the U.E.A. to North American educational institutions.
C. Model Families

Three models or model families selected from Hussain (1973 & 1974) were reviewed in terms of structure (model logics) and methods of identifying and quantifying an instructional system's relevant planning factors. The models, in order of their treatment are:

i) Computer Analysis Model for Planning in University Systems, (C.A.M.P.U.S. VIII) eighth version,

ii) Resource Requirements Prediction Model, (R.R.P.M. 1.3 and 1.6) third and sixth versions,

iii) University Simulation Game, (U.S.G.).

Comparatively speaking, these three models are considerably different in their respective scope, structure, level of detail, operating costs and, their specific objective functions. Both C.A.M.P.U.S. and the R.R.P.M. models require the use of a computer; whereas the U.S.G. model, given it's simplicity and it's intended use as a game, can be either computerized (on-line terminal or batch mode) or hand calculated. C.A.M.P.U.S. and R.R.P.M. as their name suggests were designed for management's use in planning and budgeting resource functions. Exceptions are R.R.P.M. 1.6 which could be used in a gaming mode, and the game version of R.R.P.M. 1.3, and 1.35 model.
The scope of the U.S.G. is one academic unit (program or degree) which, if appropriate, could be run repetitively to quantitatively assume department, sector or institutional capacities which it is noted are computed simultaneously in the other two models mentioned. Structurally, the U.S.G. encompasses only specific elements and generates output reports on staff needs, teaching salary costs/student and a "unique" curriculum quality index report.

In terms of aggregates of system elements, C.A.M.P.U.S. and R.R.P.M. have, in addition to the instructional segment, a preceding student flow module and a subsequent non-teaching salary and costing module. Major structural differences between C.A.M.P.U.S. and R.R.P.M. are identifiable at the level of detail contained in the planning factors and the number and type of planning factors required, given output report specifications. Perhaps the most concise method of conveying model differences amongst the instructional segments of all three 'referenced' models is by means of a pictorial presentation, in the following Figures 1, 1a and 2.
Unlike the Fribourg model, these three models' instructional segments begin by identifying a student generated instructional load, and proceed to calculate, given an available faculty inventory, the amount and type of staff required to meet the instructional surplus or deficit.

\[ a) \text{ Determination and Distribution of Instructional Requirements} \]

Unlike the course credit/contact hour loading in the C.A.M.P.U.S. and R.R.P.M. models, the U.S.G. loads in annual student hours of effort by academic unit. Through the application of a student-to-staff-effort ratio on six possible activity levels within courses, the U.S.G. then determines staff surplus or deficit in terms of a (+) or (-) contact hour value.

Initially, given a known student/staff effort ratio, this type of 'loading' may appear somewhat superfluous. However, it is a requirement for the output report specification of the U.S.G.'s curriculum quality index. (not shown in Figure 1).

The content of the induced course load matrix (I.C.L.M.) used in both the C.A.M.P.U.S. and the R.R.P.M. models is much more complex in terms of input data requirements, but for that, it generates both the total instructional load and the distribution of that "load" amongst disciplines offering courses, and within course levels. R.R.P.M.'s use of the I.C.L.M. is somewhat less flexible than in
The C.A.M.P.U.S. in that the former proceeds from a credit load generated by one student major (program) to calculate, by enrollments within programs and years (level of student), the total instructional requirement for disciplines offering courses. The C.A.M.P.U.S. base management unit is quantified in activity levels within course offerings and is loaded for a contact hour/course value.

b) Determination of Faculty Required

From the viewpoint of the distribution of the instructional load, in the C.A.M.P.U.S. and the R.R.P.M. models, both the aggregates of required data and the model's logics are very similar. They both convert the distributed instructional load, given a faculty hour (credit)/section ratio, to a total faculty teaching hour/credit requirement. From there, given the non-teaching to teaching ratio/faculty member within disciplines; a total number of teaching faculty is established. This, when applied to a defined full-time contact/credit hour value for faculty, results in the number of full-time equivalent (F.T.E.) faculty required to meet the specified instructional load and the distribution (amongst faculty) of that instructional load.

Through an aggregate percentage of an F.T.E. faculty member's available teaching time; the U.S.G. model's approach to the above function is simply to convert it's previously identified surplus or deficit in contact hours to an F.T.E. faculty value.
D. Summary of the Literature (In Search of a Model)

In order to begin describing the process by which the research model was designed and operationalized, a comment on the input value of the documented models is in order.

i) Model Classifications provided insight to both the physical structure and the objective function the research model would require.

ii) Resource Allocation Studies, summarily describable as input/output model, a computer simulation and a costing model, gave definition to the symptoms evidenced by the program studied and the analytic approach which would be both most realistic and applicable. The J.C.L.3.W. model most closely resembles this research model in terms of classification, it's analytic use, and the enrollment expansion condition. The resource hour (contact hour) measure was applicable to this researcher's quantification problem. However, in the J.C.L.3.W., as in the Fribourg study, the system's curriculum was ordered or set rather than student selected, as in the system under study.

iii) Model Families provided direction in terms of identifying and quantifying relevant planning factors, thereby clarifying the studied system's elements and the technical (applied) aspect of the research model's mechanics and/or logics. Major differences amongst these
three referenced models and the research model are identifiable as the methods and quantitative means used to determine:

i) the instructional load and its distribution across disciplines/faculty, and,

ii) the faculty's availability.

The C.A.M.P.U.S. model's use of loading in contact hours/course activities was both appropriate and relevant input with regard to this researcher's need for a base unit of measure. Whereas, the I.C.L.M. format (also used in credit values in the R.R.P.M. models) was not viable on the basis of:

i) a student selected curriculum,

ii) the full-time (F.T.) and part-time (P.T.) student enrollment, and

iii) the flexible nature of the program's required completion time (i.e. two to five years), the 'concept' of the I.C.L.M., given the required output specification of identifying both numbers and types of required staff, was invaluable in establishing both the individual and total faculty contact hour availability within and across faculty's respective instructional disciplines. The resultant faculty distribution matrix (F.D.M.) used in the research model circumvented both the lump sum (+ or -) faculty contact hour global value which was generated in the U.S.G. model, and the assumption
that for hiring and costing purposes all instructional faculty function on an interdisciplinary basis.

III. DESIGN OF THE SYSTEM'S MODEL

A. System's Model Components

The system's research model consists of two subsystems; one a computer model, the other a manual model. An aggregate representation Figure 3 depicts both the model's component parts and the computer/manual subsystem interface.

B. System's Restraints

Given the program's output specifications, and the proposed system expansion the major systems components/restraints which shaped the research model's design are as follows:

Faculty

- type: Full-time (F.T.), Part-time (P.T.), Lecturer
- rank: associate, assistant professor
- workload: minimum 18/maximum 24 credits per academic year
- annual contact hour availability
- percentage annual workload assignable to teaching
- thesis and internship credits: supervised by F.T.E. faculty only
Students
- type: Full-time (F.T.) or Part-time (P.T.)
- admission: 30/academic year

Curriculum
- degree: 90 credits.
- options: 2 (research/production).
- time: two to five academic years.
- course values: 3, 15, & 36 credits, respectively.
- course enrollments: only maximums available, class size varied by course activities.
- structure/sequence: student selected, some courses with prerequisites.

C. Flowchart of the Research Model

The research model of the system studied is represented (Figure 4) in flowchart format. The source code for the computer model is illustrated in Appendix A, (4).
D. Methodology

i) Design Procedure:

The input data required and the form in which it was collected is contained (App. A.) and titled as "Course Requirements Input Data, Course Enrollments Input, and Data and Faculty Input", respectively. Appendix B. exhibits the instrument employed by faculty to weight, in terms of four activity levels, the faculty contact hour requirements of all course offerings. Definition and use of data fields exhibited on the input requirements forms are contained in the following discussion on the model's design procedure.

a) Determination of the Instructional Load required the functional employment of both course requirements and student enrollment data. Course offerings were stated in contact hour values per course as determined by the use of the 'course weights instrument' (App. B.). Courses were then grouped for content within their respective disciplines, one to twelve. The three credit courses which comprise disciplines one to ten inclusive were separated from the internship and thesis projects (disciplines eleven and twelve) in consideration of the wide variances in both credit and contact hour values, and,
type of faculty and instruction required for 'research' supervision.

