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AUTHOR Newton, Robert D.
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ABSTRACT

Because the enrollment question is central to the resolution of a number of issues facing higher education, institutions as well as jurisdictional bodies have become increasingly concerned with the determination of future student demand. However, the changing characteristics of our population indicate the need for a new and somewhat more complex model for projecting enrollments than heretofore has been required, one which recognizes a variety of demographically-differentiated population sectors and their uniquely characterized patterns of participation in various types of organized educational experience. Presented is an example of such an endeavor. It was precipitated by the needs of a task force appointed by a state-level governing board to make appraisals of the impacts upon future enrollment prospects resulting from the application of a variety of policy assumptions designed to achieve explicitly defined goals. The development of a model to which a variety of "what if" type of questions could be addressed was a direct outgrowth of this experience. (Author)

ASSESSING THE IMPACTS OF FUTURE STUDENT DEMAND: AN APPLICATION OF A DEMOGRAPHICALLY-DIFFERENTIATED PROJECTION MODEL

By

Robert D. Newton
Associate Director, Information Systems
Office of Budget and Planning

The Pennsylvania State University
308 Old Main Building
University Park, Pennsylvania 16802
Telephone Number - 814-865-1837

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Abstract

Because the enrollment question is central to the resolution of a number of issues facing higher education, institutions as well as jurisdictional bodies have become increasingly concerned with the determination of future student demand. However, the changing characteristics of our population indicate the need for a new and somewhat more complex model for projecting enrollments than heretofore has been required, one which recognizes a variety of demographically-differentiated population sectors and their uniquely characterized patterns of participation in various types of organized educational experience. This presentation concerns an example of such an endeavor. It was precipitated by the needs of a task force appointed by a state-level governing board to make appraisals of the impacts upon future enrollment prospects resulting from the application of a variety of policy assumptions designed to achieve explicitly defined goals. The development of a model to which a variety of "what if" type of questions could be addressed was a direct outgrowth of this experience.

ASSESSING THE IMPACTS OF FUTURE STUDENT DEMAND: AN APPLICATION OF A DEMOGRAPHICALLY-DIFFERENTIATED PROJECTION MODEL

The changing composition and magnitude of enrollments and their uncertain prospects are causing conflicts within the higher education community concerning the allocation of fiscal resources, the selection of goals, and the establishment of program priorities. Because the enrollment question is central to the resolution of these issues, institutions as well as jurisdictional bodies have become increasingly concerned with the determination of future student demands and how the educational process can adapt to them. But if this assessment is to be of utility, it must be focused upon the patterns of individual behavior rather than extrapolations of historical measures of enrollment.

For some years, it has been customary to forecast enrollments in higher education from the simple cohort relationships of enrollments to births, secondary school graduates, or the traditional college age population (Mangelson, Norris, Poulton, and Seeley, 1974; Orcutt, Greenberger, Korbel, and Rivlin, 1961). The procedure provided quite accurate results inasmuch as the proportional distribution of the demographically differentiated segments of the higher education enrollment retained some degree of stability over time. But the prospective shifts in the composition of our population suggest that the constant proportionality phenomenon will not prove to be applicable in the near future. By itself, the changing characteristics of our population indicate the need for a new and somewhat more complex model for projecting enrollments, one which recognizes a variety of differentiated population sectors and their uniquely characterized patterns of participation in various types of educational experience.

Background

This presentation concerns an example of an endeavor directed toward development of such a model. It was an outgrowth of a program conceived by Pennsylvania's higher education coordinating board, directed by its jurisdictional agency, and conducted by a committee composed of representatives of both this agency and a cross-section of educational institutions. The directed purpose of the program was the preparation of appraisals of the impacts upon future enrollment prospects resulting from the application of a variety of policy assumptions developed to achieve explicitly defined goals. As such, it was designed to serve as an instrument for evaluation of enrollment questions of a "what if" nature. Frequently in the course of deliberations, the participants were frustrated in their attempts to quantify the effect of some hypothesized goal. The practical realities of time constraints led to employment by the committee of coping mechanisms to meet its immediate obligations (State Board of Education, 1974 and 1975). However, the inadequacies of the existing informational and methodological base also led to a resolution to pursue in parallel an objective addressed to surmounting these deficiencies in order to refine or even revise the initial findings.

The initial step toward this goal was provided as a result of two unrelated developments occurring within the provinces of the normally assigned responsibilities of two of the members. First, there was the completion of an age- and sex-differentiated model for projecting the population of the state (Senier, 1975a and 1975b). Second, there was the conduct of a survey of the age- and sex-composition of both the full- and part-time enrollments in the state's colleges and universities (Division of Educational Statistics, 1975). Although these two data sources were not fully consistent with one another, they were sufficiently compatible from a specification standpoint to justify proceeding with the formulation of a model for projecting state-wide enrollments in various types of organized educational activities from a demographically differentiated population forecast.

Formulation

Conceptually the model is based upon the premise that a sector of the general population, possessing a set of demographic characteristics distinguishing it as unique from all others, has an associated set of probabilities, which describe its distribution among various types of organized educational activities. If these participation rates are constant or projectible over time, they may be employed, in conjunction with a suitably disaggregated forecast of the population, to generate a projection of enrollment.

