DOCUMENT RESUME

ED 246 786 HE 017 509

AUTHOR Spiro, Louis M.; Campbell, Jill F.
TITLE Utilizing Technology to Examine the Impacts of Academic Program Plans on Faculty Staffing Levels. AIR 1984 Annual Forum Paper.
PUB DATE May 84
NOTE 20p.; Paper presented at the Annual Forum of the Association for Institutional Research (24th, Fort Worth, TX, May 6-9, 1984).
PUB TYPE Reports - Descriptive (141) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *College Faculty; *Computer Oriented Programs; Decision Making; Educational Planning; *Evaluation Methods; *Faculty Workload; Full Time Equivalency; Higher Education; Information Needs; Models; *Personnel Needs; *Student Teacher Ratio; Teacher Distribution
IDENTIFIERS *AIR Forum

ABSTRACT

The development and use of a campus-based computerized faculty staffing model is described. In addition to considering market demands for current and proposed programs, decisionmakers need to consider how program development, modification, and elimination affect the total college faculty resource base. The application of computer technology, specifically spreadsheet analysis, is demonstrated as a means of simulating the outcomes of a variety of academic program decisions. This type of application is important because it provides immediate answers to complex programmatic interactions that are otherwise not recognized. The end result is a significant decrease in the amount of hand calculating required in analysis, and a major increase in the quality of information available for informed decisionmaking. The three components of the computerized faculty staffing model are as follows: the number of majors registered within each of the undergraduate and graduate programs at the college; an impact matrix of the average student credit hours taken by each major within each of the academic disciplines by course level; and translation of full-time-equivalent (FTE) students into FTE faculty required within each discipline. The model is related to the formula budgeting approach, known as the 40 Cell Matrix, that is applied to the State University of New York System. (Author/SW)

Utilizing Technology to Examine The Impacts of Academic Program Plans on Faculty Staffing Levels

Louis M. Spiro
Director of Analytic Studies
State University of New York, College at Brockport
611 Administration Building
Brockport, New York 14420
(716) 395-2283

Jill F. Campbell
Assistant Director of Analytic Studies
State University of New York, College at Brockport
612 Administration Building
Brockport, New York 14420
(716) 395-2283

This paper was presented at the Twenty-Fourth Annual Forum of the Association for Institutional Research held at the Hyatt-Regency in Fort Worth, Texas, May 6-9, 1984. This paper was reviewed by the AIR Forum Publications Committee and was judged to be of high quality and of interest to others concerned with the research of higher education. It has therefore been selected to be included in the ERIC Collection of Forum papers.

Daniel R. Coleman, Chairman
Forum Publication
Advisory Committee

Abstract

In a period of declining resources and increasing accountability, many states and/or university systems have instituted formula budgeting methods of transforming student credit hours or FTEs into levels of faculty support. The application of computer technology, specifically spreadsheet analysis, is demonstrated as a means of simulating the outcomes of a variety of academic program decisions. This type of application is important because it provides immediate answers to complex programmatic interactions that are otherwise not recognized. The end result is a significant decrease in the amount of hand calculating required in analysis, and a major increase in the quality of information available for informed decision making.

Utilizing Technology to Examine the Impacts of Academic Program Plans on Faculty Staffing Levels

Introduction and Perspective

Higher Education has seen increasing demands for accountability in the public sector, particularly at the State or system level. Nowhere has this been more evident than in the budgetary process. Folger (1980) has outlined the changes from incremental, object of expenditure budgets to formula budgeting methods. The intent of these changes was to relate appropriations to enrollments as a means of achieving more equity in the distribution of resources. However, there has been a recent concern at the institutional level to modify these formulas with the expectation of declining enrollments, since costs do not decrease at the same rate.