Maximum course enrollments were specified in order that contact hour overages could be identified, thereby indicating the additional course sections and faculty required. Estimates of the student enrollments for the three credit courses for years 1978 to 1982 inclusive were based on both the historical and projected F.T. and P.T. student enrollments for years 1975 to 1982 inclusive (Mitchell, 1976) and, the number of student places generated by 'in system' students for years 1975 and 1976. It should be noted here that although this graduate program has been in existence for ten years, the specific academic years 1975, 1976 and 1977 were chosen for sample and test data in that:

- these years represented the most recent number and type of courses offered on a regular basis, (ie. annual basis)
- the student admissions and graduate rate appeared to be relatively stable, and
- the number and type of faculty available and the magnitude of the assigned instructional credit load appeared consistent.

In short, there was stability in both the system's instructional resource variables and
outcomes, respectively. Therefore, from an assessment of Mitchell's report (1977b) and the trend in historical enrollment data, a ratio of students enrolled to student places generated in three credit courses of 100:325, respectively, was established. The student places were then distributed for an annual admission rate of thirty students per year within the three credit courses for years 1978 to 1982 in accordance with ranges of three credit course enrollments appearing for years 1975 to 1978 inclusive. Requisite courses and courses with prerequisites were noted and the latter were filled with the previous year's course enrollments in mind. A similar student place calculation was done for the expanded rate of sixty annual student admissions. The sixty course enrollments per annum were proportionately increased to reflect the influx of approximately 98 additional student places to be distributed across all three credit course offerings. Thesis enrollments for projected years 1978 to 1982 were set at twenty students annually for the thirty admission level and again increased proportionately for the sixty admissions level. A registration option within the 1975/1976 instructions and regulations handbook made it difficult
to ascertain exactly how many students were actively engaged in thesis work.* A problem was thereby created in that both the instructional resources consumed and required were not clearly identifiable. Therefore the assigned thesis enrollments are an estimate of the expected graduation rate and, in terms of resources consumed, they are submitted as a very conservative estimate. Internship work for the thirty admission level was set in a similar enrollment pattern for years 1978 to 1982 as appeared in the historical years 1975 to 1977. As before, the internship enrollments for the sixty admission level were increased proportionately for the projected years 1978 to 1982. The determination of instructional load for a maximum admission level in the three credit courses for projected years was established by the computer based on previously set maximum course enrollments and each courses' corresponding contact hour value(s).** Thesis and internship enrollments were set at thirty students for each

*Option of registering for thesis on program entrance or in the year thesis work started.

**See App. B. Course Weights Instrument
discipline. These enrollments reflected the maximum capacity of the current system's contact hour faculty availability for research courses. A credit/contact hour ratio was established by the computer for the three credit courses for all admission levels in all years. This credit/contact hour value required definition due to the varied course contact hour requirements, the need to establish in real terms the hourly faculty workload resulting from a department assigned credit workload, and considerations of faculty hiring and costing activities.

b) Determination of Faculty Availability and Distribution of Instructional Load

In establishing both the faculty input data (App. A3) and the quantitative values that appear in data fields of faculty load, discipline load and instructional hours, there were two major difficulties encountered. The first difficulty was a question of how best to establish an annual contact hour availability for F.T. faculty member for purposes of computer calculation requirements. Secondly, having established the above, how should this 'availability' be distributed in both a realistic and equitable manner amongst the program's course offerings? In consideration of the system's restraints and
the operational objectives of this paper, a faculty member with a 100% teaching appointment to the program was assigned an availability value of 1040 contact hours* /two semesters. The assignment of this contact hour value for one F.T. faculty was an independent decision, but it is submitted, was neither unprecedented nor indefensible given the fact that the contact hour values for the system's course requirements input were not weighted to allow for instructional preparation time. Part time faculty were assigned a contact hour availability that reflected their respective percentage teaching appointment to the program. Initially the lecturer's availability was set in accordance with the relative percentage of F.T. credits that the lecturer's courses represented. This 'availability' was also expressed in contact hour values.

The distribution of contact hour availability per year is represented in the following Faculty Distribution Matrix (Figure 5, F.D.M.), the concept of which sprung from the R.R.P.M. and C.A.M.P.U.S. models' I.C.L.M. procedure.

*40 hours weekly x 26 weeks (2 semesters) = 1040 hours
### Figure 5 - Faculty Distribution Matrix

<table>
<thead>
<tr>
<th>Faculty Code</th>
<th>Disciplines</th>
<th>Faculty load %</th>
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<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
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<tr>
<td>1</td>
<td>30/60</td>
<td>30/25</td>
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</tbody>
</table>
The assignment of quantitative values or percentage availability over the three primary disciplines/faculty member within each discipline was arrived at through an analysis of:

- the number of courses taught by each faculty member,
- the number(s) of disciplines in which these courses were contained (ie. 1 to 12), and
- the amount of overlapping sharing of disciplines amongst faculty members, and the percentage 'discipline load' assignable to each faculty member.

Analysis of three credit courses indicated that no one faculty member regularly instructed in more than three disciplines, and some lecturers instructed in less than two disciplines. Thus the establishment of a maximum of three 'faculty assignable' disciplines. Each faculty's total availability was then distributed in percentages across his/her three primary disciplines to reflect the number of courses taught in each.

Distribution of availability within disciplines and amongst faculty (discipline load) was similarly quantified. Again, given the number of courses taught, each member's percentage responsibility was distributed in a representa-
tive manner within a specified discipline(s). Disciplines eleven and twelve were isolated and contact hour values separately calculated from the three credit disciplines in that the supervision of these courses were the instructional responsibility of F.T.E. faculty only. The assigned enrollment value for disciplines eleven and twelve was set at six students/each faculty member. This was the previously established maximum student load that each current faculty member could accommodate. The computer then filled for contact values both across and within disciplines, to the maximum percentage availability established per faculty member within the F.D.M., thereby establishing an 'individual' faculty member contact hour availability.

The faculty code and rank fields were employed for purposes of confidentiality of salary range specifications. 'M.A.' Time designated the percentage teaching appointment of a given faculty to the Ed. Tech. program and was employed to establish:

- on the basis of salary/rank, the cumulative salary costs assignable to this instructional program,
- contact hour values for partial teaching appointments, and,
given a maximum assignable credit load of 24 faculty credits; the respective credit load of F.T. and P.T. faculty members. It is noted that the total faculty contact hour availability does not vary in any historical or projected year. This was done for both technical and pragmatic reasons. The operational aspect was that this faculty 'constant' was intended to function as a 'built-in' or 'running' inventory against which a surplus or deficit contact hour value could be easily identified within any portion of any year specified.

The grant revenues data identifies for historical years were the actual monies generated by F.T. and P.T. faculty. Current total faculty grant revenues (G.R.) for projected years 1978 to 1982 was set at $27,500 per annum as an historical and mean (X) estimate for potential faculty G.R.'s. The G.R. value set for each new faculty member to be hired was established on the basis of the current assistant faculty's individual mean G.R.'s, and set at $3,000 per annum. This done on the assumption that new staff would be hired at the assistant level and initially generate a lower G.R. At first glance, the G.R. data appears to be relatively insignificant in terms of the system's 'other' and
larger resource input incomes. However, the G.R.'s resulting from these projects are totally reinvested in the instructional system in terms of acquisition of faculty knowledge or professional development and more visibly for capital expenditures for hardware and software to be used by, and remain within, the system's instructional laboratories.

The output reports (App. C) entitled Faculty Overage/Underage Report, and Faculty Contact Hour Requirements were generated by the interaction of both the course requirements and course enrollments input, and the subsequently applied faculty input data. These output reports which are discussed in the following section represent contact hour requirements for annual admission levels of thirty and maximum student enrollment over years 1975 to 1982; and sixty student enrollment over years 1978 to 1982. Condensed versions of these complete output reports are contained within the text and are intended as a reference point for both the model adjustments that were required and the subsequent development of the manual portion of the system's model.
ii) Model Adjustments

The faculty's cumulative contact hour overages and underages within disciplines and years are illustrated below (Tables 1, 2 & 3). Data for both historical and projected years, for annual admission levels of thirty and maximum course enrollments were included in order to demonstrate that an inordinately large or significant variance in contact hour requirements or credit/contact hour ratios appears either within or between, historical and projected year groups, respectively. This data consistency would indicate that the computer program was functioning effectively, and that the projected contact hour requirements for the system are within the realm of 'reasonable estimates'.