Mathematically, the formulation for calculation of the demographically and educationally unique components of enrollment may be expressed as follows:

$$E_{e,d,y} = (P_{d,y})(r_{e,d,y})$$

where $E_{e,d,y}$ = enrollment of persons with demographic characteristics "d" in educational activities "e" in year "y"

$P_{d,y}$ = population with demographic characteristics "d" in year "y"

$r_{e,d,y}$ = participation rate in educational activity with characteristics "e" of persons with demographic characteristics "d" in year "y"

From these enrollment components, aggregations of enrollment over common demographic and educational characteristics may be computed as follows:

$$E_{d,y} = \sum_{e=1}^{n} E_{e,d,y} \quad \text{for d and y} = 1,2,3\ldots,n$$

where $E_{d,y}$ = enrollment of persons with demographic characteristics "d" in year "y"

and

$$E_{e,y} = \sum_{d=1}^{n} E_{e,d,y} \quad \text{for } e \text{ and } y = 1,2,3....n$$

where $E_{e,y}$ = enrollment in educational activity with characteristics "e" in year "y"

Data Requirements

For application as a forecasting vehicle, two types of information are required for use of the described relationship. First is a demographically differentiated forecast of the population for each year in the time horizon. The second is a set of participation rates of each of these demographically differentiated population sectors within various educational activities for the base year and for any years within the time horizon in which changes are anticipated.

Specification of Demographic and Educational Characteristics

The potential number of discriminating characteristics associated with college attendance is extensive. Summarizations of various research efforts in this area have been prepared by Folger and Nam (1967), and Shryock and Siegel (1975). For development of a projection model, the selection of characteristics is case-specific and limited to those on which measurements can be provided or estimated from existing data.

For our purposes, population was demographically differentiated by the two sexes, two racial categories, and five different age groups. The participation of each of these population sectors within higher education was further disaggregated by type of attendance and five different levels of study. The specifications of these characteristics are detailed in Table 1.

TABLE 1

DEMOGRAPHIC AND EDUCATIONAL CHARACTERISTICS

Demographic	Educational
Sex:	Attendance:
Male	Full-Time
Female	Part-Time
Race:	Level of Study:
White	Credit
Racial Minority	Occupational
Age:	Baccalaureate
18-22	First Professional and Graduate
23-25	Unclassified
26-30	Non-Credit
31-35	
36-55	

Population Projections

A projection of population for as many as twenty-five years was obtained by application of a sector-differentiated model for Pennsylvania developed by Senier (1975a and 1975b). Because the demographic differentiation from the population model is limited to sex and five-year age groups, certain adjustments were made in the composition of the output. Racial distribution was introduced using data collected by the U.S. Bureau of the Census (1970) and the age categories were recompiled in accord with the specifications cited previously.

Participation Rates

The participation rates may be introduced simply for the base year, in which case the enrollment projection will reflect only the impact of changing population composition, or for a series of years in the time horizon as well in order to show the impact of prospective shifts in participation.

For our purposes, rates applicable to Pennsylvania for the base year were computed from measures of enrollment, appropriately disaggregated demographically and educationally, and from the similarly demographically differentiated population.

For those educational activities circumscribed by the credit categorization, opening Fall enrollments by level of study and type of attendance (Hummel, 1976) were employed. These in turn were further subdivided racially by the use of data collected in connection with the so-called Federal "compliance report" (Hummel and Nunemaker, 1975) and age-wise by employment of an age distribution survey (Division of Education Statistics, 1975).

The non-credit category of enrollment represented a unique problem inasmuch as unduplicated counts of enrollment at a fixed point in time are not typically compiled for this type of educational pursuit. Thus, data compiled in two special surveys on adult education made by the U.S.

Bureau of the Census for the National Center for Education Statistics (1974 and 1975) were employed to derive appropriate participation rates in non-credit educational activities offered by institutions of higher education. Inasmuch as the surveys were conducted on a nationwide basis, the use of the participation rates derived from these data is explicitly conditioned on the assumption of applicability to Pennsylvania.

Application

The model which has been programmed in PL/1 for use on an IBM 370, generates projections of enrollment by multiplying the disaggregated population projection by the similarly differentiated participation rates for each educational sector. A facsimile of the output for two years is shown in Table 2. Headcount enrollments are displayed in terms of sex, race, attendance, and level of study. Selected aggregations over common characteristics are also compiled as is a summary conversion to full-time-equivalent enrollment.

Use of the model may be directed to three types of situations. First, it may be employed simply as a more refined method of forecasting. Second, it may be of utility for identification of salient trends in the composition of enrollments which might otherwise go unnoticed. Third, it may find application for assessment of the impacts of various assumed goals in a typical "what if" mode. Illustrative examples of each of these three cases are described below.

