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ABSTRACT

A model and implementation process is presented for projecting student headcount and credit hour and contact hour enrollment for each academic area and all areas aggregated by semester and fiscal year for each campus of Montgomery College, Maryland. The projection model is suggested as a managerial tool to assist the college's management to monitor enrollments to meet its enrollment projections, generate forecast revenue, and expend only budgeted funds, while annoying few students because of class cancellations. While one part of the projection deals with student headcount, total credit hour enrollment, and credit hour enrollment in different academic areas, the second part projects faculty instructional equivalent semester hour (ESH) or workload and faculty average ESH, the number of course sections, and instructional ESH to be taught by part-time faculty members. Student headcount enrollment is projected as resulting from yield rates from various populations from which the college student is drawn. Total credit hour enrollment is regressed from the relationship previously established between headcount and total credit hour enrollments, and that between headcounts and student average load. Credit hour enrollment in each academic area is projected from the past trend using regression or moving average, and adjusted after consultation with academic deans and their staffs to incorporate new developments to improve the accuracy of the model. Credit hour enrollment for each academic area and all areas combined has been projected for two years and the results to date are encouraging. The second part of the model is still in development. (SW)

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BETTER MANAGERIAL EFFECTIVENESS THROUGH IMPROVED PLANNING AND BUDGETING IN THE ACADEMIC AREA

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INTRODUCTION

Higher education in the United States is going through a period of change due to economic, financial, and social developments begun during the 1960's and 1970's in the country. These developments, particularly the decline in the number of traditional college-age students and inflation have reduced real income, increased operating costs, generated a demand for greater accountability, and diminished the full-time student population in practically all colleges and universities in the nation. Added to this picture is increased consumerism, a product of business marketing, now prevalent in every single aspect of our consuming economy. Higher education has to address increasing educational "consumer satisfaction" as a result of this rise in consumerism.

Faced with these changes, colleges and universities must manage their institutions in ways that achieve optimum efficiency and productivity. One manner in which they can do this in the academic area is to design a budget and corresponding course schedule that will enable them to meet realistic enrollment objectives while having to cancel only a few course sections. Provided that its objectives are realistically, hierarchically, and quantitatively set, such a process enables an institution to meet its enrollment projections, generate its forecasted revenues which are generally largely based on student enrollment such as tuition, fees, and state aid, and expend only budgeted funds, while annoying few students because a class has been canceled. This process requires the continual monitoring of student enrollments, so that budgeting and scheduling decisions can be made as early as possible prior to and during the registration process. These statements are based on the assumption that an institution has a recruitment and retention program that works in tandem with its enrollment projections.

STATEMENT OF THE PROBLEM

Like most four-year colleges and universities, community colleges in the country also are experiencing difficulties in increased accountability, consumerism, restricted financial resources, increased costs, and possibly stabilized or declining enrollments. Even if enrollments are increasing, community colleges still must face the other problems. Thus, colleges must manage their institutions in ways that achieve optimum efficiency and productivity. Although student enrollments in community colleges in the past two years generally increased 6.2 percent in Fall 1980 over Fall 1979, and 3.2 percent in Fall 1981 over Fall 1980 (The Chronicle of Higher Education, Nov. 10, 1980 and Nov. 4, 1981), this increase may not last forever. Colleges must design budgets and course schedules that will enable them to meet their student enrollment objectives while having to cancel only a few course sections to generate forecasted revenues.

The projection of student and credit hour enrollments have, therefore, become a managerial tool, a basis on which a college can build its strategic management and marketing plans for its survival and, hopefully, its development. Such projections will enable them to look at academic areas in which enrollments are growing, stabilizing, or sharply declining, to revise their curricula and course offerings, and to plan ahead for development or curtailment to meet "consumer's" needs and to attract target markets. When carefully and realistically done, enrollment projections will enable management to meet projections, to generate forecasted revenues, particularly, those based entirely on enrollment, and to expend only budgeted funds. Too, the process helps create "consumer" satisfaction because fewer courses will be canceled, if enrollments are monitored continuously so that budgeting and scheduling decisions can be made as soon as possible prior to and during the registration process.

This managerial tool, thus, requires a detailed and well thought-out plan to project not only student headcount and credit hour enrollments for the entire college, but also to project for each academic area, credit and contact hour enrollments, student-faculty ratio, faculty instructional work load, the number of course sections, and work load to be carried by part-time faculty members per semester and for each campus. Obviously, when the projections are done at this finite level, they run more risks of lacking precision and accuracy, particularly when one cell has an insufficient entry. For this reason, it is very important that insights from those who deal with scheduling and budgeting at the campus level; i.e., campus academic deans and, ideally, department chairs, be integrated in the process of making the projections.

This paper presents a model and implementation process for projecting student headcount and credit hour enrollments by semester and fiscal year, and for projecting credit and contact hour enrollment for each academic area and all areas aggregated by semester and fiscal year, for each campus of Montgomery College, a large community college in the Washington, D.C., metropolitan area. Historical and projected data are aggregated for the College.

