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UNIVERSITY OF MINNESOTA HEALTH SCIENCES

COST CONSTRUCTION STUDY

February 1983

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FOREWORD

This is a report to communicate further details of the Health Sciences Cost Construction. While the report includes a discussion of cost construction methodology in general, the main purpose of this transmittal is to set forth the completed Cost Construction for the School of Nursing.

Interpretations and commentary by Meredith A. Gonyea, President, the Center for Studies in Health Policy are also included for an external perspective.

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COST STUDIES IN THE HEALTH SCIENCES

In 1971 the Health Science units of the University of Minnesota were invited to participate in a national AAMC-NIH Cost Allocation Study. This was an effort, across a group of about forty academic health centers, to get at "average costs of education" for about twenty-five kinds of Health Science students. The participation proved useful and the resulting information obtained has been helpful in dealing with interstate education contracts in Nursing, Dentistry, and Medicine; with legislative workload requests during the 1970s; and with back-up for cost reimbursement from third-party payers. This study, updated in two-year intervals, was and is an implementation of an externally recognized methodology. The University of Minnesota Health Sciences did not set up and experiment with a cost-finding methodology but simply tried out and started using a procedure deemed by advocates around the country to have usefulness in understanding education programs and pertinent cost factors.

The central analysis technique of the Health Sciences Cost Allocation Study is effort reporting by the participants themselves, i. e., faculty and staff, in a setting carefully pre-planned to obtain interest and cooperation. The various programs of education within a college are defined and written out with the assistance of the faculty while, at the same time, the needs for clear and direct information on program costs are set forth. Faculty and staff prepare annual allocations of their effort towards programs on the basis of definitions and categories they have helped establish. Individual effort profiles, estimating annual effort to such programs as undergraduate education, graduate education, research, and continuing education, are then computer-matched with the cash salary cost of the individual participant in the year of study. Through summaries by department and college, program "cost pools" come into being quite readily. In cases where resources are shared across colleges, there is clear delineation and sorting across all Health Science units. Regarding education costs, the information produced comes out in the form of annual average education costs by program. The average costs per student relate to the actual numbers of students in training across all of the colleges and the "control total" for the system is the University general expense ledger covering the study year.

COST CONSTRUCTION -- THE BASICS

While the results of cost allocation studies are useful historically and on a current basis, there is increasing interest in obtaining cost factor information, particularly for education programs, in terms of future or hypothetical levels of class size. While existing cost studies deal nicely with the here and now for many purposes with average costs, the new data needed are in the realm of marginal costs. Specifically, what are the differences in required resources at different levels of enrollment? In emerging programs where enrollment may increase by 10%, 20%, 30%, or 40%, what are the staffing changes that would be predicated upon existing data? Conversely, in programs where there may be less student demand for any one of a variety of reasons, what would be the differences in required resources with class size decreases of 10%, 20%, 30%, or 40%?

Cost construction studies identify the required student curriculum by quarter, by year, and for all years in the subsequent format:

(a) The units of curriculum (courses) taken by the typical student in each major or study field.

(b) The mode of the course --lecture, laboratory, or clinic/seminar --as a first step in getting towards the highly important group sizes through which the courses are delivered to the student.

(c) The class size at the actual or selected level.

(d) The major determinants of utilization of faculty resources are the group sizes that are associated with the particular courses taken by the students within a defined program. (In lecture offerings, the whole class is often lectured to at one time. At the opposite end of the spectrum, there are some courses taken by students on a one-to-one basis in which one faculty member teaches one student. In these clinic/seminar offerings, there are gradations upwards -- one-to-two, one-to-three,one-to-four, and so on. In a variant of this, a student in a clinical setting may be under the tutelage of one faculty member but the faculty member supervises the student on an intermittent basis. Between the opposite ends of the spectrum of group size, there is much education in the laboratory mode where typically 8, 12, or 16 students learn at one time in a course from one faculty member.)