Improved Methodology

Because the model differentiates among a wide variety of population sectors and their appropriate educational activity patterns, the enrollment projections are sensitive to changes in population composition. As a result the projection may exhibit a significantly different pattern from that produced from a typical relationship of enrollment to a single cohort of population. This divergence is particularly noticeable in those situations where the population composition is shifting,

TABLE 2
FACSIMILE OF OUTPUT

PROJECTED HIGHER EDUCATION ENROLLMENTS (THOUSANDS)

	1981						1982					
	OCCUP	BACC	GRAD	UNCL	N-CDT	ALL	OCCUP	BACC	GRAD	UNCL	N-CDT	ALL
1. FULL-TIME	33	254	37	5	0	329	33	250	37	5	0	325
2. MALE	19	141	26	3	0	189	19	139	26	3	0	187
3. WHITE	18	131	24	3	0	176	18	129	24	3	0	174
4. MINORITY	1	10	2	0	0	13	1	10	2	0	0	13
5. FEMALE	14	113	11	2	0	140	14	111	11	2	0	138
6. WHITE	13	107	10	2	0	132	13	105	10	2	0	130
7. MINORITY	1	6	1	0	0	8	1	6	1	0	0	8
8. PART-TIME	18	57	52	41	154	322	18	58	52	41	156	325
9. MALE	10	30	26	19	78	163	10	31	26	19	79	165
10. WHITE	9	28	24	18	73	152	9	29	24	18	73	153
11. MINORITY	1	2	2	1	5	11	1	2	2	1	6	12
12. FEMALE	8	27	26	22	76	159	8	27	26	22	77	160
13. WHITE	7	25	21	20	71	144	7	25	21	20	72	145
14. MINORITY	1	2	5	2	5	15	1	2	5	2	5	15
15. TOTAL MALE	29	171	52	22	78	352	29	170	52	22	79	352
16. TOTAL FEMALE	22	140	37	24	76	299	22	138	37	24	77	298
17. TOTAL WHITE	47	291	79	43	144	604	47	288	79	43	145	602
18. TOTAL MINORITY	4	20	10	3	10	47	4	20	10	3	11	48
19. TOTAL HEAD COUNT	51	311	89	46	154	651	51	308	89	46	156	650
20. FTE	39	273	54	19	51	436	39	269	54	19	52	433

a phenomenon which will be characteristic of the forthcoming decade.

In Figure 1 are shown two projections of the total headcount credit enrollment for Pennsylvania over the next fifteen years. The higher of the two projections was developed from application of the described model and reflects the effect of changing population composition inasmuch as current participation rates are assumed to be applicable over the full time-horizon. The lower projection was computed by applying an historically observed relationship between enrollment and the traditional 18 to 22 year college-age population to a projection of this same population sector.

Trend Identification

Since the model projects the enrollment for individual demographic-educational sectors independently from one another, the output from the application may be useful in identifying salient trends in the composition of future enrollments.

For example, in Figure 2 are shown the projections of both full- and part-time credit enrollments for Pennsylvania through 1990, assuming continued applicability of the current participation rates. The upper curve portraying full-time attendance, reflects a significant drop after 1990 whereas the lower curve, applicable to part-time enrollment, continues to exhibit a growing trend through 1985.

Impact Assessment

Inasmuch as the model is formulated in a way to facilitate alteration in the participation rates of the population sectors in various educational activities over time, it may be employed to measure the prospective impact of assumed changes in participation in one or more years in the time horizon.

The characteristic "what if" mode of application is illustrated in Figure 3 which shows two projections of total headcount credit enrollment for Pennsylvania over the 1975-1990 time span. The lower of the