Student headcount and credit hour enrollments have been projected for a number of years, and credit hour enrollment for each academic area and all areas combined has been projected for two years now. The results to date are encouraging.

The paper also will discuss the current expansion of the model to project the following for each academic area by semester and by fiscal year for Montgomery College and its campuses:

- Faculty work load or instructional ESH, as it is called at this College.
- Faculty average instructional ESH
- Number of course sections, and
- Instructional ESH to be taught by part-time faculty members

However, this paper is a report on a hands-on exercise, rather than a theoretical position discussion.

ENROLLMENT PROJECTION

This part of the paper will present a brief review of the background of the College, the enrollment projection model, and its current expansion.

A BRIEF REVIEW OF THE BACKGROUND OF THE COLLEGE

Montgomery College was established as a junior college in the Washington D.C., metropolitan area in 1946, as a "post-high school division of the Montgomery County Public Schools". It had two main programs of instruction: transfer and career, then called terminal (Fox, 1970). From its first site in a high-school, with the first enrollment of 186 students, the College has evolved and become now a multi-campus community college with an enrollment of 18,753 credit students and 151,271 credit hours in the fall semester of 1981. Students' curricula of study currently consist of transfer programs, general education, and career programs. The students of the College are enrolled in more than 60 different academic areas, or disciplines, as they are referred to by College officials.

Managing an institution of this size with its multi-campus complex nature, requires careful planning and budgeting. Moreover, with all colleges facing the possibility of stabilized or declining enrollments, an enrollment projection model will be invaluable to the management of the College.

THE ENROLLMENT PROJECTION MODEL

In 1974, the College developed and implemented a statistical enrollment projection model. This model provided single figure best estimates of predicted enrollments for each of a number of enrollment segments (campus, semesters, etc.) for a ten year period. Since 1974, the model has been refined and modified as need has arisen. This single figure enrollment estimate model was a useful planning tool for the College during a period of growth and expansion. In recent years, however, enrollment growth has slowed, budgets have become tighter, and as a result, a necessity for more controlled staffing and budgeting has emerged. These changes suggested the need for reevaluation of the enrollment projection methodology to allow the College to plan for possible ranges of enrollment. Enrollment planning now had to provide answers to questions such as these: What is the lowest enrollment that the College might reasonably expect in a given year? What is the highest? What is the best estimate of potential enrollment? What are the assumptions that must be met to achieve these base, middle, and high estimates?

Everyone knows that it is impossible to predict the future with complete certainty. In the years of enrollment growth, if the College achieved an enrollment that was three or four percent over or under projections, the effects were not severe, since there was always some growth to support the College's budget. At the current time, however, when enrollment growth is less certain and resources are not as readily available, the effects of enrollment shortfalls or overages can be devastating, especially if they have not been considered in the planning and budgeting process.

Beginning with the fiscal year 1980 projections, the College developed projections which provide ranges of possible enrollments; i.e., high, middle, and base levels of projection, rather than single projection figures. This approach has proved to be more practical than the approach which had been used by the College previously. The projection series are reviewed by appropriate College personnel, including the chancellors, academic deans, and deans of students. A decision is reached by these individuals and the College research staff concerning the projection series which is most appropriate for use in planning a campus' future enrollment. In arriving at the decision of which enrollment series to be adopted for each campus, a number of factors have been taken into consideration. These factors are: 1) increased or decreased actual enrollment over the most recent years; 2) that the Reagan administration's budget cuts approved for the next several fiscal years, which will supposedly reduce the amount of federally insured loans and other financial aid to university and college students throughout the nation; consequently, should have a positive impact, on student enrollment at the College, and 3) one of the three campuses has planned to add a summer session starting in fiscal year 1983, and one other campus has planned to expand its summer sessions. It is possible for one campus to believe that the base series projection is most appropriate for it, one campus the middle series projection, and one campus the high series projection. As an example, it has been projected that College student enrollment in fiscal year 1983 will exceed actual enrollment in fiscal year 1982 by 6.1 percent.

A. Student Headcount Enrollment Projection

There are two principal projection techniques which are applied within the framework to project the number of students: a mathematical technique (curve fitting) and a statistical technique (yield from population components), each will be discussed in detail in the remainder of this section.

Method I - Curve Fitting

The theoretical assumption underlying projection by curve fitting is that enrollment growth during a specified period can be described by some type of mathematical function and that enrollment growth will continue in the future to follow the path it has followed in the past. Three separate types of curves, one of them linear and two of them nonlinear, have been evaluated for effectiveness in describing the growth of headcount enrollment at the College. These curves, including the one deemed most appropriate, will be discussed more fully below.

Method II - Yield from Population Components

The College student body is made up of components with varying degrees of importance for the total enrollment. The main components comprise the following: new entrants who are recent high school graduates of Montgomery County schools; returning students from previous semesters; new adult residents from Montgomery County; residents of other counties; and non- residents of Maryland. The College has historical and projected data available concerning the size of the populations from which these components are drawn and trend data for yield rates for enrollment at the College from these population segments. Projections for each component can be made by applying projected yield coefficients to projected population statistics. Overall enrollment for a given year is then projected as the sum of the projected components for that year.