What would now appear to be the relatively simple task of converting the contact hour underages to the number of required faculty members does not specify either the type of faculty that is required, or where the faculty member is to be allocated amongst disciplines within the instructional system. The identification of staff required is further hampered by two additional system restraints. The first restraint being that
the instructional supervision for both thesis and internship projects are assigned to the F.T. faculty only. The assignable faculty credit responsibility for these two courses were, in the original system's works, set at one and zero, respectively.

This latter credit value issue introduces the second restraint. Research courses are not equally valued in terms of contact hour credits assigned to the three credit courses within disciplines one to ten and as such they are not representative, either in terms of assignable faculty credits, or in terms of the contact hour resources consumed by both the thesis and internship projects on an annual basis. Therefore, in an attempt to remain within the system's current policy structure, it was independently decided that the least disruptive action in terms of the systems' on-going function would be to weight the thesis and the internship credits at 3.0 and 0.5, respectively. These adjusted values were derived from both the annual contact hour values identified for the three credit courses which were generated by the automated
model, and also in consideration of the contact hour resources required (App. A. Course Requirement Input Data) by each of the above two research courses per faculty member.

iii) Automated/Manual Model Interface

Assuming the credit revaluation of thesis and internship to be both a prudent and an acceptable decision, then only the question of staffing alternatives and staff allocation to meet the required contact hour deficits remains. By referencing the condensed faculty overage/underage reports (Tables 1, 2 & 3, p. 38, 39 and 40) in all admission levels and for all years it is evident that contact hour underages have not, and do not occur until the application of disciplines eleven and twelve instructional requirements. Contact hour underages that occurred within disciplines one to ten if sizable, either in terms of the underage's relationship to the credit/contact hour ratio for that year, or in terms of the maximum contact hour values established/course, are logically traceable to the need for additional specific course sections.

From the detailed "faculty output reports" (App. C.) added sections in the order of two
or three for any year would accommodate the occurrence of these unique 'spot' underages. Moreover, these added course sections are assignable to any faculty type (F.T., P.T. or lecturer). However, the above cumulative overages when applied to the contact hour requirements in disciplines eleven and twelve consistently* result in contact hour underages in all years and for all admission levels. The underages presented in Tables 1, 2, & 3, are of note with regard to two items. First, the magnitude of the total annual contact hour deficits and, secondly, the type of staff required to meet the specific instructional content of the deficit occurrences.

Notwithstanding the estimated nature of the projected contact hour requirements for years 1978 to 1982, the historical contact hour data definitely indicates that the total (annual) faculty contact hour availability is not equal to the total annual student generated contact hour requirements. How significant are these underages? Could they in fact be absorbed by the current faculty for projected years 1978

*academic year 1976 excluded.
to 1982?

What additional contact hour effort on the part of the current faculty has to be expended in order to accommodate these contact hour underages from 1975 to 1978?

Again, referencing Tables 1, 2, & 3 (p. 38, 39, and 40), the significance of these underages has been translated (far right columns) to an 'absorbable' daily faculty contact hour value. It is reemphasized here, that contact hour requirements/course were generated on the basis of a zero value for lecture preparation time for faculty. The 'absorbable' daily contact hours therefore indicates faculty time over and above the previously established eight hours daily. Preparation time over the above the 'absorbable' hours shown leads one to consider first the physical effort required of the faculty, and secondly, qualitative considerations such as the faculty's ability to sustain an effective productivity level and that effect on both the instructional processes and the system's output (graduates) product. Given the magnitude of the total annual contact hour underages and the
relevance of the repercussions noted above, it can be stated that, additional faculty are required for the system's current admission level of thirty students/annum. By extension, then for both an expanded system state, or for an admission level greater than thirty students, additional faculty are also required. It is now time to address the second operative concern that being the development of the procedures employed to allocate current faculty resources as well as identify both the number and type of faculty required for the current and expanded system states with regard to model validity. It is notable that, whether or not the annual contact hour deficits identified are converted to F.T.E. faculty in terms of model values (1040 hours = 1 F.T.) or in terms of the departmental method of assigned credit values (18 to 24 annual credits = 1 F.T.), that the same numbers of F.T.E. faculty are required. (Table 4)
As previously stated the automated portion of the model identified course contact hour overages. The automated model was not intended to create additional course sections indicated by these contact hour overages, nor was it set to assign the required instructional faculty member/course. Therefore, for both the above reasons, and in order to work within the system's established hiring and faculty assigned credit (workload) practices, 'credit' values will be used in the following faculty assignment procedure.

iv) Faculty Credit Assignment Procedure

(Manual Portion of the Model)

In consideration of the majority of both faculty and student valued credits that are represented by thesis and internship courses and, the student practice of completing research projects as the last requirement for the program's degree, it was decided to design and sequence the faculty credit assignment in the following manner. Given a difference in annual maximum credit availability for combined F.T. and P.T. faculty (87 credits) and lecturers (21 credits) the sequencing precedes as follows:
Theses and Internship credits were the first values to be subtracted from the annual faculty credit availability. If additional faculty were required at this juncture, a note was made of the credit requirement in terms of F.T.E. faculty credit value. If a credit overage resulted, this was added to the 21 credit lecturer's input and assigned to disciplines one to ten credit requirements. If a deficit occurred on completion of the previous step, the cumulative credit value was noted (for salary cost considerations) for the three possible faculty alternatives (F.T.E., lecturer, or a mix F.T.E. and lecturers).

Credit requirements established for thesis and internship were based on the number of students registered by the revalued credits of three and 0.5 respectively. Credit requirements for disciplines one to ten were based on the number of section offerings by a three credit course value/section. The faculty assignment procedure was employed for all years and all admission levels.
The results of this procedure appear in Table 5 - "F.T.E. Faculty Required For All Admission Levels and All Years". Referencing the aggregate representation of the model's total structure (Fig. 3, p. 22), the final model segment, that of the costing procedure, was designed to transform the previously identified annual credit/faculty requirements to salary cost values. Simply stated, this cumulative accounting procedure was a matter of totaling the system's income potential (resource inputs) and from that, subtracting a singular expenditure, both current and future, and required, faculty salaries. The income possibilities were identified as:

- student tuition,
- annual government grants per F.T.E. student, and
- grant revenues (G.R.) generated by faculty.

Faculty salaries for new staff are a function of the identified total annual credit deficits. (Table 5) In accordance with the current staffing practices, these annual credit requirements could be filled by either F.T. or P.T. faculty in percentage teaching appointments of 50, 66, or 75, respectively, or in
faculty combinations thereof which would also include lecturers. The four types of staffing alternatives employed to meet the total annual credit deficits identified are identified as:

- lecturers only,
- F.T. or P.T. only (F.T.E.), or
- a combination of minimum F.T.E. and maximum lecturer or
- a combination of maximum F.T.E. and minimum lecturer.

The resultant faculty salary costs for newly hired faculty were based on an assistant faculty member's mean (\( \bar{x} \)) annual salary.

Annual instructional salary costs attributable to the system for current faculty were held constant at $95,700. Supportive financial data and documentation used for purposes of this accounting exercise are exhibited (App. B.)

The description of the costing procedure that follows was employed for all admission levels in all academic years.

v) Costing Procedure

From Table 5, p. 49, the faculty required to meet both the current and projected credit deficits have been converted (Table 6) to their specified faculty alternative salary requirements.
The F.T. or P.T. faculty salaries required to meet 'absolute' credit needs in disciplines eleven and twelve (Table 6 - Col. 3), have been added to the four available faculty salary alternatives in order to identify the total base or absolute salary need for both the systems current and projected states for disciplines one to twelve inclusive. It is to be noted that these four alternative base salary costs are in addition to the salaries of faculty currently employed in the instructional system. Therefore, when considering the total instructional faculty salary costs, an additional and estimated $95,700 must be added to these four alternative faculty salary cost subtotals.