FIGURE 7

EXAMPLE OF RESULTS: IMPROVED METHODOLOGY

COMPARISON OF ENROLLMENT PROJECTIONS
FROM DEMOGRAPHIC MODEL AND
18-22 YEAR COLLEGE-AGE COHORT

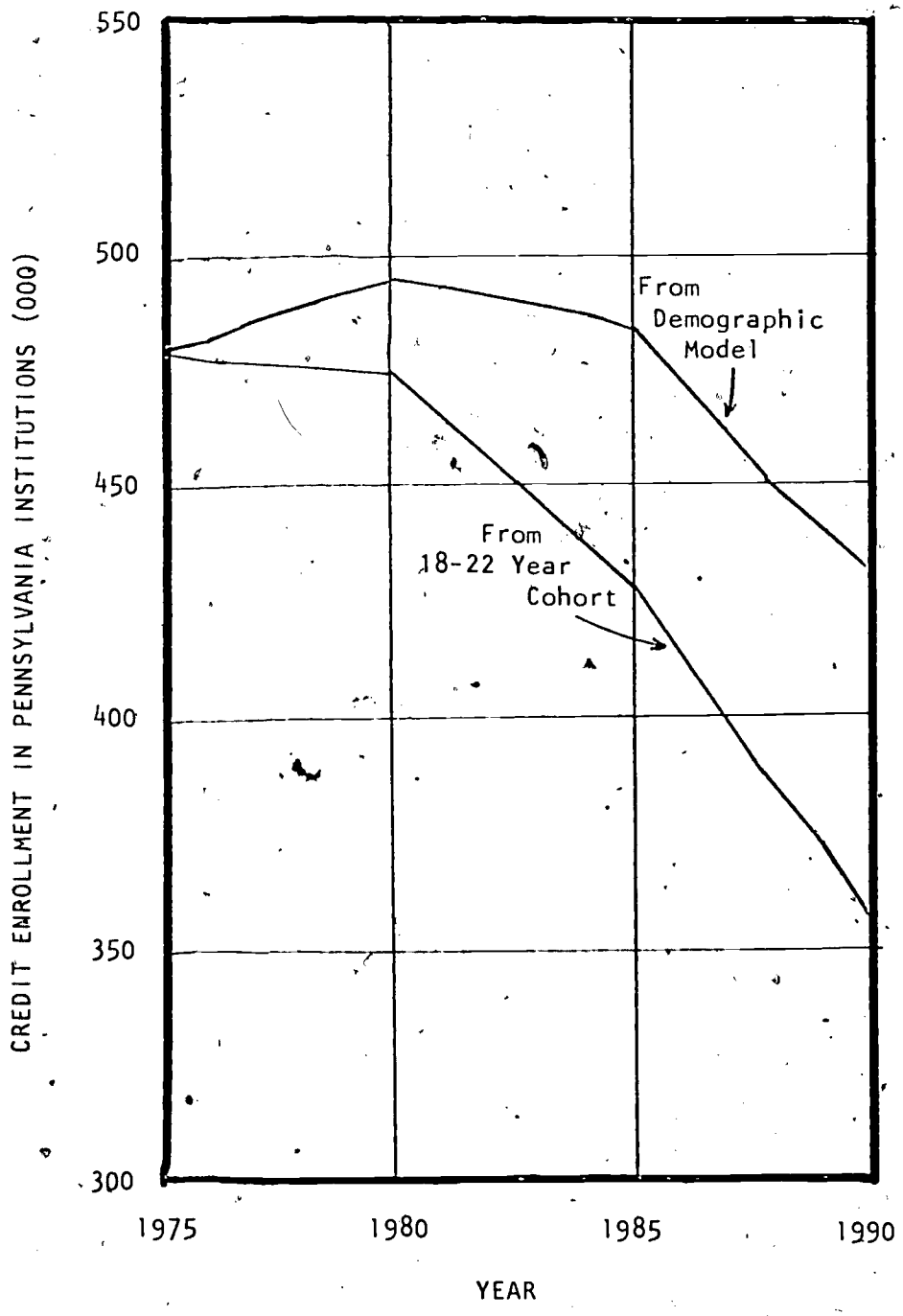


FIGURE 2

EXAMPLE OF RESULTS: TREND IDENTIFICATION

DIFFERENTIATION BY ATTENDANCE STATUS
OF ENROLLMENT PROJECTION FROM
DEMOGRAPHIC MODEL

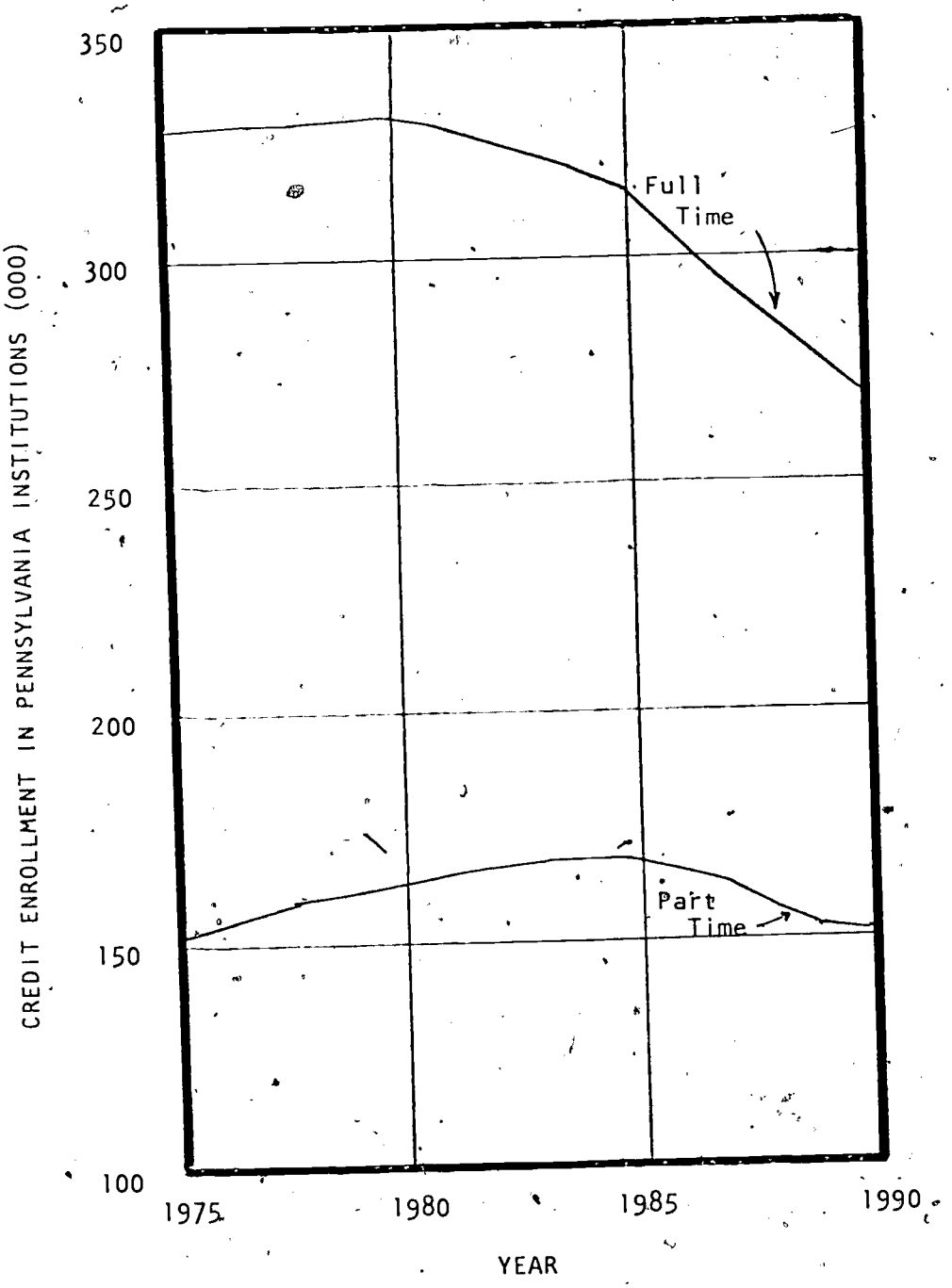
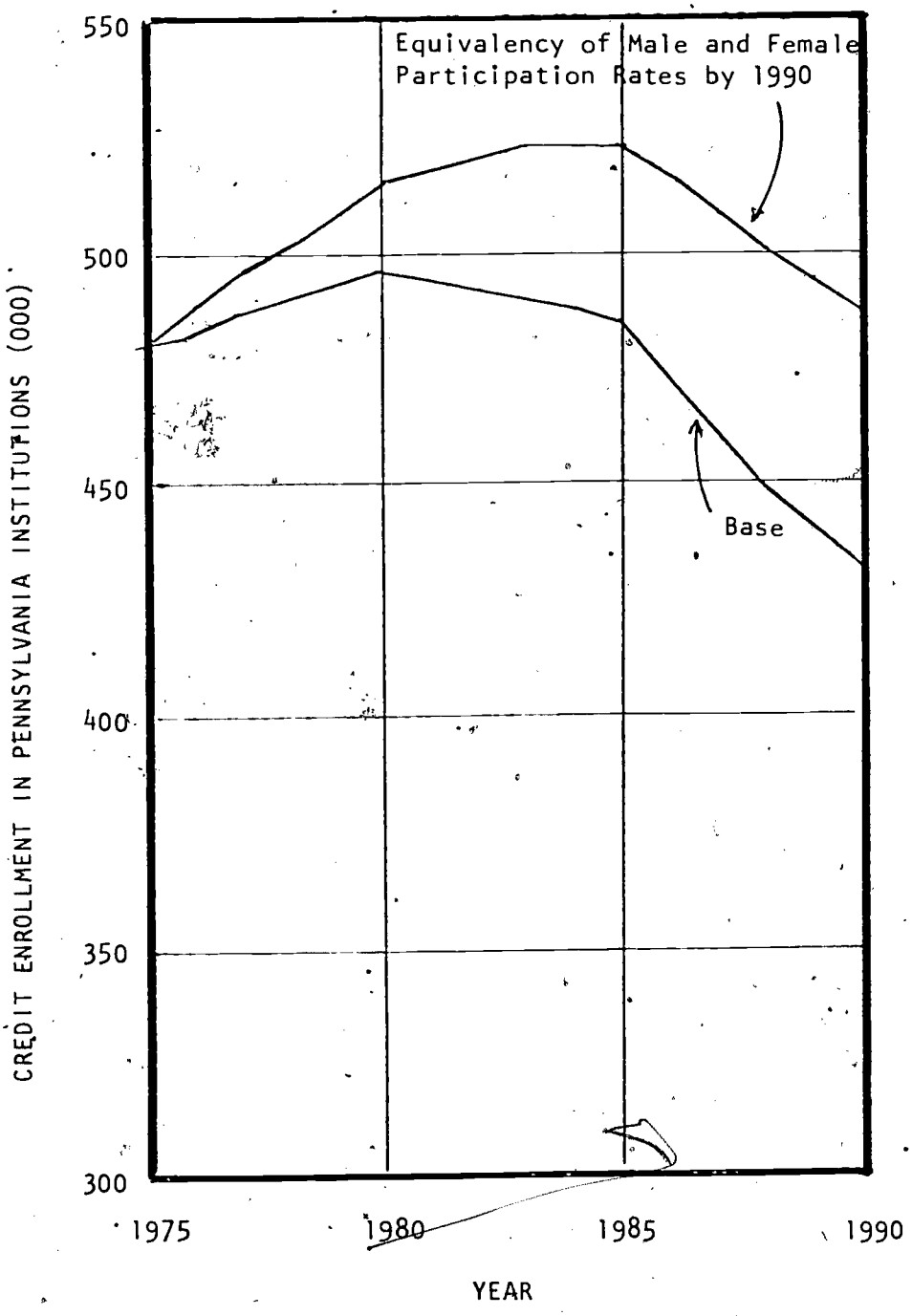


FIGURE 3

EXAMPLE OF RESULTS: IMPACT ASSESSMENT

IMPACT UPON ENROLLMENT PROJECTION
FROM DEMOGRAPHIC MODEL FROM ASSUMED EQUIVALENCY OF MALE AND FEMALE
PARTICIPATION RATES BY 1990



two projections is based upon assumed continued applicability of current participation rates. The upper projection portrays the total enrollment if the participation rates of female sectors of the population are increased in a linear fashion over the time span to those equivalent to the male sectors of the population by 1990.