Comparison of Two Projection Methods

The relationship between these two projection types deserves some consideration. Curve fitting of the type we have described above has time as the independent variable and is based upon the assumption that the curve which has most closely approximated growth in the past will be that which most closely approximates growth in the future. It should readily be apparent that this is not always a good assumption, since it fails to consider such information as unusual growth patterns in certain elements of the population. The component method, on the other hand, allows us to avoid the use of time as an independent variable and to use, instead, independently projected values of population components and yield rates. The reliability of the projection series is then greatly increased because it takes into account population characteristics and their changes. It also is improved because it is based upon several independent variables whose probable errors may be expected to cancel each other out to some extent.

Given that the components method is the more reliable and defensible of the two approaches, why bother to include the curve fitting method as part of the framework? The curve fitting method is used as a means of validation of the projections obtained through the components method. Should a substantial discrepancy be found in the projections obtained through these two methods, it can be taken as indicating a need for additional close examination of the assumptions upon which the components method is based.

Application of the Projection

Trends in the College Headcount Enrollment Since 1955 and Curve Fitting

Headcount enrollment by year at the College is displayed in Figure A. Although a straight line can be reliably fitted to these data, it is clear from observation that the data exhibit a significant deviation from linearity. Another type of curve that can be fitted to the data is an exponential curve, which also yields a highly reliable fit. However, such a curve yields unreasonable projections of enrollment in the long run (e.g., 100,000 students in 1988).

-Figure A About Here-

Further examination of the enrollment distribution reveals a slowdown in enrollment growth starting in 1974 or 1975. The form of curve which this pattern suggests is logistic or "S" shaped. A fitted logistic curve with an upper limit of 23,000 students, which is approached in 1990, yields a nearly perfect fit to the data (Figure B). The selection of 23,000 as a theoretical upper limit for the College headcount enrollments is based upon projection considerations of maximum utilization of current and projected College facilities. The high correlation coefficient suggests that 23,000 is an appropriate limit for the logistic curve

-Figure B About Here-

Thus, while any of the three mathematical models could provide reasonable accuracy of projection for the next one to three years, the logistic model appears to have the best potential for being an accurate predictor of enrollment in the more distant future. The model projects a fall 1982 enrollment of 19,800. This figure is similar to the one obtained for the high series through the components.

Projections from Population Components

This aspect of the enrollment projection framework is based upon adaptation of the previous College enrollment projection model. This allows for the calculation of enrollment ranges. The actual method of projection involves combining for each segment of the student body: (1) external information on the size of that segment; with (2) past College experience with that segment. This historical information is then tempered with consideration of reasonable expectations for the future. It is these expectations or assumptions about the future that are varied to derive the possible ranges of enrollment.

The segments of total enrollment that are projected separately and the sources of external data for each segment are listed as follows:

Segments	Data Source
High school graduates, early placements and delayed entry students	County Public Schools, projections of enrollment in twelfth grade.
State residents	State Department of Planning, projection of enrollment in twelfth grade in neighboring counties
Non-state residents	Related to the size of the College and the extensiveness of its programs
Returning students from past semesters and re-enrollees	Retention rates of returning students from past semesters and re-enrollees.
New older County residents including post graduates, those over 60 years old, and transfer students	County Planning Board, projection of population between 20 and 55 years of age; the College's past enrollment rates of transfer students, post-graduates, and those over 60 years of age.
Off-campus credit enrollment	Projected employer training program needs.

In the high school segment of the enrollment projection model, each category depends in one way or another on the number of graduates from the high schools in the County. The principal categories considered are: (1) those students entering the College immediately after graduation from a public high school, excluding those graduates who participated in prior years in early placement programs, and who are included in the returning student category; (2) those students who enter the College after some years of employment, military service, travel, etc.; (3) those private and parochial high school graduates entering the College, and (4) early placement students--those who enroll at the College while still in high school. A change in the number of students in any one of these categories has a direct effect on the size of the segment and is reflected in the total enrollment of the College. Projections of these categories are based on the projections of twelfth graders developed by the Montgomery County Public Schools.

The most reliable base found for making projections of the out-of-county resident segment has been the projections of twelfth grade enrollment in the public high schools in each of the neighboring counties. These projections are published by the State Department of Planning. The College expects the enrollment rate for this segment to increase during the next three years and then level off due to a lack of growth in the high schools in these counties.

Out-of-state enrollment has two principal sources - District of Columbia residents and aliens holding student visas, although some students do come from other areas. Of the two sources, the aliens holding students visas constitute the larger number.