In addition to providing information on numbers of faculty required at selected levels of enrollment, cost construction studies, through a series of charts, portray various scheduling and peak-load problems that may not not otherwise be brought to the attention of the college.

COST CONSTRUCTION -- ANALYSIS FOR THE 1980s

Cost construction is not an isolated unique procedure developed and applied in a few scattered locations here and there in universities. Instead, it is just one more example of simulation modeling that became the focus of much attention in the 1960s. Modeling is essentially a technique of defining a system to identify the internal dynamics through description of the components in numerical terms. A system, once defined, such as the curriculum for a particular set of students, contains "variables" that can be altered to observe effects. Modes, class sizes, and group sizes taught at one time can be varied one at a time or varied in selected combinations for insights into future "What If" checking out of alternatives. In addition to the above factors involved in resource planning, department heads and deans can seek to balance out student contact hour loads by quarter, year, and program if they so desire. Similarly, by means of appropriate simulation charts, faculty contact hours by quarter, year, and program can be studied for patterns. Student contact hours and faculty contact hours can be compared externally to various norms and indices as a means of achieving greater balance where needed. As a communications device useful in discussing workloads across various phases of programs, the charts capture and record useful information.

Cost construction has also the further potential of providing a systematic basis for explaining to those individuals and groups in the business of allocating (and retrenching) education funds just what are the facts involved in the financial logistics. For example, cost constructions have the potential of documenting the specific curriculum offered to students with the related modes and group sizes shown clearly. Documentation of external norms and indices can be provided, along with information from accreditation requirements. Along these lines a suitable curriculum for this or that type of student can be described and communicated as necessary. This kind of information as it reveals staffing requirements based not on generalities, hunches, or truisms but on facts derived from an observable plan often has great impact. Anyone not understanding a budgetary request for a particular (future) enrollment level could be simply shown how the line-by-line (course) information translates into required faculty teaching hours via the mode of the course and the associated group size.

A third level of use of cost construction emphasizes the combining of other information with the chartings. For example, in the modern era of high and rapidly increasing tuition, some significant management information can be readily assembled to show the relationships of enrollment change. Specifically since cost construction charts show faculty resources required at any selected level of enrollment within reason (say $\pm$ 40%), it is just another step to determine the cost of faculty at the various selected enrollment levels. Mean salary data related to the pertinent faculty category (typically Instructors and Assistant Professors) are readily available for these projections. The tuition increments covering the various enrollment portrayals, especially as the lowest tuitions are now approaching $2000 per year per student, are or ought to be of more and more interest to those at the management level. This is of particular significance where documentation shows ample numbers of student applicants and other positive factors.

SCHOOL OF NURSING COST CONSTRUCTION

Please refer to the two enclosed cost construction charts -- one for the three-year BSN program and one encompassing the seven Master's level advanced programs.

On the basis of the previous description of cost construction, the flow of calculations horizontally on a line-by-line basis should be clear and direct to the reader. Each course in the curriculum is shown with the pertinent lecture, laboratory, and clinic/seminar modes and accompanying group sizes as applicable. Faculty contact hours by course are summarized at the end of each line and these course hours are in turn summarized by quarter, year, and for the program as a whole.

The BSN program currently has an enrollment of approximately 480 with 165, 160, and 155 as the three component years representing subsequent classes towards graduation.

The charts presently show for both programs a divisor of 675 annual clock hours of teaching contact per faculty member. This is based upon 15 hours for each of 3 12-week quarters plus 15 hours per week for the 9-week summer session. Across the School, the predominant appointment is the A-base covering 12 months, with approximately 60% of the appointments in this form. An alternative index of annual teaching hours would be based upon the nine-month cycle during which the great majority of the education occurs. One outside norm on analysis plans based upon nine month programs suggests 18 clock hours per week for the three 12-week quarters for an annual divisor of 648. In the ensuing discussion, the 675 annual clock hours figure will be used. Additional documentation of these external norms and indices on this will be provided later.