Generally, these formula budgeting methods have been developed to link academic productivity in terms of student credit hours or Full-Time Equivalent (FTE) Students to a "suggested" level of FTE faculty necessary to provide these instructional services. Some modifications to these formulas have included marginal cost or average enrollment calculations. Another approach that has a major impact on the institutional research function is the recognition that different disciplines and levels of instruction should be evaluated by separate formulas. A budgeting process based upon this methodology becomes a great deal more complex and changes the required faculty staffing level in many interrelated ways which were previously unrecognized or irrelevant. It becomes the task of the institutional researcher to illustrate how faculty resource needs can decrease while enrollment might stabilize or increase, and conversely, how resource needs can increase with declining enrollments. The result is that in addition to considering market demands for current and proposed programs, it is now vital to examine how program development, modification and elimination impact the total college faculty resource base.

Literature Review

Gonyea (1980) describes the issues surrounding the problem of determining faculty resource needs, allocation and utilization. Existing faculty resource allocation can be analyzed by faculty flow models. These models provide an indication of future commitments and flexibility, but they do not provide insight into the need for faculty resources. Similarly, existing faculty utilization can be measured through the use of faculty activity analysis reports. While imprecise, these reports do provide some perceptions about how faculty apply their available time.

The most pressing problem is to determine future faculty requirements in a steady state or declining student environment, and the author provides a four step process to address this task. These steps include determining current faculty requirements for instructional programs, identifying the major institutional constraints, developing alternative futures, and making and evaluating future resource allocation decisions. In a budgetary process based upon formulas for determining faculty resource needs, the formulas become both the major constraints and the mechanisms for developing and evaluating alternative futures.

The actual development of alternative futures has been a persistent problem for institutional researchers. However, Ford and Martin (1983) have reviewed the historical evolution of computerized modeling packages and demonstrated how they can be applied to develop future scenarios. Early models such as the Resource Requirements Prediction Model (RRPM) were not used extensively because they were considered to be expensive relative to data collection, inflexible, limited in terms of analyzing a wide variety of institutional variables and heavy users of computer resources.

Current interactive modeling systems overcome these problems and are available through three sources. Examples include The EDUCOM Financial Planning Model that can be accessed through a time-sharing network; the Interactive Financial Planning System available for mainframe computers; and Visicalc designed for microcomputers. While the selection among these techniques is determined by the model requirements, available computer resources and individual expertise, the presence of this technology allows the institutional researcher to provide better information about alternative futures to aid in decision making.

Purpose

The purpose of this paper is to describe the development and use of a campus based computerized faculty staffing model. It is specifically related to the formula budgeting approach, known as the 40 Cell Matrix, that is applied to the State Operated institutions within the State University of New York System, (Freeman and Anslow, 1981). As part of this approach, all instructional offerings are clustered together to comprise one dimension of 10 composite HEGIS groups, and four course levels are identified as a second dimension. Within each one of these 40 cells, a normative student/faculty ratio has been developed based upon historical experience at the campuses. Faculty requirements are developed based upon the Student FTEs generated in each cell and divided by the appropriate student/faculty ratio. The current computerized model provides a disaggregated representation that focuses upon the faculty requirements generated by each instructional discipline as a function of the student credit hours taken by each undergraduate and graduate major. Model results allow academic administrators to examine the impacts of a wide variety of academic program changes on the anticipated level of FTE faculty.

Methodology

There are three basic components to this computerized faculty staffing model. The first component is the number of majors registered within each of the undergraduate and graduate programs at the College. This is an important aspect of the model since majors influence the student credit hours produced in a wide variety of disciplines outside of their own program. Some of these interrelationships occur spontaneously because of the distribution requirements of the liberal arts degree, while others arise from required courses in other disciplines as part of a major program. It is important to identify the impact of these linkages because most enrollment management strategies concentrate on the strengthening and development of programs in high demand, and potentially the reduction or elimination of weaker or lower demand offerings.

The second component is an impact matrix of the average student credit hours taken by each major within each of the academic disciplines by course level. This value is particularly important because it allows the impacts to be evaluated if the number of majors in one or more programs change and the average student credit hours remain constant. If programmatic change indicates different levels of student credit hours in one or more majors, these can be modified as well and the outcome re-evaluated.