Further Innovation

The institution of innovation efforts directed toward refinement of the described model will depend in large measure upon perceptions of its utility to policy makers. Aspects deserving further attention may be divided into those confirmed to the existing set of specifications and those expanding upon the array.

Within the initial category, an area of obvious merit concerns the development of the availability of measures, which are fully consistent with one another and do not rely upon approximation. Of specific note are those related to the educational sector of non-credit enrollment. Although the existing deficiencies could be overcome through institution of additional survey vehicles, the reluctance to contribute to the already significant burden represented by these instruments will cause prior consideration to be given to the application of sampling procedures.

Concerning innovations expanding on the existing specifications, further disaggregation with regard to educational sectors and the introduction of income discriminants within the population sectors are perceived as areas requiring exploration.

General Applicability

Although the enrollment projection model as described is case-specific, its conceptual basis is applicable to analogous organizational

or geographical structures. The experience has indicated that, in spite of informational deficiencies, it is feasible to formulate a model which incorporates a variety of demographically differentiated population sectors and their uniquely characterized patterns of participation in different types of educational activities. Such a construct is of particular utility in evaluating the impact of prospective change. It is suggested that the need for such appraisals are likely to increase in the future, as the educational community devotes greater attention to widening its accessibility to population sectors beyond those traditionally associated with the collegiate experience.

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faculty members with divergent views in such a way that one or both of them will change their attitudes? Which faculty have a proclivity for interdisciplinary exploration of ideas and which feel so strongly about their own disciplines that they probably will be non-contributing members of an interdisciplinary team? Which faculty have so little confidence in students' abilities to be involved in designing their own learning experiences that they logically would not be the ones asked to serve as mentors in self-directed programs?

Conclusion

Colleges (and individual programs within colleges and universities) differ widely in terms of the particular academic ethos which attracts and retains certain types of students. Faculty help to shape the curricular-instructional environment, both in their role as formulators of academic policy and as implementors of particular teaching styles in the classroom. Students make judgments among institutions, choosing one which they believe will suit their needs and in which they hope to find the learning environment hospitable. All too often, choices are based on inadequate information and knowledge; the instructional environment is most commonly a missing element in such decisions. Resulting conflicts are manifested in disillusionment, dissatisfaction or even alienation of students, in campus debates based on emotional rather then rational grounds and sometimes in departure of the student from the institution which he/she had initially viewed as a desirable choice.

Based on their individual orientations, faculty debate policy and devise curricular processes, sometimes with little understanding of student

learning style preferences. Attempts at improvement of teaching, at least as reflected in better student ratings, may fail because some students feel that the particular instructor's style can never result in a good learning environment for them.

Administrators encourage interdisciplinary efforts which fail when the faculty involved discover that they cannot agree on even the basic purpose of the course, much less the process through which the learning experience is to be implemented. In some colleges career-oriented programs are tried and abandoned because they conflict with the prevailing educational philosophy of faculty, while attempts in other colleges to broaden the liberal education components fail for precisely the same reasons.

For an institution to be responsive to changing educational needs of students, to use its faculty resources effectively and to maintain institutional viability, a necessary first step is to better understand the educational views and preferences of the key participants, namely the students and faculty. Where these views conflict, the conflict must be faced, the reasons for differences ascertained and experimentation undertaken to facilitate optimum matching of students and faculty. Consideration should be given to recognition of more than one serviceable academic environment to accomodate the diversity of student and faculty views. The institutional research technique presented here is one direct method of detecting potential conflict and developing better understanding of the person-environment interaction within a given institution.