The BSN program extending over the three years requires 670 lecture hours, 458 in laboratories, and 975 in seminar/clinics. The percentages, respectively, are 32%, 22%, and 46%. However, as these modes of education get translated into faculty hours through the intervening variable of group size, the result is a skewing of faculty contact hours. The resultant faculty contact hours by mode are lecture --262 (the hours from Nursing and not including those from the Basic Sciences, Public Health, and other parts of the University) which equals 1%, laboratory (similarly Nursing only) 3201 or 14%, and seminar/clinic 19013 or 85%.

The Nursing education programs (both BSN and Master's) are heavily clinic-oriented averaging one-to-eight faculty-student group sizes and this results in a nearly proportional relationship between enrollment change increments and faculty resources required. (An illustration at this point may be helpful. In the Duluth School of Medicine, for example, Biochemistry is taught in the lecture mode to the entire class. If the present class size of 48 were decreased by 10% or 20% or 30%, there would be no change in the required faculty to staff the course.) To the extent that a particular curriculum is skewed towards the lecture mode, there is less of a change in requirements for staff based upon enrollment change. In a program such as BSN nursing where 85% of the faculty contact hours are in small groups, the required faculty hours tend to be proportional to the changes in enrollment. Cost constructions for curriculums of the lecture-oriented variety tend to show quite vividly that faculty teaching resources are nearly the same for 10%, 20%, and 30% enrollment cutbacks as they are for current 100% levels of enrollments. The discovery of these lecture vs. clinic relationships should not cause one to revert to simple faculty-staff ratio analysis since the cost construction charts can serve other purposes such as highlighting peaks and valleys during the academic year of student contact hours and faculty contact hours. But most important it is the detail portrayed in the cost construction model -- not only the contact hours by the students and faculty but these are shown at 10%, 20%, 30%, and 40% enrollment changes. Last of all, it is the ability to change the "variables" in the system to see what would likely occur under different circumstances. With additional documentation the annual norms of faculty clock hours could be adjusted and this would impact upon the patterns of faculty utilization through the academic year.

As a means of illustrating the uses of the charts a series of calculations will be presented on relationships of faculty needed in the BSN program and student tuition. In doing so, the assumption will be made that there are many more qualified student applicants than there are current entering positions (165). It will be assumed, further, that other factors such as employment opportunities for University BSN graduates are such that the program at current levels of enrollment is a meaningful possibility. Let us recognize for purposes of illustration that enrollment cutbacks across all Nursing programs are being discussed in various forums and planning groups and that a 40% enrollment cutback needs to be checked out in terms of class sizes by year, faculty needed by quarter, and the likely tuition impact to the University and the State. In 1982-83 tuition is $38.50 per credit and it will be assumed that the individual students pay for 40 credits per year. Based upon a recent University announcement of a $154,000 retrenchment for Nursing, the following chart of information may be helpful.

ILLUSTRATIVE RELATIONSHIP BETWEEN CLASS SIZE AND TUITION

	1982-83	1983-84	1984-85	1985-86	1986-87
Year-1 Class	165	100	100	100	100
Year-2 Class	160	160	95	95	95
Year-3 Class	155	155	155	90	90
Enrollment	480	415	350	285	285
Tuition per credit (incremented by 12% per year)	$38.50	$43.00	$48.00	$54.00	$60.00
Tuition receipts based on the above	739,200	713,800	672,000	615,600	684,000
Tuition receipts based on continued enrollment at 480	739,200	825,600	921,600	1,036,800	1,152,000
Difference	0	111,800	249,600	421,200	468,000

The State of Minnesota, in various fiscal straits due to the economy and other factors, may well reduce education base dollars currently flowing to the University. In the instance of the School of Nursing a preliminary estimate of required fiscal retrenchment is $154,000 to be achieved largely in 1983-84 with the full $154,000 to be removed by 1984-85.

Within the School of Nursing it is reasonable to assume that an enrollment cutback is or ought to be in the discussion stage. While the cutback illustrated down to 100 entering class may be either too much or too little based upon the discussions, the fiscal projections are shown on this for purposes of illustration.