The third component translates student FTEs into FTE faculty required within each discipline. The values used are the normative student/faculty ratios from the 40 Cell Matrix that correspond to the appropriate HEGIS code of the discipline and the level of the courses offered, (see Table 1). Beginning Graduate courses are those designed for Masters Degree programs and Advanced Graduate courses are designed for degrees beyond the masters such as the Certificate of Advanced Study and Doctoral programs. There is a great deal of variation in the normative student/faculty ratios at all course levels, since they represent a combination of differing methods of instructional delivery and historical student demand and faculty supply patterns.

The components of this faculty staffing model are illustrated in Figure 1. The number of majors in each undergraduate and graduate program is obtained from official enrollment reports. The disciplines and course levels offered are arrayed within each instructional department and the departments are grouped by School. Average student credit hours taken within each discipline can be derived from a number of sources. In this case, the data were obtained from an Induced Course Load Matrix, with the total student units in each discipline divided by the number of majors. The 40 Cell Matrix was entered as illustrated in Figure 1. Total Student Credit Hours for each course level within each discipline were calculated by multiplying the elements of each row in the average student credit hour matrix by the corresponding element in the row of majors, and summing each of the products. Total FTE Students were determined by dividing the Total Student Credit Hours by 15 for undergraduate courses and by 12 for graduate courses.

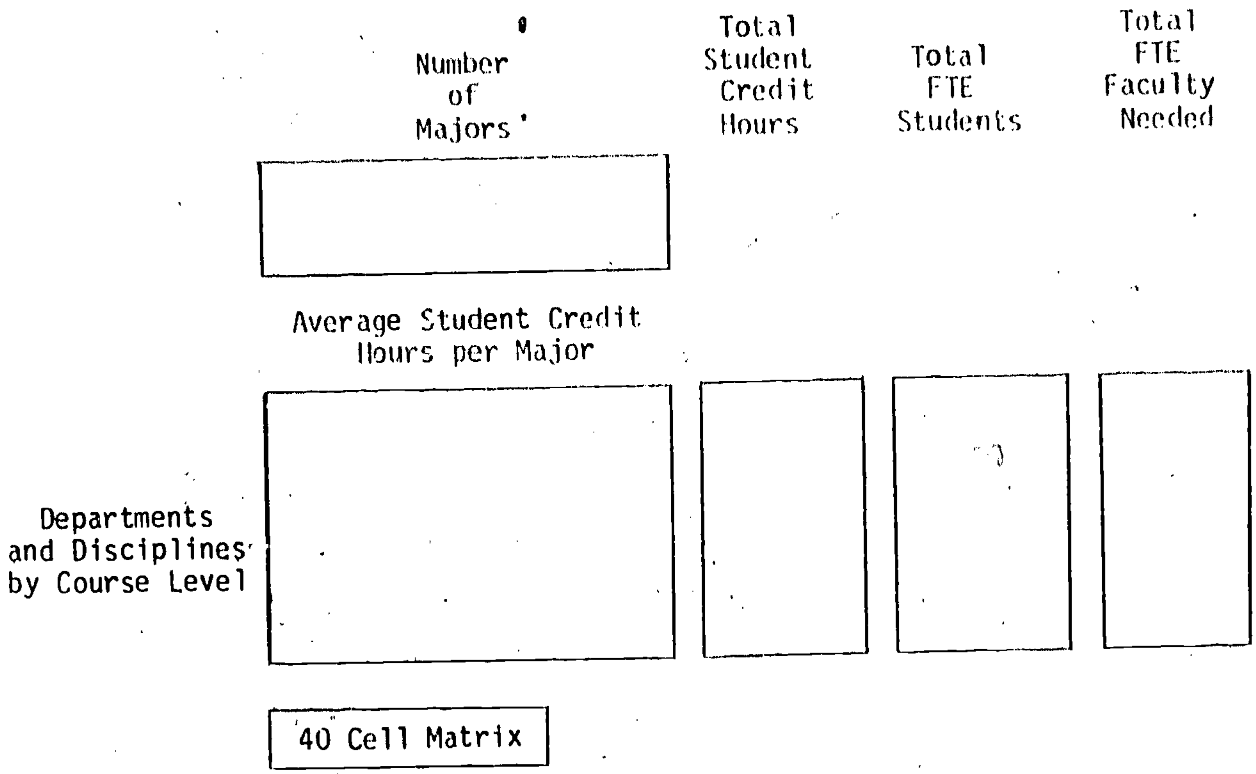
Finally, the Total FTE Faculty Needed were divided by identifying the student/faculty ratio in the 40 Cell Matrix corresponding to the specific discipline and course level, and then dividing it into the Total FTE Students. Totals were also calculated for each Department, each School and for the entire College.