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Figure 1

ORIENTATION PROFILES FOR FACULTY AND FRESHMEN

AT SIX LIBERAL ARTS COLLEGES

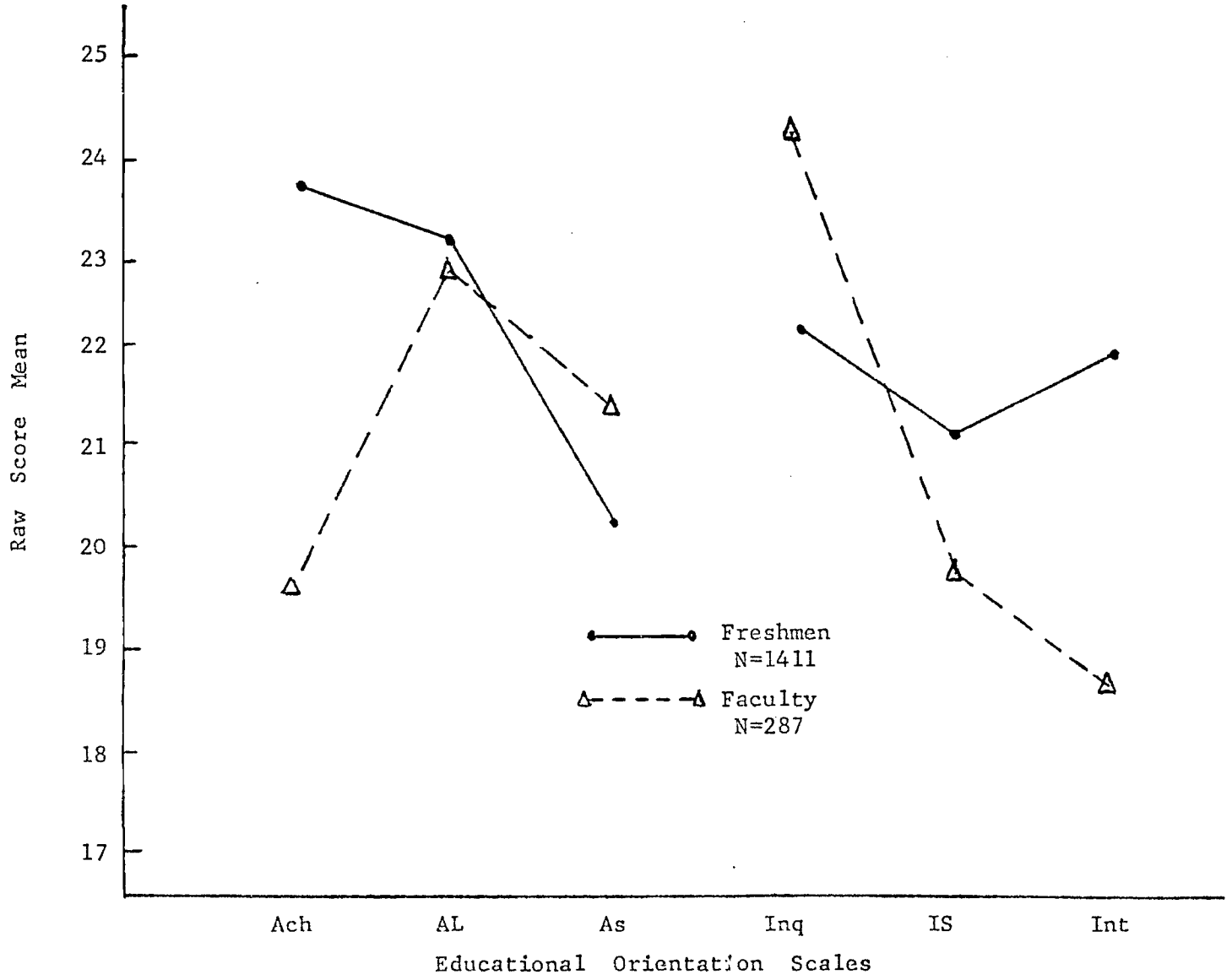

Figure 2

ORIENTATION PROFILES FOR THREE STUDENT SATISFACTION GROUPS AND FACULTY (UNIVERSITY SENIORS)