The point to be made is simply this: if the State/University seeks to recapture funds to do some book balancing, and if $154,000 of resources were to be removed from Nursing by 1984-85 and these "resource constraints" in combination with other factors were to bring about a one-third (approximate) cutback in class sizes, then the beginning object of recovering funds for the State and University could well have an outcome at cross purposes with original intent. Based upon the assumptions in the above projection which need careful additional review, the end result of retrenching Nursing may not be a recovering of $154,000 of education base funds but decreases in total tuition revenues of such a magnitude that alternatives need to be explored. All of this should be considered in light of the loss of 195 BSN students who seek training in a current situation (based upon the stated assumptions) that there are more qualified applicants than there are places and that the University BSN graduates are currently experiencing little difficulty in obtaining employment.

COST CONSTRUCTION CHARTS REVISITED

In the previous discussion, it can be seen that in a new era of high and rapidly tuition there may be some two-edged swords involved in the retrenchment process. The reason for the discussion was not so much to set forth in several decimal places of accuracy the likely unfolding of events but rather to illustrate the kinds of planning and decision making that may be improved through use of forecast models and projections. It was shown in the previous discussion that the State goal was to, in effect, come out $154,000 ahead. A potential offsetting effect was pointed out.

A more constructive question may well be raised: what are some of the ways through which the State/University goal of achieving $154,000 could materialize?

(a) In approximate terms there are about 480 annual enrollments which, assuming 40 credits paid for per student, accumulate to 19,200 credits paid for per year. If $154,000 were to be recovered and lodged into the State/University coffers, this would amount to a $8 approximate increase in the per-credit tuition. (Based on University MPIS figures on % of "instructional cost," the Nursing tuition is below the 32%, now the currently used index. Further, if the supply of BSN applicants is <u>substantially</u> <u>larger</u> than the the current 165 entering class size, then a recovery of $154,000, either in part or all, could be a viable alternative.)

(b) On the basis of the charts covering the BSN and the seven Master's programs, it is to be noted that, based upon the 675 hours of faculty contact time per year, approximately 33 faculty are required. On a similar basis, approximately 17 faculty would be required for the seven Master's programs. This adds to 50 faculty. However, beginning in school year 1983-84 an entering group of 5 Ph D students will begin in a program ultimately geared to an enrollment of 25 additional graduate students.

According to information available within the School, there are 29 faculty positions associated with the BSN program. Based upon norm hours of 675 for which more information will be presented later on, the BSN program is short by 4 faculty positions. However, as the charts show clearly, there are peaks and valleys over the teaching year. The Winter Quarter, during which the faculty accomodate the required faculty contact hours for the first, second, and third years in total, there appears to be a workload peak that seemingly needs to be looked at very carefully in any changes in School plans. The existence of the Winter Quarter workload peak might very well be the basis of serious discussion within the School for class size decrease. There are probably a great many reasons and needs that dictate just why the curriculum is scheduled in the way it is over the year. On the basis of the BSN curriculum as currently established and meted out during the year, there would appear to be no opportunity for trimming and belt tightening on the basis of current enrollment volumes.

According to information available in the School, there are 27 faculty positions associated with the seven graduate programs and the emerging Ph D. program designed to accomodate 25 students. While the cost construction chart shows a required complement of 17 (again assuming 675 faculty contact hours as an annual norm), there may well be a critical mass argument set forth to suggest that a graduate specialty ought to have a contingent of 3 faculty per program. On this basis, the seven programs would require 21 faculty which would leave 6 faculty for the developing Ph D. program designed to accomodate 25 advanced students. According to the charts, the peaking problem as was the case with the BSN program is not apparent here.

Cost construction, on the basis of the current structure of the BSN and the seven Master's programs and the emerging Ph D. program, indicates that across the School there is little slack that can be absorbed via retrenchment. The BSN Winter Quarter peaking problem is such that fewer faculty would make a difficult situation worse and that enrollment reduction, even with the cross purposes indicated earlier, may have to be considered.