Table 7 (p. 54) represents the actual (historical) and estimated (projected) income generated by the system's input resources. From Table 7 the student thesis enrollments differ as of 1977 from the active enrollment estimates previously stated. These thesis enrollment numbers were estimates and due to the first year thesis registration requirement. For purposes of income calculations in student tuition and government

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grants, it was assumed that this first year thesis enrollment requirement was practiced by all newly admitted students. Therefore all students enrolled in thesis projects were considered active thesis candidates. Government grant/F.T.E. student monies were calculated in accordance with the appended formulae (App. B.). Total annual faculty grant revenues, other than those actual and estimated monies generated by current faculty, are dependent on the faculty alternative(s) chosen to meet the credit deficits within any year specified. Table 8 "Net Revenues Attributable to the Instructional System", identifies for current faculty and the four new faculty alternatives the estimated annual G.R. potentials. Current faculty G.R. was set and held at $27,500/annum (the mean historical value generated) for projected years 1978 to 1982, inclusive. New faculty's ability to generated G.R. monies was estimated at $3,000 per member per annum. These G.R. values are listed separately within each faculty alternative by year and admission level and were not used in the calculations of the four potential net revenues.
IV. Analysis of Findings:

A. Introduction

Within the following discussion there are two subsections. The first section deals with the validity of the research model and as such responds to the theoretical concerns of this research paper. Secondly, the financial feasibility of the system's instructional resource requirements are considered. This latter section addresses the previously identified operational concerns (p. 3, 5, and 6) and the specified research objectives contained therein.

1) Validity of the Research Model

The first, or automated, portion of the research model attempted to measure the instructional resource requirements of the faculty in both contact hour and credit/contact hour values. The response to the question of model validity is not submitted here in purely statistical terms, but rather stated in the model's ability to accurately represent the system's instructional resource requirements. Working within the policy structure of the system, and by employing the "minimum 18, maximum 24" annually assignable credits to F.T.P. faculty, Table 4 (p. 46) was presented to demonstrate variances in the faculty required by comparing the two model measures to the department's use of the credit measure. In terms of validity, as defined by model representativeness, the
largest variance demonstrated between either the model's contact hour availability value and the department credit values or credit/contact hour values and department values for required faculty was 0.130 F.T.E.'s. In terms of course credits or F.T.E. salary dollars, this model/department variance is equivalent to 3.12 credits or $2,600, respectively. Therefore, it is submitted that the research model is valid to within a 3 credit course value or a faculty contact hour value of 130 instructional hours and as such is valid by all measurement methods employed herein.

The data generated by the automated model was invaluable in:

- initially establishing the existence of annual instructional resource underages in contact hour values
- identifying the current faculty's contact hour effort expended in order to fulfill the department assigned course credit and student generated instructional/credit workload
- identifying an actual contact hour value/course credit, and thereby pointing the way to the reevaluation of both thesis and internship credit values, and

the development of the manual portion of the research model wherein, for purposes of the appropriate
(ie. according to an identifiable instructional need) allocation of F.T.E. faculty by number and type, a breakdown (by discipline) of annual contact hour overages was required.

In short, the automated model identified both the system's general and specific instructional resource requirements, some of which it is added required further probing. The automated model was not designed to account for the fact that for each section or course a presiding faculty member was required, nor was it capable of filling courses to a specified maximum and thereby creating additional course sections where needed. Course contact hour overages were anticipated and flagged as such within the computer program.

Therefore, in consideration of:

- the objective functions of both the mechanized and manual portions of the model
- the viability of the research model within the identified policy constraints of the current instructional system, and
- the negligible differences in F.T.E. faculty required resulting from the above comparative analysis of the model measurements and system's measurements.

(Table 4, p. 46).

The total research model is submitted as valid/representative of the instructional resource requirements of the
system under study. Valid, it is submitted to a + 3.0 credit course value which represents one course out of a potential 35 course offerings, or $2,600.00 F.T.E. faculty dollars.

At the level of theoretical issues and from within the problem statement, the term "appropriately applied" was, as in the above discussion on model validity, intended to connote "simulative", representative, or properly functional. There now remains a measurement and definition of the term "successfully applied", which brings us to the operational issues contained within the boundaries of this research paper.

B. Operational Findings

1) Developmental Background

Given the availability of qualified faculty (MEN) and the interest evidenced by the sizeable number of annual student applications (MATERIALS), the remaining link in this economic chain is that of MONEY. It would be difficult, if not impossible, to refute the need for this latter commodity in order that the system studied could continue to function in ongoing, expanded, or improved states. Therefore, throughout the following discussions, the measurement of the "successful" criterion of the model's application will be dealt with largely if not entirely, in monetary terms. However, before proceeding to the financial aspect, there are three system elements
which require a short notation. Maximum admission level was initially included in the mechanized portion of the model in order to determine, given the respective maximums assigned for each course offering, the actual physical limits of the instructional system. That is, if the system was enrolled to its maximum enrollment/course what instructional resources would be required, and what admission level/annum would have to be realized in order to attain this physical limit? Working from both the total student places generated/year for three credit courses, and from the previously established (p. 28) student to student places ratio of 100:325 respectively, the resultant mean (X) admission level was estimated (over the eight year span studied) at 83.5 students annually. Two factors preclude the attainment of this annual admission rate. First, is the one-out-of-three student applicant rejection rate (P.D. Mitchell, 1977) for a total maximum of 100 applicants/year. Secondly, it is extremely unlikely, given the random nature of student course selection, that each course would fill to its exact maximum. The above notwithstanding, it was essential to identify the admission level which would result from a maximum course enrollment in order to establish that an increase of 20 to 25 student admissions per annum did not exceed either the system's space limitations or its physical resources. The maximum
Enrollment data was of value, at least in theoretical terms, in identifying net revenues, faculty alternatives and salary costs for this maximum enrollment condition. For the above reasons, financial data on maximum enrollment has been included in all previous tables even through the major thrust within the following analysis will be on the feasibility of an annual admission level of 60 students for the projected years studied. References made to an expanded system's state or an increased enrollment is intended always to connote an admissions level of 60 students annually. Although it was initially proposed (P.D. Mitchell, 1977) that the current admissions rate be increased to include an additional 20 to 25 students, an annual admission level of 60 students is, with the usual 10% drop-out and no show rate, in effect increasing the annual admissions rate by the proposed number of 20 to 25 students. The two remaining aforementioned notations are linked to the historical data. This researcher was mainly concerned with designing a model which would be sufficiently representative of the system under study in order to detail both the physical viability and financial feasibility of an increased admission rate. No consideration was given to identifying data for the annual admission level of 60 students for historical years and as such this was, retrospectively speaking, an oversight on the part of this researcher.
It would have been perhaps both more theoretically and programmatically sound, given the attributable net revenues and staff requirements of the system resulting for projected years, to have had a comparative (i.e., historical) data base from which to work. However, that stated, and from a hand-calculated rerun on this historical section of data, this researcher found that the resultant financial considerations, given the start-up time required for an increased enrollment, were roughly parallel (+ $5,000) to those figures appearing for projected years 1978 to 1982 inclusive as viewed in Table 8 (p. 56). Therefore, while the data oversight is conceded as an error in judgement on the part of this researcher, it is contended that, given the hand-calculated rerun and the above results, both a logical and pragmatic means were employed in order to amend the noted data omission.
The final notation relates to 'exception' conditions on data and calculated results stemming from an admission level of 30 in academic year 1976. In the two other historical years employed (1975 and 1977) the mechanized model initially tabulated contact hour underages -318 to -1008 per year. (Table 1, p. 38) In 1976, an annual total faculty contact hour overage of +960 was identified. The relative size of this overage was significant enough, in terms of a F.T.E. faculty value, to warrant researching the source data in order to determine what factor(s) were either directly responsible or related (in combination) to effect this contact hour overage. It was found that for year 1976 the total faculty availability (due to one sabatical leave) was, in fact, not equal to either of the other historical years nor to the faculty inventory value run for projected years. It is submitted then, that this faculty sabatical factor alone accounts for the resultant contact hour overage identified in academic year 1976. Other factors that were identified through researching the source data are listed as follows:

- a decrease in course offerings which may have resulted in P.T. students scheduling unavailable courses for a later year,

- a decrease in the annual total enrollment, enrollment being down from 1975 and 1977 by 64 and 28 student places, respectively, and
the change in registration requirements for thesis registrants. It is suggested that the increased monetary expenditure required on the part of the newly admitted student resulted in a decreased enrollment within the available three-credit courses.