Table 1

The 40 Cell Matrix of Normative Student/Faculty Ratios

HEGIS Clusters	Lower Division	Upper Division	Beginning Graduate	Advanced Graduate
Biological Science	28	10	8	4
Business & Management	30	20	15	6
Education	23	20	15	6
Fine & Applied Arts	18	10	7	7
Language & Letters	21	14	10	7
Math & Computer Science	28	15	10	6
Physical Science & Engineering	25	15	8	6
Psychology	35	20	10	7
Social Sciences	30	18	10	7
Other	17	17	10	--

Figure 1: Faculty Staffing Level Model Components



Results

The initial calculations of the model were used with the actual data on majors and average student credit hours that existed in Fall 1982. Since the Total FTE Students and Total FTE Faculty Needed had been developed previously on an aggregate basis, this provided a test of the model logic. Table 2 is a small extract of this model.

The model becomes exceedingly valuable when it is used to evaluate the impact of potential program changes on the related disciplines and the College.

Table 2

Extract of the Faculty Staffing Model for Fall 1982

Departments	Disc.	Level	BIO	BUS	COMM	PHYS ED	Total FTE Stdt.	Total FTE Fac.
# OF MAJORS			117	640	110	299		
Art	ARH	Lower	.05	.06	.03	.02	34.67	1.93
		Upper	.03	.00	.00	.00	7.65	0.76
	ART	Lower	.03	.07	.03	.06	41.93	2.33
		Upper	.03	.05	.16	.00	48.12	4.81
TOTAL ART							132.36	9.83
Communication	SPE	Lower	.00	.00	.00	.00	0.00	0.00
		Upper	.00	.00	.93	.00	9.25	0.46
	SPH	Lower	.03	.15	1.25	.04	85.69	4.08
		Upper	.08	.27	5.65	.06	173.50	12.39
		Grad	.00	.00	.00	.00	5.51	0.55
TOTAL COMMUNICATION							273.96	17.49
Dance	DNS	Lower	.10	.06	.08	.12	63.98	3.55
		Upper	.00	.02	.05	.05	41.61	4.16
		Grad	.00	.00	.00	.00	2.01	0.29
TOTAL DANCE							107.60	8.00
Phys. Ed.	PHE	Lower	.11	.26	.19	1.83	147.39	6.41
		Upper	.09	.24	.05	8.94	226.19	11.31
		Grad	.00	.00	.00	.00	16.05	1.07
TOTAL PHYS. ED							389.64	18.79
TOTAL COLLEGE							6344.93	358.11

For example, the demand for Business is expected to slacken while it is expected to increase in Communications. If enrollment targets are adjusted to increase Communications majors from 110 to 250 and lower Business majors from 640 to 500, the total enrollment will not change, however, there will be some significant changes across the institution as illustrated in Table 3. Very minor changes are evident in Art, Dance and Physical Education disciplines because these two majors do not have strong interconnections with them. The large increase in Communication reveals the need for 4.51 additional FTE faculty to compensate for the extra 69.16 student FTEs generated within the discipline. At the College level, there are only very minor changes in student FTEs and FTE faculty. The large decline in student FTEs and FTE Faculty in Business resulting from the decline in majors offset the increases in Communications. There are also changes in highly related disciplines, such as Economics and English.

Changes in student clientele can also affect the institution. For example, if a larger proportion of transfer students were brought into the Physical Education and Communications programs, the average student credit hour figures could change from lower to upper division within these disciplines. Table 4 shows this type of adjustment without modifying the total number of credits taken by these students. The total enrollment does not change, but there are some increases in the FTE Faculty required in these disciplines. There is no impact on any of the other disciplines. Even though the increases are modest in this sample, a conscious movement to more upper division enrollment would be rewarded with more required FTE faculty resources. Disciplines within the Biological Sciences and Math and Computer Sciences would especially benefit because of the much smaller student/faculty ratios at the upper division in the 40 Cell Matrix.