The segment of the total College enrollment which consists of students continuing from the previous year is dependent upon the retention rate including the number of re-enrollees from previous years. Students tend to take longer than two years to complete their programs. For example, 9 percent of the students who entered the College in the fall of 1970 were still enrolled during the fall of 1973, while 11 percent of the students who enrolled in the fall of 1971 were still enrolled during the fall of 1974, and over 10 percent of the students who entered in fall 1972 were still attending the College in the fall of 1975. The current retention rate from spring to fall is approximately 55 percent. It is expected to increase by 2 percent during the next five years.

The number of students in the category of older county residents has increased rapidly at the College. This enrollment pattern is the result of many factors - citizens returning to college in order to complete their education; those beginning their college career but at a cautious pace; as well as those individuals attending for self-improvement, preparation in a special job-related skill, or job upgrading, to name a few reasons for attendance.

The most reliable reference point for predicting the number of students in this segment has proved to be total county population in the 20-55 year old age group. The latest available population projections for the County that were developed by the County Planning Board, show the expected 1984 population to be 626,500 while their 1973 projection extended to 1984 was 763,730.

There are two forces working in opposite directions which are affecting enrollment in this segment. More citizens are taking advantage of the educational programs of the College. At the same time, the total number of persons expected to live in the County has been reduced considerably from previous projections, thus reducing the size of the potential pool of prospective students over the next five years. The projections are based on the assumption that the rate at which older students enroll will continue to increase over the next five years. This rate increase will tend to offset the reduced growth rate which would otherwise result from the new and lower population projections made by the County Planning Board.

Rather than the rapid enrollment growth of the seventies continuing, a more moderate increase slightly greater than the growth rate of the county population is foreseen as reasonable for the next five years. This growth is dependent on continuation of the proven determination of the College in developing programs and services to meet community educational needs.

Headcount enrollments are projected for the total College for the fall semesters, then projected out to the spring and summer semesters; then, they are broken down to the campus level.

B. Student Credit Hour Enrollment Projection

A relationship has been established between student headcount and credit hour enrollments over the years. The correlation between the two has been mostly positive, i.e., as headcount enrollment increases, so does credit hour enrollment, except in 1978, credit hour enrollment decreased by 2,762 hours from the previous year. However, when taking student average load into consideration, a different picture appears. As headcount enrollment increases, student average load decreases. One way to project credit hour enrollment is by using linear regression directly from student headcount, and then multiplying the results by the number of students projected earlier. Table 1 and 2 illustrate this.

-Tables 1 and 2 About Here-

Credit hour enrollment is actually a function of both student headcount enrollment and student average load. However, when comparing the results, (a) and (b), of the two separate projections presented in Tables 1 and 2, a discrepancy of 1,712 credit hours is found. This difference is due to the fact that student average load keeps decreasing and is negatively correlated with headcount enrollment. By the same token, credit hour enrollment is positively correlated with headcount enrollment and, consequently, it increases as headcount enrollment does. All factors considered, the average of the results of the two projection methods seems to be closer to reality than either of the two projections.

The results of both headcount and credit hour enrollments then are divided among the campuses using the percentages based on the historial relationship between the campuses' enrollment patterns and the College's available facilities, planned curriculum changes, and recruitment and retention plans. At this stage, the College's central administrative personnel such as the Academic Vice-President and campus personnel such as chancellors and their academic deans and deans of students, are involved in the projection process. In this process, insights, suggestions, and recommendations from these people are taken into consideration, and one of the levels of projection, i.e., high, middle and base, is decided upon, for each of the campuses for each semester and fiscal year.

C. <u>Discipline Credit Hour Projection</u>

After a level of projection has been developed, and a projection has been agreed upon, credit hour projections for each academic area (discipline) take place. This projection activity is done on the campus level for each semester and for fiscal year for two years into the future, and then aggregated for the College.

Historical data of credit hour enrollment in each area for the past five years is dealt with in ratio terms since actual figures cannot be compared because total credit hour enrollments vary over the years.

The ratios of each area are scrutinized to depict a trend. If a trend, either positive or negative, is revealed, linear regression is applied to project the future credit hour enrollment for the related area. If the ratios of an area fluctuate over the years and, consequently, no trend is depicted, moving average is used in the projection for that one area.

After the projected ratios are generated, they go through an adjustment process. In this process, a total ratio of 1.0000 is used to force adjustment on this ratio of all areas in the projection. Then, the total credit hours projected earlier for the campus for the semeter are multiplied by the ratio for each area to derive credit hours for an area.

At this point, it is imperative that campus personnel such as deans and their associates, and, preferably, department chairs, be involved in the projection process. These people are directly involved in the recruiting, budgeting, and scheduling processes at the campus level. They have insights on new developments and/or curtailments in certain academic areas.