In that a sensitivity analysis was not run on these factors, it is difficult to state to a high degree of assurance that the sabbatical leave factor was the singular cause of this contact hour overage which consistently appeared in 1976. What can be stated is that, due to the inaccuracy of source data on faculty availability, little if any comparative value was placed on the resultant financial calculation for year 1976.

ii) Analysis of Operational Concerns

Although this research paper has been confined to the direct or immediate instructional aspects of the system under investigation, this researcher is fully aware of the myriad of items which can fall under the 'catch-all' category of overhead or 'support costs' when dealing with systems of an education nature. Salaried costs, for the purposes of this paper, have been categorized in a very simplistic manner. Estimates of salary indices (i.e. cost of living) were not available. 'Other' faculty costs (health care, sick leave, pension plans, etc), which are costs directly attributable to the system studied and which are the financial responsi-
bility of the total (university) system, were not employ-
ed within the following cost comparisons. These 'support
costs' are 'detailed' and are fluctuating in nature and
were therefore omitted in that the research model was
not designed for this level or type of data input.
Secondarily, the very nature of the data required,
again, bordered on 'privileged' information. Net revenue,
a term frequently employed requires definition, and is
simply the arithmetical difference between the sum of
the system's annual input resource dollars and the col-
lective faculty's annual salaries.

Given the major operational concerns cited (p. 3,
5, and 6), there are effectively two major questions
that require both an analysis and a detailed response.
These are that given the projected student generated
instructional requirement is a request for required
faculty for either system states both a financially
feasible/justifiable and a physically viable proposal,
and as such, which of the four previously identified
faculty alternatives would most adequately meet both
the financial concerns and the instructional require-
ments for the system states. Therefore there are in
actuality a total of four operational issues to be
discussed.

In that information on both the method of distri-
bution of funds and rationale for amounts of funds
allocated to the system was, to say the least, scarce, budgeting projections from the most recent Budget for Graduate Studies (BGS) appraisal (P.D. Mitchell, 1977) were employed for the purposes of establishing a comparative base for the subsequent costs analysis. Budget projections for academic years 1977 and 1978 cited a $313,162 allocation of funds for use by the instructional systems current state. Of this amount, slightly more than $200,000 was earmarked for faculty salaries. This latter figure represents a faculty salary requirement of 63.86% of the system's total allocation of funds. In addition to the BGS budget projection, the related literature would also provide supportive documentation in favor of faculty salaries usually consuming the major portion of the system's allocated funds. The $200,000 salary consumption on the projected 1977/1978 budget was used both to illustrate this percentage issue and additionally because these figures were the most recent and available source of documented fund allocation data.

In returning to the initial operational query of the financial feasibility of faculty requested for the system's current state, and while on the theme of budget projections, let us scan Table 9, ('Faculty Salary Range For Annual Credit Requirements'). For years 1978 to 1982 inclusive, neither $200,000 in faculty salary nor a major percentage (ie. an amount greater than 50%)
of funds generated by the systems resources is ever exceeded! In fact, if for academic year 1977 we identify from the BGS appraisal the salaried dollar difference between funds budgeted and funds consumed, a discrepancy in favor of funds budgeted occurs in the order of $100,000 (rounded figure). This latter amount, in terms of faculty members, is equal to salaries that would hire four F.T.E. faculty members. From the manual portion of the research model for year 1977, the system required and did not receive faculty coverage for 40 credits or a faculty value of 1.66 F.T.E. This is not to exclude historical year 1975, where it is noted that, although the figures are slightly less dramatic, the principal exampled runs a direct parallel. Here it is again repeated that resource data and faculty salary calculations illustrated in Table 9 are based on an identifiable instructional need and the theoretical assumption that, given this 'need', the faculty required have been (or would be) approved and hired.
From the financial data, for both the historical and projected years for the system's current state, the following two general observations are made:

The current system's state appears to be generating sufficient funds in order to support the faculty salaries required to meet the identified instructional needs.

Secondly, that if the system continues in its current enrollment pattern, year 1980 would appear to be the year in which faculty salaries would consume the largest percentage of the system's generated income.

Let it be noted here that the collective faculty salary of $145,700 for 1980 is neither equal to the BGS projection of $200,000 nor consumes the major (≥ 50%) portion of the system's generated income of $350,055. Therefore, given this system's modest consumption of resource generated income, it should be capable of supporting the increase in student enrollment or an expanded system's state.

It is conceded that, in order to be totally objective, one should view this system's request for faculty in terms of the total (department/university system) system's faculty needs. However, it is contended that in terms of both amounts of funds earmarked for faculty salaries for 1977 and the annual incomes generated,
that the salary costs identified for the faculty needed to meet this instructional requirement and therefore the faculty requested, is a feasible proposition. Costs other than direct instructional ones (i.e. faculty salaries) intentionally have not been identified other than mentioned of the somewhat nebulous category of 'support' costs. With regard to this, 'support costs' issues have been sidestepped rather than ignored as a non-existent for, by initial definition, this paper is limited to purely direct instructional costs issues. Table 9 (p. 68) illustrates for all years and all admission levels the net revenues and the percentage of total incomes which remain following the deduction of both the most and least costly faculty salary alternatives. Again, the most costly faculty salary is the product of meeting the instructional (contact hour) need by hiring only F.T. associate faculty members. Conversely, the least costly salary alternative results from the use of combined F.T., P.T. and lecturers to meet that same instructional need. Now, for the system's current state within projected years and given the choice of the more costly faculty alternative, (this process obviously reduces the generated income by the greatest amount and results in the least remaining net revenue) the support or administrative costs would have to consume, in any
year, upwards of 60% of the generated income in order to place the system in the "red" financially. The 60% support cost illustration represents 1980. This academic year demonstrated the least net revenue following the deduction of the most costly faculty salaries, or stated another way, this was the year in which the instructional credit need was the largest of all projected years studied, and as such, even the most costly faculty salary alternative did not consume the major portion of funds generated by the system. Given the trend toward decreased university enrollments in Quebec, and the interest (as obviated by the number of qualified applicants) in this instructional program, can this system then support an expanded enrollment state? This brings us to the second portion of the financial query.

As previously noted, (p. 61) an estimated annual admission level of 84 students would have to be reached in order that the systems physical (space) capacity was reached. Therefore, in terms of physical limitations, the system can accommodate the increased enrollment state as projected (P.D. Mitchell, 1977). In financial terms, given the increased instructional demand, what faculty costs would the system be required to support?? For an expanded system's state for years 1978 through 1982, Table 8 (p. 56) illustrates the salary costs and the remaining net revenues for the four faculty alter-
natives. Salary costs are always calculated from an identified instructional need and total salary data are based on student enrollment figure estimates taken from the current and projected to an expanded system state. As occurred in the current systems state (again notwithstanding 'support costs')

it would appear financially feasible to expand the system's current admission level to include 20 to 25 additional students annually.

As demonstrated within Table 8, for an expanded system state, the most costly faculty alternative (#2) appears in academic year 1982. Here an estimated $205,700 of the projected potential income would be required and consumed by the most costly staffing option. Two points are of note here:

From Table 8 for academic year 1982, and faculty alternative #2, the amount of $205,700 is equal to approximately 1/3 of the generated funds for that year and clearly does not represent the major (>50%) portion or percentage of available funds.

Secondly it is noted that, the above salary requirement for year 1982 is a mere $5,000 more than the salaried amount earmarked or projected for faculty salaries for faculty salaries for an admission level of 30 students in the year 1977!
Both in consideration of these points and in light of the increased net revenues remaining for, or available to, the total (university) system (Tables 8 and 9), it is contended that an expanded system's state is not only a financially feasible proposition, but also financially advantageous one for the university as a whole. Therefore, requests for faculty to support the identified instructional demands of the expanded system state should be granted.