Table 3

Extract of the Faculty Staffing Model With Increased Majors

In Communications & Decreased Majors in Business

Departments	Disc.	Level	BIO	BUS	COMM	PHYS ED	Total FTE Stdt.	Total FTE Fac.
# OF MAJORS			117	500	250	299		
Art	ARH	Lower	.05	.06	.03	.02	34.39	1.91
		Upper	.03	.00	.00	.00	7.65	0.76
	ART	Lower	.03	.07	.03	.06	41.56	2.31
		Upper	.03	.05	.16	.00	49.14	4.91
TOTAL ART							132.73	9.90
Communication	SPE	Lower	.00	.00	.00	.00	0.00	0.00
		Upper	.00	.00	.93	.00	17.93	0.90
	SPH	Lower	.03	.15	1.25	.04	95.96	4.57
		Upper	.08	.27	5.65	.06	223.71	15.98
		Grad	.00	.00	.00	.00	5.51	0.55
TOTAL COMMUNICATION							343.12	22.00
Dance	DNS	Lower	.10	.06	.08	.12	64.16	3.56
		Upper	.00	.02	.05	.05	41.89	4.19
		Grad	.00	.00	.00	.00	2.01	0.29
TOTAL DANCE							108.07	8.04
Phys. Ed.	PHE	Lower	.11	.26	.19	1.83	146.74	6.38
		Upper	.09	.24	.05	8.94	224.42	11.22
		Grad	.00	.00	.00	.00	16.05	1.07
TOTAL PHYS. ED							387.21	18.67
TOTAL COLLEGE							6350.53	359.77

Table 4

Extract of the Faculty Staffing Model With Adjustment of Lower & Upper Division Average Hours in Physical Education & Communication

Departments	Disc.	Level	BIO	BUS	COMM	PHYS ED	Total FTE Stdt.	Total FTE Fac.
# OF MAJORS			117	640	110	299		
Art	ARH	Lower	.05	.06	.03	.02	34.67	1.93
		Upper	.03	.00	.00	.00	7.65	0.76
	ART	Lower	.03	.07	.03	.06	41.93	2.33
		Upper	.03	.05	.16	.00	48.12	4.81
TOTAL ART							132.36	9.83
Communication	SPE	Lower	.00	.00	.00	.00	0.00	0.00
		Upper	.00	.00	.93	.00	9.25	0.46
	SPH	Lower	.03	.15	0.50	.04	80.19	3.82
		Upper	.08	.27	6.40	.06	179.00	12.79
		Grad	.00	.00	.00	.00	5.51	0.55
TOTAL COMMUNICATION							273.96	17.62
Dance	DNS	Lower	.10	.06	.08	.12	63.98	3.55
		Upper	.00	.02	.05	.05	41.61	4.16
		Grad	.00	.00	.00	.00	2.01	0.29
TOTAL DANCE							107.60	8.00
Phys. Ed.	PHE	Lower	.11	.26	.19	.50	120.88	5.26
		Upper	.09	.24	.05	10.27	252.70	12.64
		Grad	.00	.00	.00	.00	16.05	1.07
TOTAL PHYS. ED							389.64	18.96
TOTAL COLLEGE							6344.93	358.42

Finally, there is a dramatic example of a change in programmatic focus and content across HEGIS clusters. The Physical Education discipline has traditionally been part of the " 'ucation HEGIS cluster, however, one potential change would refocus the program towards kinetics which would place the discipline in the Fine Arts HEGIS cluster. This one change would have a tremendous impact of 14.31 extra FTE faculty on the needs of the discipline and the College, as shown in Table 5, while not changing any of the other disciplines. If this change in program emphasis resulted in a loss of 100 majors, there would be a decline in enrollment and student FTEs. However, there would still be an increase of 7.74 FTE Faculty for the discipline and 6.24 for the College while other disciplines would have small losses based on the strength of their interrelationship to the Physical Education program.