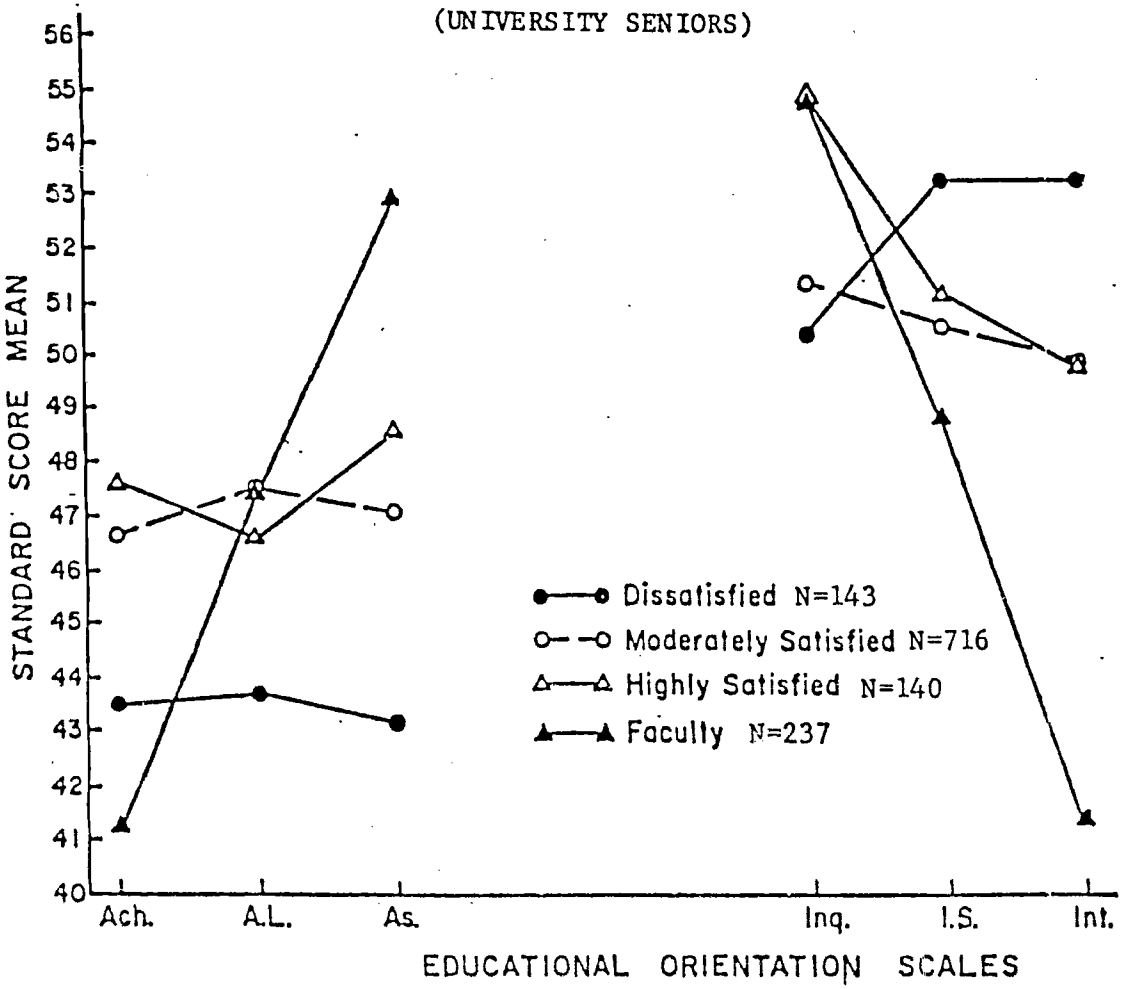

Figure 3

ORIENTATION PROFILES FOR TWO STUDENT GROUPS AND FACULTY (College Sophomores)

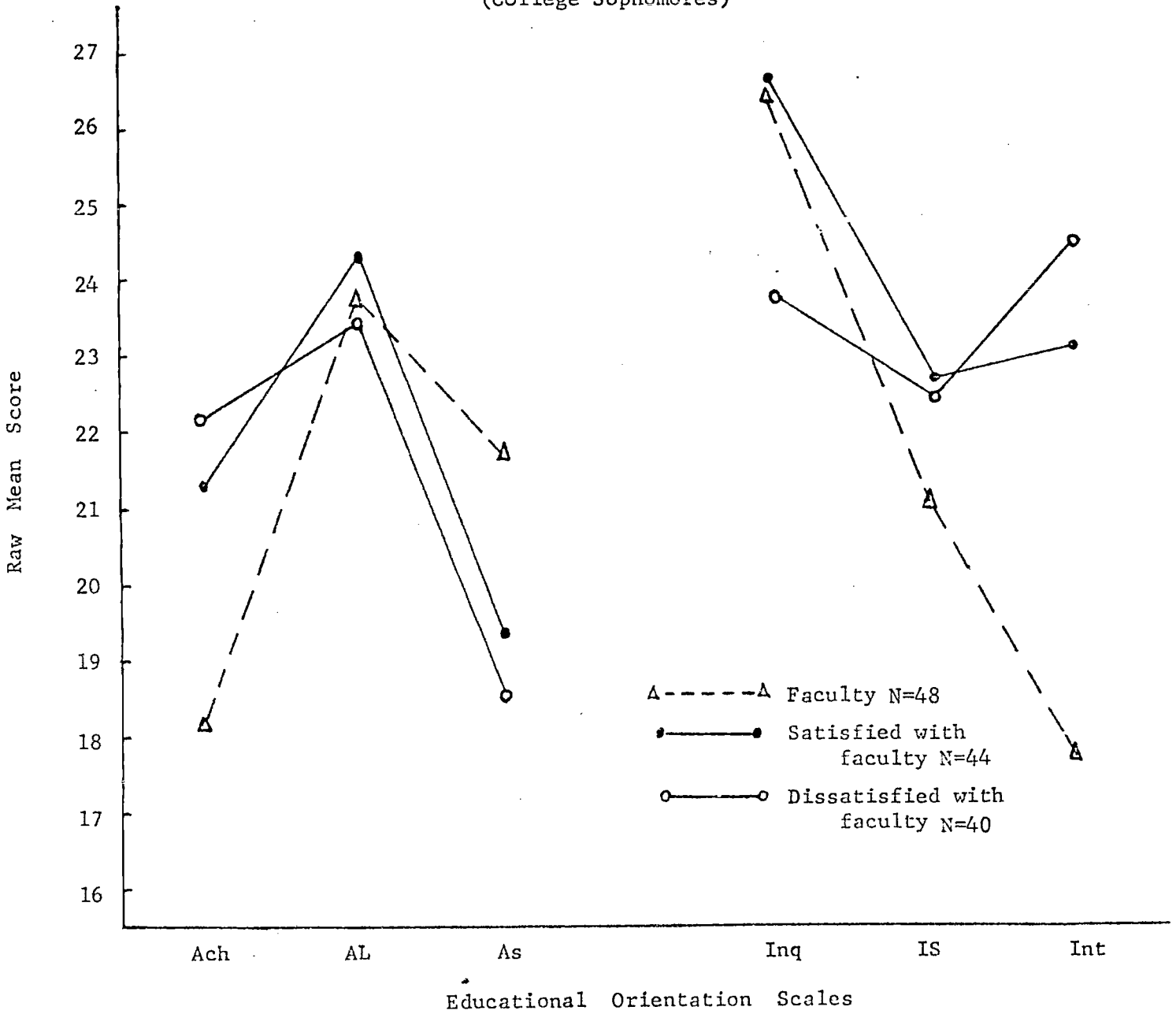

Figure 4

MEAN SCALE SCORES ON SELECTED EDUCATIONAL ORIENTATIONS
FOR FACULTY, CONTINUING STUDENTS, & STUDENTS WHO WITHDREW/TRANSFERRED

(Private Liberal Arts College)