Given the acceptance of the proposed expansion, and in an effort to inject a large measure of objectivity in the selection of faculty/salary options, only the most costly salary options were selected (Table 9, p. 68), for the purposes of comparing net revenue possibilities between and amongst current and expanded system's states. Referencing Table 8, (p. 56), and proceeding in a chronological fashion, projected academic year 1978 demonstrated no additional faculty requirement costs between system's states. This resulted in a between system state net revenue difference of $180,000 (rounded). Throughout the entire table the expanded system's state consistently demonstrates a proportionately larger annual net revenues than the current system's state. The zero difference in salaries for 1978 is directly attributable to the influx of registered, but as yet 'inactive' research (thesis and internship) students.
This zero difference phenomenon corrects as we proceed through to year 1982, wherein the largest number of thesis students was expected to occur. As a direct consequence of this thesis backlog the largest difference in credit needs and therefore faculty salaries also results. Even as the most costly year, in terms of required faculty salaries, 1982 is estimated to realize a difference in net revenues of $180,020 for the additional faculty cost of $75,000 for that year. As the lease costly year, 1979 shows a difference in net revenues of $179,690 for an additional faculty salary expenditure of $10,000. Can the system afford to lose these 'differences' in potential net revenues by not expanding the current admission level?

In an effort to recapitulate, it has been established that the system in its current and expanded states does generate sufficient income to support the instructional credit need generated by either annual student enrollment. In addition it has also been determined that an expanded enrollment would not threaten either the physical limits and space available to the current systems state.

At this point, in the discussion it is time to consider the remaining operational concern. This concern, which as before results in a four pronged issue, deals
with the selection of the most appropriate faculty alternative, for both systems states (over projected years) in consideration of the individual instructional and financial requirements of both systems states. In that the financial hurdle has been cleared, the following discussion on faculty alternative(s) is based on the assumption that if a faculty requirement has been both identified and financially supported that the systems administrators would meet that need through hiring, at the least, the appropriate number, if not also the appropriate faculty type(s).

Issues of the order of instructional cost, faculty course curriculum development and program continuity, illuminate the rather repetitive "quantity versus quality" situations that often develop between the administration and instructional faculty. In the case of the system under study, and in the instance that the university/administration did opt for the least costly faculty alternative for either system state, this decision would consistently result in the lecturer faculty alternative. In addition to the least costly salary factor there are other tangible benefits linked with this staffing alternative. The lecturer, while on the university payroll, does not incur expenses in the form of office space, sick leave, or pension plan benefits, etc., in the same manner in which the regular (F.T. and
P.T.) faculty would require. While the faculty option of lecturer is definitely the least costly in terms of filling the credit need, it cannot offer the specified flexibility to the system in terms of research supervision and mobility among courses that both the regular (F.T. and P.T.) faculty types can provide. A specific example of this point will follow shortly.

In the interests of planning and development of curriculum, the organizing of assignment of faculty to course offerings, faculty research, and publishing activities, it is strongly recommended that the system should lean toward hiring approval for either regular (F.T. and P.T.) faculty or a mix of regular and lecturer staff with primary emphasis on the former faculty type. In addition to the 'flexibility' feature previously mentioned, regular faculty do generate grant revenues (G.R.'s) which, while these are not huge sums, do serve a very real system 'need'. Grant revenues provide, guaranteed capital assets without which there would be scant if any funds for laboratory/research experience and equipment for the system's students. However, to return to the specific issue under consideration, which faculty alternative would most aptly meet the annual credit underages/requirements identified for both current and expanded system states across projected years 1978 to 1982?
In generating the data which appears in Table 10 (Faculty Salaries by Annual Credit Requirements) a number of faculty allocation faculty averaging and credit averaging methods were tested for 'nearness of fit'. It is of note here, that the single element which necessitated the data (Table 10, p. 79) requirement for the systems expanded state was the annual faculty (FTE) requirement (deficit) on instruction and supervision of research credits. (disciplines 11 and 12)

Again, it is noted that this F.T.E. only requirement on disciplines 11 and 12 stem directly from the systems restraints (p. 21). Therefore, for the systems credit needs current state over the five projected academic years could be aptly matched by the addition of two F.T.E. faculty within any of the four faculty alternatives defined. Instructional requirements within any specified year that are not equal to 48 credits exactly, (as these 'spot requirements' vary by ± 6 credits) could be covered by instructional assistance by lecturers. Then to move from the current to the expanded enrollment situation, the initial increase in faculty salary costs for projected years occurs, not surprisingly, in academic year 1978. This salary increase remains relatively constant within each faculty alternative for the following four years, 1979 to 1982 inclusive. The exact dollar amount of this salary increase is, of course,
subject to the specific alternative chosen to equal in credits the equivalent of two F.T.E. faculty members. In that there are no research demands which specifically require regular faculty, the 'any' credit category for the four faculty alternatives would adequately meet the averaged credit requirements identified. If one faculty combination must be selected from amongst the four alternatives specified, it is assumed herein that the time required to procure 16 to 18 course lecturers (or the equivalent in lecturer credits) would preclude this faculty alternative. Other than justifying the most costly (two F.T.E.) faculty alternative, the additional trade-off to the system itself is the difference in potential faculty grant revenues of, at the least, $6,000 annually. Therefore, with the previously noted overage/underage differences within each year of the averaged five year/48 credit requirement, the closest match would appear to be faculty alternative number three. This alternative is a mix of minimum F.T. and maximum lecturer faculty types and represents both the mean (X) cost of both the most and least expensive faculty alternatives and, as well, being the second least costly option. Therefore, given the additional credit flexibility of F.T. faculty element requirements, this staffing alternative number three is submitted as the most viable faculty option available for the current
system needs.

The expanded admission level, as noted above, required at the outset some trial-and-error testing (Table 10, p. 79) in order to match credit needs with the faculty alternatives that could be considered as both 'reasonable' and financially justifiable faculty choices. The methods that were tested and the resultant data are illustrated in Table 11(p. 88). The terms "absolute" and "any" credit need are repeated here in order to differentiate between faculty types of "regular only" (absolute) and "any of the four possible faculty alternatives" (any), respectively. As these terms are constantly employed in the following discussion they required redefinition. Given the detail required in the trial-and-error methods tested and in attempting to determine a match for faculty number, type, and cost on the expanded system's state, what will follow is a very general assessment of the entire process and a general recommendation statement of faculty instructional credit requirements. In consideration of the current faculty employed within the instructional system, and working from data in Table 10, it is obvious that the least costly and perhaps the most expedient faculty alternative for years 1978 and 1979 and an expanded state would again be the lecturers alternative. This resultant choice is due solely to the "any" credit need.
of 54 credits and 52 credits for the academic years 1978 and 1979. And as with the projected current system's state, this alternative results in, at most, 18 course lecturers which again leads to the management of accumulated and cumbersome numbers of staff. To sidestep the selection of this lecturer faculty alternative is not to discredit the quality of the instruction provided. However, on the basis of program (system) management and the assurance of both curriculum development and continuity of program elements, these accumulated numbers of staff are a serious consideration. Therefore, while alternative three represents, for years 1978 and 1979, what initially appears to be an unnecessary salary expenditure, this alternative does keep lecturer and regular staff ratio in more manageable numbers. On the basis of long-range hiring benefits, the faculty "accumulated" within alternative three also prepares the system for either of two projected instructional credit eventualities for years 1980 to 1982, inclusive. One projection deals with the expanded system's research credit requirements which increase proportionately from the student numbers indicated in the 30 students/annum admission level to a 15, 29, and 69 student generated research credit requirement for 1980 to 1982, inclusive. Also, in the event that there is a significant (i.e. requiring more than the addition of one FTE faculty)
increase/shift in student generated research requirements from 1980 to 1982 inclusive, this credit need could then be covered by the staff number and type availability of faculty alternative three. In that the latter situation is the more probable eventuality for the expanded system state, and in consideration of the above issues, faculty alternative number three is recommended herein and approved therefore 'in principle' only. The recommendations that stem directly from the 'in principle' approval of faculty alternative three are as follows:

Hold to the recommended 6 to 8 lecturer/F.T.E. ratio until, on the basis of 'absolute' credit need (research credits) or faculty type requirements it becomes advantageous to the system to add faculty.