This faculty staffing model allows more simultaneous changes in the number of majors within academic programs, their impacts on disciplines and the resulting faculty levels than can be illustrated here. These modifications can now be examined in terms of the affects on other program staffing levels and on the entire institution. Another important outcome is that timely evaluations of planned change can be provided before implementation, with the intention of improving the decision making process during a period of very scarce resources. Finally, the institutional researcher is more likely to become a more active participant in decisions that are now recognized as having campus-wide implications.

Table 5

Extract of the Faculty Staffing Model With A Change In HEGIS

Cluster of the Physical Education Discipline

Departments	Disc.	Level	BIO	BUS	COMM	PHYS ED	Total FTE Stdt.	Total FTE Fac.
# OF MAJORS			117	640	110	299		
Art	ARH	Lower	.05	.06	.03	.02	34.67	1.93
		Upper	.03	.00	.00	.00	7.65	0.76
	ART	Lower	.03	.07	.03	.06	41.93	2.33
		Upper	.03	.05	.16	.00	48.12	4.81
TOTAL ART							132.36	9.83
Communication	SPE	Lower	.00	.00	.00	.00	0.00	0.00
		Upper	.00	.00	.93	.00	9.25	0.46
	SPH	Lower	.03	.15	1.25	.04	85.69	4.08
		Upper	.08	.27	5.65	.06	173.50	12.39
		Grad	.00	.00	.00	.00	5.51	0.55
TOTAL COMMUNICATION							273.96	17.49
Dance	DNS	Lower	.10	.06	.08	.12	63.98	3.55
		Upper	.00	.02	.05	.05	41.61	4.16
		Grad	.00	.00	.00	.00	2.01	0.29
TOTAL DANCE							107.60	8.00
Phys. Ed.	PHE	Lower	.11	.26	.19	1.83	147.39	8.19
		Upper	.09	.24	.05	8.94	226.19	22.62
		Grad	.00	.00	.00	.00	16.05	2.29
TOTAL PHYS. ED							389.64	33.10
TOTAL COLLEGE							6344.93	372.42

Implications

This computerized model was operationalized using the System Tabucomp spreadsheet package on a Burroughs 6800 mainframe computer. The complexity of this model and the number of disciplines and major programs represented at the College took up a large part of the available storage. Over 18,000 cells were used in this project out of a maximum storage capacity of 23,000 cells, for a 78 percent utilization rate. As an experiment to see if the same analysis could be performed on a microcomputer, Lotus 1-2-3 was loaded into an IBM-PC with 512K of memory. With this configuration, only 10,000 cells were available, suggesting that a model of thi type is not appropriate for personal computers.

The fact that this analysis is so complex makes the application of available technology through simulation models essential for institutional researchers. This type of simulation is widely applicable since many institutions operate in an environment where student credit hours or FTEs are equated to staffing levels. It is now more important than ever to examine future alternatives, since in a period of resource decline, there is little margin for error. At an operational level for institutional research offices, the application of existing technology cannot be over-emphasized. Staffing levels for research are generally the same, or smaller, but many new demands have been placed upon these offices. Technology offers the only opportunity for researchers to increase productivity to meet these new demands.

References

Folger, John K. Implications of State Government Changes. In P. Jedamus and M. Peterson (ED), Improving Academic Management. San Francisco: Jossey-Bass, 1980, pp. 48-64.

Ford, Marge L. and Martin, Mary. Applications of Computer Modeling Packages in Institutional Research. Paper Presentation, Twenty-Third Annual Forum of the Association for Institutional Research. Toronto: 1983.

Freeman, Thomas M. and Anslow, William H. Considerations Used In Recommending 1981-'82 Faculty Lines. Memo to State University of New York Presidents, April 30, 1981.

Gonyea, Meredith A. Determining Academic Staff Needs, Allocation, and Utilization. In P. Jedamus and M. Peterson (ED), Improving Academic Management. San Francisco: Jossey-Bass, 1980, pp. 364-372.