There are other important reasons for the involvement of these people at this level. For areas in which a decline or growth has been established, the linear formulae used would call for an allocation of resources that may distort reality. A case in point is growth in an area such as computer science. As a result of linear regression, this discipline would require an allocation of resources so substantial that it would be impossible to serve this enrollment in terms of facilities, faculty, equipment, and supplies. At the same time, it would decrease available funds and facilities for other areas, which could cause enrollment to decline where it should not or decline more than necessary where it is going to decrease. As a result of the projections, these areas begin a "negotiation process" where the needs of the areas and constraints in college and campus resources can be more closely examined (Wieler, 1980). It is campus personnel who can make such decisions as putting a cap on the growth in a particular area, or allocating more resources to try to attract more enrollment in an area with declining enrollment. These individuals are in the position of providing insights which will help make the projection closer to reality than otherwise would be the case. These individuals also are in a better position than anyone else to find trade-offs for areas which, in their judgment, are in excess of, or below projected credit hours.

This process strengthens the model because input from people who deal with reality certainly compensate for and correct any deficiencies the linear regression method may have in over inflating or curtailing credit hours in the areas where a trend, whether negative or positive, has been established. Any adjustment to these projected data also reflects consideration for current facility and resource constraints under which actual enrollment in a given area, semester or fiscal year operates. Table 3 illustrates results of the credit hour projection for a number of areas before and after adjustment by campus personnel, with facility and resource constraints taken into account.

-Table 3 About Here-

When this stage is completed, contact hours for each academic area are projected based on past relationship between credit and contact hours. This relationship is mostly one-to-one, except for areas in which laboratory work is involved. The projection of contact hours supports the facilities utilization planning and management efforts of the college.

D. Evaluation of the Existing Model

The student headcount and credit hour enrollment projection has been done for a number of years at this institution, and the results to-date are very encouraging. The College has been able to meet and, as in the case of the last three fiscal years, exceed projections in both student headcount and credit hour enrollments. Table 4 presents the percentages of enrollments realized over projected enrollments by semester. In each case where the College exceeded projections, the middle series projection had been selected. If the high series projection had been selected, actual enrollment may have more closely approximated it.

-Table 4 About Here-

The success of the model is attributed to a number of factors. First of all, the bases on which the model was built remain valid; i.e., that yield rates from various segments that make up the student body will constantly grow until they peak in 1984. Also, the projection is used as a guideline for budgeting, scheduling, and, especially recruiting and retention efforts of the College. In other words, it is used as a tool for controlling enrollment, which is growth at this point in time with facilities and resource constraints being factors of it. When efforts of the institution are geared toward achieving a specific objective at a specific period of time, the objective has a high probability of being met. Moreover, the involvement of the College and campus personnel in the discussion of the feasibility of the projection, in adjusting it to make it as realistic as possible, plays a crucial role in the success of the model.

To facilitate the user in the process of implementing the model, the part that is automated has been expanded greatly, using the FORTRAN computer programming language. This process decreases considerably the degree of manual work which would have to be put into the yearly construction and updating of the model. The projection model for academic areas has been in its implementation stage for two years, and its results also are encouraging. The projections have been met fairly consistently for the same reasons stated above. The model will eventually allow College personnel other than researchers to log in their reaction to a projection for discussion purposes At the level of academic areas, insights from academic people are even more important to the model. As stated earlier, linear regression formulae may result in a projection with a large discrepancy from reality in a number of areas. Academic people may suggest adjustment to the projections in these areas in light of their insights, facilities, and resource constraints.

E. The Expansion of The Model

The model is being expanded to project faculty instructional work load or equivalent semester hours (ESH) as it is called at Montgomery College and average instructional ESH, the number of sections in each academic area, and number of instructional ESH to be taught by part-time faculty members.

Faculty instructional ESH is defined as the result of credit hours in an academic area divided by the student-faculty ratio in the same area. From the credit hours projected earlier for each academic area, instructional ESH will be projected, using a student-faculty ratio, decided upon and provided by the College's central management, after consulting with campus academic people. This projection also will be done by semester and fiscal year for each campus, and aggregated for the College.

Faculty average instructional ESH will be projected in two separate steps (1) from the historical data, for historical faculty average ESH, as a product of instructional ESH in each academic area divided by the number of sections in the same area, and (2) from a regression between instructional ESH in each academic area and its corresponding faculty average ESH. Here, the assumption under which the regression is made is that a relationship betweeen instructional ESH in each academic area and faculty average ESH holds true over a number of years. The projection also will be done by semester and fiscal year for each campus, then aggregated for the College.

The number of course sections in each academic area is defined as the result of the projected instructional ESH divided by the projected faculty average ESH. It is, thus, a simple projection, and done by semester and fiscal year for each campus, then aggregated for the College.

The number of instructional ESH to be taught by part-time faculty members is the number of outstanding instructional ESH not covered by full-time faculty. Each full-time member of the faculty is required to teach a certain number of ESH per semester. Therefore, this projection is simply to find the number of outstanding instructional ESH after full-time faculty have exhausted their required teaching load. This projection will be done on two levels: aggregated campus and for each academic area, both by semester and fiscal year.

The expansion of the model should be helpful for the college management, particularly for academic deans and chairs, who are dealing primarily with scheduling and hiring part-time faculty members. It will enable them to determine the number of sections needed to meet enrollment projections and the number of part-time faculty to hire to achieve a set student:faculty ratio and to expend within the budget for a subject area.