The additional faculty type recommended is a F.T.E., (or a percentage thereof), thereby deleting the required number of lecturers/course.

This ratio, 1 F.T.E./6 to 8 lecturers or satellite arrangement of faculty would appear (Table 11) to be the most advantageous option within faculty alternative three in terms of both effective use of system funds and the flexibility in annual credit assignment for faculty members.
These latter two items are especially vital in the last three years of the system's credit requirements, as the lead time necessary for faculty hiring activities as well as the availability and use of funds critical to the system's financial solvency and survival.
V. Conclusions

A. Recommendations

Based on the data employed within the confines of research model, it appears that the proposal to expand annual admissions by some twenty to twenty-five students is both a physically viable and financially justifiable proposition. It is noted here that before the completion of this research project, that the system studied underwent some very major physical changes. Changes in the form of additional numbers of faculty and new locale most certainly affected the systems functioning in terms of potential (ie. maximum enrollment possibilities) outputs (graduates) and the funds required to effect those outputs.

Wherein the numbers, time and place have shifted it is herein submitted that the expansion process and as such recommended pre-expansion and expansion activities will remain the same. Therefore the following recommendations are offered as pre-expansion activities and as such address the system's need for both a more accurate and identifiable annual instructional credit requirement.

I. To establish and maintain through the employment of a tailored version of this research model an on-going information system which will identify (at minimum) one
semester in advance the system's annual instructional and thus budgetary requirements.

**Operative detail:** For purposes of flexibility of both data and the analysis, it is recommended that the scope of the model used not be limited to a singular measure of the instructional (faculty) requirement. Specifically, that as in the research model developed, the three data fields of:

- faculty credits
- faculty contact hours, and
- the above combined credit/contact hour ratios

be conjointly employed in the determination of the system's annual instructional requirements. The rather obvious short term advantage of this information to the system is the identification, on the basis of course pre-registration data, the system's credit requirements in advance of both the commencement of the fall semester and the hiring deadline. Additionally, the application of this (or a similar) model provides management with various levels of relevant data which would be vital to activities of allocating instructional faculty and assessment the systems course/annual budgetary requirements.

The long term advantage of creating an information system which would evolve and grow with the system itself would be that, over a period of two or three
years, there would be a substantial amount of relevant and supportive documentation on the effects of various course/annual enrollments on the faculty availability as well as cost requirements for the total instructional system and the system's program elements. The above information would then be available and valuable to management in terms of both planning and implementing quantitative (expansion) and qualitative (curricular) changes.

Aside from the considerations of accuracy in model design, the modeling of a system's function to obtain reliable and relevant data output depends almost entirely upon the accuracy of, and representativeness of, the data input. Simply stated, but not so simply completed. Therefore, in an effort to:

- accommodate the instructional system's established practice of a student selected course registration
- introduce what is submitted as a 'required element of control'
- improve the level of information available on the physical and financial system requirements, the four items that follow are noted as requiring careful consideration well in advance of any expansion activities. The following three items are listed in a 'suggested' order of treatment.

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a) To establish the development and utilization of a 'unit cost measure' that is viable and relevant to determining the annual funding required to support the instructional system activities and is, in addition, functional in terms of the established budgetary measures used and policies employed by the system's presiding department.

Operative Detail: The suggested 'unit cost measure' for the system studies is that of cost/course offering. Cost/student and FTE's in faculty costs are, in the considered opinion of this researcher, considerably less malleable within the larger system's (university/department) functioning and policy considerations.

b) To establish both a functional and defensible minimum and maximum course enrollment figure(s). In light of the recent relocation of instructional facilities, the 'maximums' previously employed within this paper would have to be adjusted. In that in the financial justification for the system's expansion "hinged on" the question "can the system independently support its own instructional resource cost?", it would then follow that the system's program elements (courses) should also be considered or treated in terms of cost effective system units.
Operative Detail: From Table 12 (p. 91) and for disciplines 1 to 10 only, it will be noted that on the basis of faculty salary, F.T.E. student government grants and student tuition/credits employed, a minimum student enrollment of 7 students/course is required in order to recover what would be a mean (X) faculty salary of $2,500/3 credit course. Differences in course costs are not that great among courses within disciplines one to ten. In disciplines eleven and twelve (thesis and internship respectively), there are vast course cost differences. For example in discipline twelve, a 2:1 student to faculty ratio is required per internship project (0.5 credits) in order for the course to retain and enjoy the position of a self or an auto financed course. In the interest of both cost effective system elements and the effective and judicious deployment of faculty credit resources, it is recommended on both a qualitative and quantitative basis that a biannual offering of the program's full slate of courses be seriously considered. The identification and recording/updating of the instructional course requirements of the system's student populace for both in-system and newly enrolled students is essential for purposes of:

establishing both core course and remaining elective credits required to complete the degree offered.
planning both the annual semester course offerings and the number of sections/course that may be required
counseling the student in choosing course studies and course availability (i.e. course electives to be offered in which year/semester) and,
assessing the student 'flow' through the system and estimating or projecting course enrollment figures, as they become available.

(1) To establish and assess the relative value to both the student and the operational aspect of the system of offering a full slate of courses on only a biannual basis.

Operative Detail: Tangentially it is suggested that, in the interests of both the system's financial status and the analysis and identification of a pattern of student flow through the system, that core courses be absolute prerequisite to all other electives. Additionally, it is suggested that without exception, all research courses be registered for in the first or entrance year of study. Some immediate advantages of the above suggestions are that contracts for research course faculty could then be established early on in the student's chosen course of study. The individual student would still have the flexibility of course selection and, as well, the assurance that the specific electives he/she requires
would be available when they were ready to assume those particular course choices. Other levels of information made available by the implementation of these 'control' measures are seen as:

- an ability to anticipate the need for additional course sections in advance of the instructional need and thereby effectively allocate the current and additional faculty required.

The offering of a full slate of courses on a biannual basis has a decided advantage on yet another plane which is vital to the system's function, that being the financially astute employment of available and budgeted funds. Under enrollment (given the previous establishment of minimum enrollment figures/course) is an unnecessary consumption of faculty credit availability and effective faculty allocation, as well as having the effect of increasing faculty salary costs. Biannual offering of some elective courses would, in fact, 'free-up' both three faculty credits/course and the faculty course cost of $2,500 for use in other courses requiring additional sections. The recommendations set forth in the preceding sections may appear to be heading toward over-management in the sense of regime requirements or regimentation. However, as was indicated in the opening remarks, all items offered for consideration were done so in the interest of creating both a functional and
applicable information system which, through use of a systems approach, would facilitate the system's curricular evolution and financial development in a positive direction.

It is submitted then that the model employed within this initial research has established on a quantitative basis the applicability of modeling techniques for instructional programs within systems of higher education. The future measure of a successfully applied model for this educational system depends, to a large extent, on either the 'tailoring' of this research model or the development of a new model which would include both the newly acquired faculty and the classroom space brought about by the system's recent change in locale.

In conclusion, this researcher poses a question. Given the potential value of both the qualitative and quantitative levels of information available to either the system studied or to any system of higher education, as well as the opportunity to understand the system more clearly, can management then afford not to pursue or explore the realm of modeling techniques or models available to educational systems under the aegis of Systems Analysis?