DISCUSSION

In these turbulent times, what will happen to enrollment and budgets may be irregular to and non-linear with what has happened in the past. Fortunately, the underlying causes of turbulence can be analyzed and predicted (Drucker, 1980), and people can still develop strategies for the management of their institutions in the future. Nevertheless, how far in the future can these strategies be developed, for planners have to keep in mind that the longer the forecasting interval, the more tenuous the forecast becomes (Kotler, 1980).

The projection model presented in this paper is a managerial tool, a part of the strategies for the management of this institution in these turbulent times. It takes into consideration and puts heavy emphasis on the changes in the structure and dynamics of the populations from which the college student is drawn. Population is, perhaps, the most important factor which, when going through changes, is the cause of turbulence, and which also can be managed, even in turbulent times, as Drucker says. The population segments on which this projection was based has the projections of county population and twelfth-graders as the primary bases. These population projections are reliable in that their estimated figures for 1980 are very close to the actual 1980 population count released by the U. S. Bureau of the Census and the Montgomery County Public School's actual enrollment. These population projections also are revised almost yearly to reflect any changes in the structure and dynamics of the county population. Likewise, the coefficients in the College's projection model are revised yearly to be sensible and alert to any changes in these segments.

The limitations of the model exist, however, in its reliance on linear regression, and, in some part, in its use of time as an independent variable. A model that relies on linear regression and that treats time as an independent variable assumes that the past trend will continue in the future. In these changing times, such an assumption is no longer valid because there may not be a high degree of continuity of yesterday trends. However, this shortcoming of the present model is compensated for by a number of factors which were accounted for when the model was built.

First of all, the projection is done on three different levels: high, middle, and low. The management, thus, has three alternatives, each with a set of assumptions from which to select the one that best fits a manageable level of growth. In selecting a level of growth, resources and facilities considerations must be among the factors leading to such a decision. Additionally, the involvement of academic people in discussing the trends that have developed in different academic areas, is important. These people contribute to the planned level of enrollment of the institution. Because of their daily contact with the academic world, they have insights in actual growth and decline in various areas. Therefore, they can give valuable suggestions for the adjustment of the projected figures to reflect perceived reality. As Drucker says, a time of turbulence also offers great opportunities for those who can understand and exploit "new realities". The academic people, both faculty and administrators, are those who have an understanding for, and who can exploit new directions of growth in a certain number of academic areas. Their insights are incorporated in this projection.

Moreover, concerned about the uncertainty of the future, and knowing that as the length of the forecast period increases, the chance for the assumptions to hold true decreases. Thus, the more finite projections for subject areas are done for only two years in the future. Also, the projection is revised annually once the new academic year begins.

Finally, the aggregate student headcount and credit hour projections are used to formulate College plans and budgets, but the discipline projections are used more as a guideline for the purposes of scheduling and recruiting faculty within the constraints of available resources and facilities. All of the projections are viewed as forecasts, not the absolute truth. They help to indicate to management areas in which the institution should plan for or limit growth, or plan for decreasing enrollment, provided the assumptions on which they are built hold true.

SUMMARY AND CONCLUSION

In these times of changes, with demand for increased accountability, consumerism, restricted financial resources, increasing costs, and possibly stabilized or declining enrollments, colleges need a managerial tool to help them to design an operating budget, plan facilities, hire personnel, and develop a corresponding course schedule that will enable them to meet their enrollment objectives while having to cancel few course sections.

Montgomery College's projection model is suggested as a managerial tool to assist the College's management to monitor enrollments to meet its enrollment projections, generate forecasted revenue and expend only budgeted funds, while annoying few students because of class cancellations.

The projection is in two parts. One part deals with student headcount, total credit hour enrollment and credit hour enrollment in different academic areas. The other part is an expansion of the present model to project faculty instructional ESH or work load and faculty average ESH, the number of course sections, and instructional ESH to be taught by part-time faculty members.

Student headcount enrollment is projected as resulting from yield rates from various populations from which the college student is drawn. Total credit hour enrollment is regressed from the relationship previously established between headcount and total credit hour enrollments, and that between headcounts and student average load. Credit enrollment in each academic area is projected from the past trend using regression or moving average, and adjusted after consultation with academic deans and their staffs to incorporate new developments to improve the accuracy of the model. The same method is being used in the expansion of the model.

The results of the projection are aggregated for each campus and the total college by semester and fiscal year. The first part of the model has been used for two academic years with the part of it related to headcount and total credit hours having been tested for a number of years. Results to date have been found to be very encouraging with the total headcount and credit hour projections being met consistently, and projection by academic areas being reasonably close to actual enrollments. The second part of the model is still in development; thus, it has yet to be tested for validity and reliability. At this moment, the college is considering developing or purchasing a third model which will assist academic administrators to determine the effect of adding or canceling a course section during the hectic days of registration. It will determine a new student:faculty ratio, project campus credit hours, changes to revenue, and changes to costs.

This managerial tool has helped this institution to achieve its enrollment objectives, to generate forecasted revenue from tuition, fees, and state aid, and to reduce class cancellations, ever since it went into operation. Other institutions with characteristics similar to this one should be able to benefit from the model to improve the planning of their strategies for survival in these changing times.

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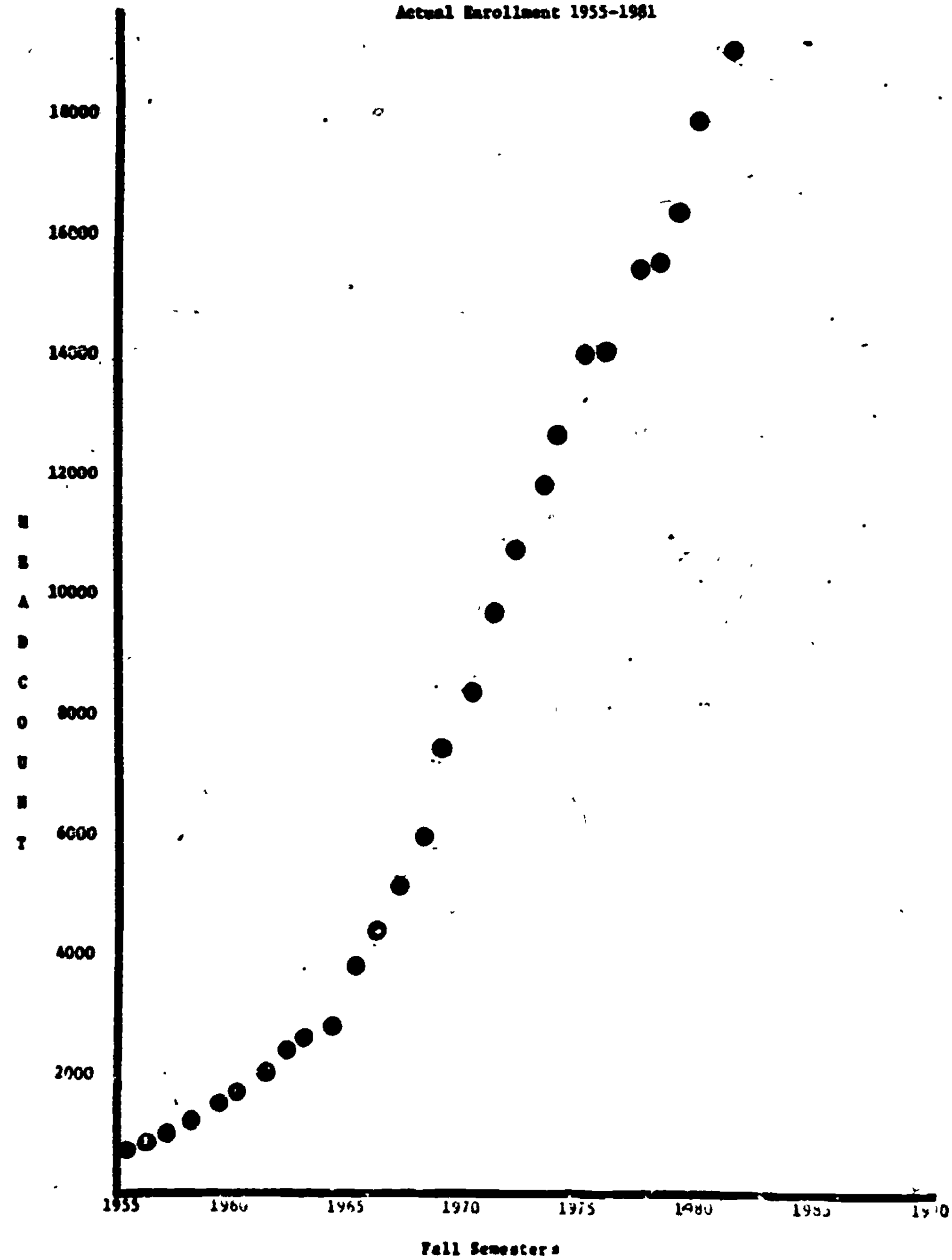
FIGURE A
Actual Enrollment 1955-1981