B. Summation

The following overview is submitted in response to both the 'technical conditions' specified within the
formal problem statement, and this researcher’s overall contention that solutions to problems arising in the planning and utilization of instructional resources are available within the modeling technique of systems analysis.

i) The mechanized aspect of the research model encompasses an eight year time span -- three historical and five projected years, respectively. In that time frame there were two assumptions made on data employed within the construct and design of this system's model. First, that one F.T.E. faculty member should be equated with an instructional contact hour output of 1040 hours per academic year. Secondly, that the course enrollments for projected years could be based directly on data employed for the system's current state given the enrollment trend demonstrated therein and simply increased proportionately to represent the system's expanded state. Therefore given these two working assumptions, the mechanized model demonstrated for the system's current, expanded and maximum enrollment states, the occurrence of both contact hour overages/underages by discipline and semester within each year and the consistent occurrence of contact hour underages on an annual basis. The significance of this data to both the system and this researcher was three-fold.
First, it was clearly evident from the historical contact hour underages that additional faculty are required for the system's current instructional demands. By extension, for an expanded system's state, additional faculty would also be required. Laterally, it was determined that, from annual credit contact hour ratios established for disciplines one to ten inclusive, a comparative credit value discrepancy existed for research disciplines eleven and twelve (thesis and internship). Therefore, in that the system administrators assign a faculty member's workload on the basis of credits, and in order to fairly (equally) represent the faculty's contact hour output across all instructional disciplines, the two research courses were revalued in a faculty assigned annual credit value of 3.0 per thesis and 0.5 per internship project.

Secondly, the annual contact hour requirements generated for a maximum course enrollment state indicated that in terms of physical limits (space) an expanded system's state could be accommodated within the current system's instructional facilities. In addition, the physical limits of the system were determined through a reconversion of the enrollments to student ratio, and estimated to be capable of accommodating 84 annual student admissions.

Lastly, through an assessment of the credit/contact
hour values, and the underages and ratios specifically established by the mechanized model, it was evident that a means by which to identify both the number and type of faculty required and the relative cost of those faculty was clearly indicated. The identification of this data requirement lead to the interface and design and development of the manual portion of the research model.

ii) The instructional design and the data employed within the manual model required the establishment of two major assumptions. First, that one F.T.E. faculty member was equal to the maximum assignable institutional credit value of .24 and that faculty could be categorized by function and type into the four faculty alternatives of F.T., lecture, minimum F.T./maximum lecture, and maximum F.T./minimum lecture.

The second assumption dealt with the financial value of, and the "a priori" assignment of the research disciplines to annual 'regular' faculty availability. All newly admitted students were required to register for thesis on entrance to the instructional system. This 'a priori' assignment of annual research credit requirements to faculty credit availability assured that the student flow through the system (immediate or potential graduates) would not be impeded due to a lack of specific type of faculty (F.T. or P.T.) availability. Given these established/working assumptions, the function of
the manual model was to:

- assign by type the annual credit availability of currently employed faculty,
- identify both the amount and type of annual credit deficit,
- generate, through the four faculty alternatives defined, the number, type and salary cost of the faculty required to meet annual credit deficits for both system's states, and
- establish, through an annual accounting of income generated versus faculty salary costs, a monetary base for both a comparative cost of the two system's states and the relative financial feasibility of the proposed expanded system's state.

iii) On a totally theoretical plane, the relevance of the manual model's resultant data was input not as significant, to this researcher, as the modeling concept itself. The model demonstrated that a means was available by which both system's states credit requirements and the faculty salary cost of meeting those requirements could, in fact, be identified. On the proviso that accurate and substantiated course enrollment data could be procured on an on-going basis, thereby establishing rather than estimating the system's annual credit requirements, what remains is the relatively simple task of identifying credit deficits and costing
faculties alternatives to meet the credit need. Given this data proviso, the value of the modeling concept, on an operative basis to the system studied can be succinctly described in a word,... TIME. Specifically, lead time in order to:

- prepare budget proposals and faculty requests for the next academic year,
- consider on both a qualitative and quantitative basis the faculty mix (by type) which would most adequately meet the needs of both the instructional system and the individual,
- prepare contingency plans for both budget and faculty requests which may be required for budgetary restraints, and
- interview and hire in accord with approved faculty requests.

These few examples of the management tasks which are requisite to the ongoing functions of the instructional system require this lead time. The time afforded the system through relevant and substantiated data on the system's annual credit requirements and the level of information available is crucial to planning activities which affect the system's functioning in either an expanded or an ongoing state. The building of models to represent a system's structure and functions, or modeling techniques, is essentially the construction
of an information system for a system studied. The value of the manual portion of the research model in operative terms lies in its ability to facilitate the identification and allocation of the appropriate number and type of faculty required to meet a given annual credit need - thereby converting a credit need to a dollar value and/or the cost of meeting that credit need. On a financial basis, the manual model provided a means by which to evaluate, on a comparative basis, the relative costs of four faculty alternatives within and between academic years, for either the current or expanded system's states, respectively. The relative value of this level of information is that it provides the system with substantiated or documented cost data on which to base budget and faculty requests. In the case of the potentially expanded system's state, information of this order allows management to intelligently decide and affect aims which would promote the system's positive evolution and, as such, improve the systems output... the graduate.


APPENDIX A
COURSE WEIGHTS

Instructions:

This form represents an attempt to estimate, in terms of contact hours, the instructional effort required of a faculty member assigned to the responsibility of conducting a given Educational Technology course.

The courses listed below have been assigned 2, 3, and 4 activity components. The lecture and lab components are not student dependent in the sense that whatever number of students are enrolled in these two activities, the contact hours which represent faculty effort is equal to the number of lecture or lab hours established for that specific course in a given semester.

The student dependent activities (individual work and examinations) therefore are to be expressed in faculty contact hours per student.

Individual work includes such elements as student term papers, a student project, a student seminar.

Examinations - could include written, media or oral presentations.

In weighing the above activities on a contact hour per student basis, the following details should be considered.
The staff time required:

1) to prepare and evaluate assignments, projects, examinations
2) for consulting with the student who is preparing a given paper or project;
3) for formal seminar presentation or examination, if other than a regularly scheduled lecture period.

Note: 690 and 699 (Thesis and Internship)

The 'individual' category refers to the faculty advisors' guidance time spent with a student on a thesis or internship project.

The 'exam' category designates the time a faculty member spends reviewing (either alone and/or in a formal faculty meeting) thesis, thesis proposals or internship projects.
### COURSE WEIGHTS INSTRUMENT

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<th>Course Number</th>
<th>Credits</th>
<th>Maximum Class Size</th>
<th>Course Activities - Faculty Contact Hours</th>
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FINANCIAL DATA, REFERENCES AND FORMULAS

I. Faculty Salary (estimates)/annum
   a) Associate Professor = $25,000.00
   b) Assistant Professor = $20,000.00
   c) Lecturer = $1,450.00/3 credits

II. Government Grant/F.T.E. Student
   a) 1 F.T.E. Ss = \(\frac{\text{student places/course X course credit value}}{30 \text{ credits}}\)
   b) 1 F.T.E. Ss = $3,800.00/annum

III. Student Resource Input - Tuition
   a) 1 student place = $10.00/course credit
   b) $30.00/student/3 credit course
      $360.00/students/thesis (36 credits)
      $150.00/student/internship (15 credits)

IV. Calculation For Faculty Grant Revenues
   a) Associate \(\bar{x}\) value $7,735.00 \(\bar{x}\) for this
      Assistant \(\bar{x}\) value $3,250.00 range = $5,492.00
      Let current/faculty member be = $5,500.00/annum grant revenue.
      Current (total) faculty = $27.5K/annum
   b) Let newly hired faculty be = to assistant \(\bar{x}\) value
      New faculty = $3.0K/annum/faculty member

* Full time equivalent student
## Enrollment Forecast

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<th>Category of Student</th>
<th>77-78</th>
<th>78-79</th>
<th>79-80</th>
<th>80-81</th>
<th>81-82</th>
<th>82-82</th>
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<tr>
<td>5.1 F.T. (WMR for 2 yr.)</td>
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<td>73</td>
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<td>F.T. (BMR)</td>
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| Total Enrollment            | 124   | 130   | 122   | 114   | 114   | 112   |

| F.T.E. (F.T. - \(\frac{1}{2}\)(P.T.) | 107   | 119   | 116   | 112   | 113   | 112   |

| 5.3 Partial                 | 1     | 1     | 1     | 1     | 1     | 1     |

| 5.4 Q.Y. (Day)              |       |       |       |       |       |       |

<p>| 5.5 Q.Y. (Evening)          |       |       |       |       |       |       |</p>
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<th>Percentage Appointment</th>
<th>Annual Salary (K) Assistant</th>
<th>Annual Grant Revenue Estimate (K) / New Staff Member</th>
<th>Instructional Credit Range Assignment</th>
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