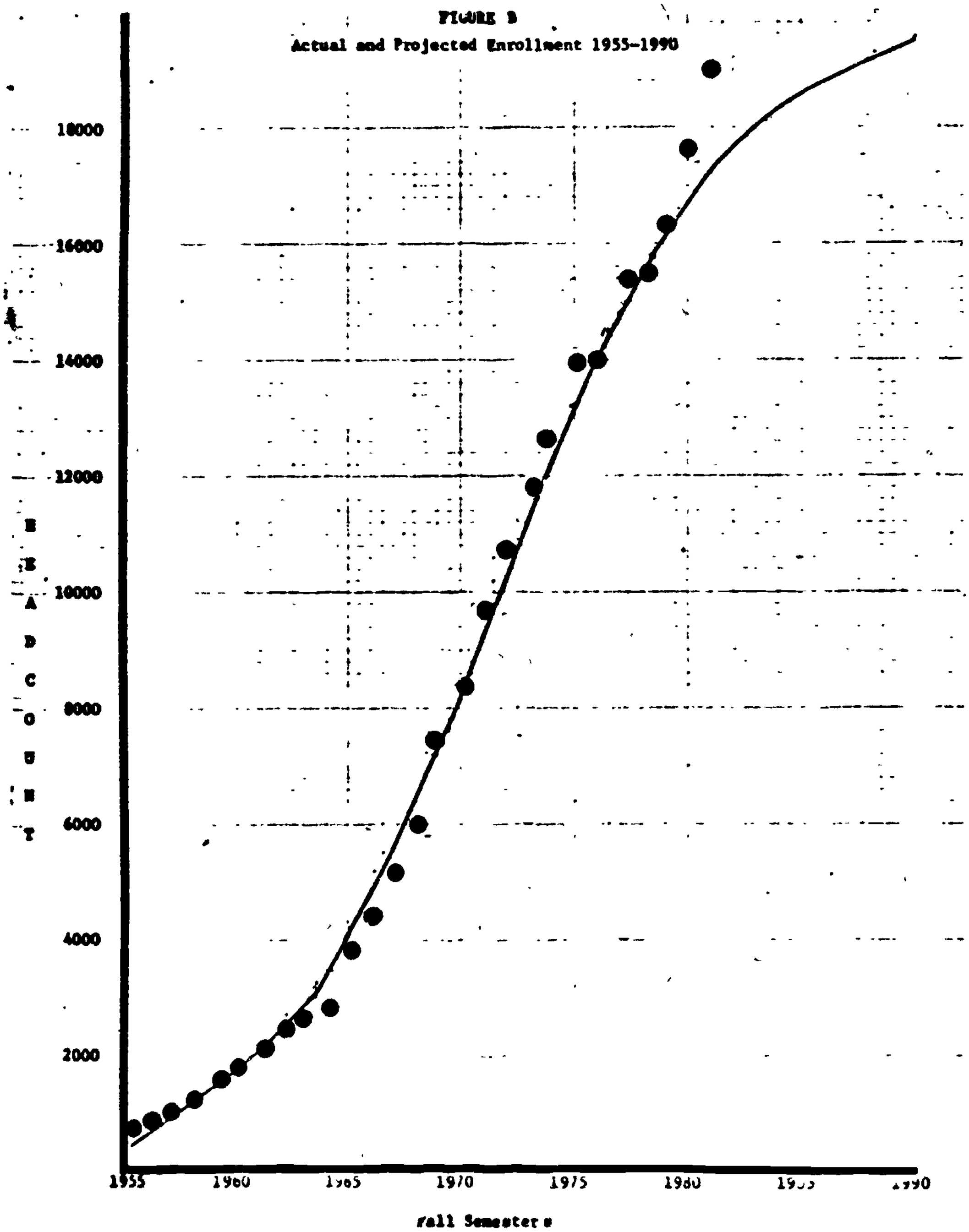


FIGURE 3
Actual and Projected Enrollment 1955-1990
18000
16000
14000
12000
10000
8000
6000
4000
2000
HEADCOUNT
1955
1960
1965
1970
1975
1980
1990
Fall Semesters

Table 1

Linear Regression of Credit hour Enrollment Directly from Headcount Enrollment

Year	Headcount Enrollment	Credit Hour Enrollment
1	13,256	125,860
2	14,408	131,739
3	14,550	128,977
4	15,570	136,090
5	16,788	141,614
6*	17,715*	145,558(a)*

Table 2

Linear Regression of Student Average Credit from Headcount Enrollment

Year	Headcount Enrollment(1)	Student Average Load (2)	Credit Hour Enrollment (3 = 1x2)
1	13,256	9.49	
2	14,408	9.14	-
3	14,550	8.86	-
4	15,570	8.74	-
5	16,788	8.44	-
6*	17,715*	8.12*	143,846 (b)*

*Projected

Table 3

Examples of Credit Hour Enrollment Projections in a Number of Areas Before and After Adjustment by Campus Personnel

Academic Areas	Projected Enrollment (Before Adjustment)		Projected Enrollment (After Adjustment)	
	Year 1	Year 2	Year 1	Year 2
Accounting	3200	3203	3200	3203
Art	4800	4800	4700	4700
Chemistry	2647	2672	2700	2700
English	11450	11730	11500	11675
Management	4020	4038	3997	4008
:	:	:	:	:
:	:	:	:	:
TOTAL	104550	105165	104550	105165

Table 4

Percentages of Enrollments Realized
Over Projected Enrollment

Fiscal Year		1982	1981	1980
Spring	Headcount	100%	102%	101%
	Credit	100%	100%	101%
Fall	Headcount	102%	105%	102%
	Credit	102%	103%	100%
Summer	Headcount	106%	104%	103%
	Credit	111%	106%	101%