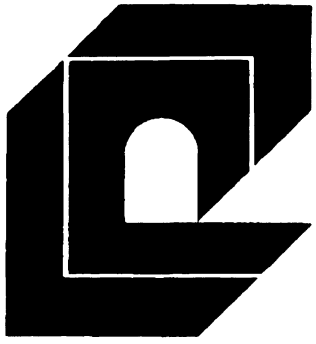

COLLEGE OF ENGINEERING
THE UNIVERSITY OF MICHIGAN
ANN ARBOR, MICHIGAN

COLLEGE OF ENGINEERING BRIEFING

February 15, 1984

EXECUTIVE BRIEFING

COLLEGE OF ENGINEERING

February 15, 1984

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EXECUTIVE SUMMARY

1

EXECUTIVE SUMMARY

FACT SUMMARY:

History (during the 1970s):

Instructional staff (FTEs) declined by 15% (-45 FTEs)
Enrollment (FYES) increased by 46% (+1150 FYES)
Annual growth rate in General Fund support (GF$/SCH or GF$/student) was the lowest in the University (less than 0.5% compared to a University average of 7% and a CPI of 8% for this period).

Recent History (1981 - 1984):

Instructional staff (FTEs) has continued to decline (-9 FTE)
Enrollments have continued to increase (+420).
Real budget growth (aside from salary or University-wide programs) has been less than $1.6 million ($2,000,000 - $530,000 = $1,470,000), only 21% of the estimated Engineering Gap of $6.93 million.
The College has been forced to support an increasing fraction of its salary program, flexible instructional staff, and administrative staff from private gift receipts -- resources which more properly should be directed toward student financial aid, equipment support, and research initiatives.

Present Status:

The instructional loads of the College are now among the highest in the University:

FYES/FTE = 18.1
SHC/FHC = 22.1
SCH/FTE = 244

General Fund budgeted instructional staff (216) is less than half that estimated by the Owens-Huffman Needs formula (435) and the National Accreditation Board for Engineering and Technology (441) for the present College enrollment (5,607 headcount or 4,070 FYES).

GENERAL FUND BUDGET NEEDS:

The College's Five-Year Plan requested a restoration of General Fund support to a level commensurate with its enrollments and its unique responsibilities to our State and nation. This Plan called for a minimum restoration of $6.93 million in base support (the "Engineering Gap") over this period. While there was some early progress made through a reallocation of $2 million for the College's research agenda, the past year has seen a backsliding in this

commitment (with the levying of an additional base budget cut of $530,604).

REQUESTED ACTION:

General Action:

An acceleration of University efforts to restore an adequate level of General Fund support to the College of Engineering.

Alternative:

Phased enrollment reductions of 30% or greater.

Consequences of Enrollment Reduction:

Admission denial (and consequent loss to the University) of Michigan's most outstanding high school graduates.

Public and political reaction to University enrollment cuts in engineering during a period of peak demand on the part of students and industry.

Tuition loss of $7 million per year (compared to the General Fund growth of $5 million needed to sustain present enrollments).

Comment:

The rest of this decade will see a continuation of the unprecedent demand on the part of Michigan's most outstanding high school graduates for engineering educations, coupled with the urgent need of our State and nation for talented, broadly-educated engineers. We believe a decision to reduce engineering enrollments at Michigan, in the face of such intense societal demand and need, would be irresponsible. We could not endorse such action.

SPECIFIC ACTION REQUESTED FOR FY84-85:

Urgent Budget Growth Needs:

$1,000,000	Flexible staff to provide some relief for instructional overloads
$ 300,000	Technical support staff
$3,500,000*	Laboratory equipment support (from special State program OR General Fund support)

Other Critical Matters:

Sponsored Research Department Administration: $800,000

Recent Federal Fund Accounting audits have confirmed the University's failure to provide funds for department administration within academic units included in indirect cost rate negotiations. Based on 24% of indirect cost recovery, this corresponds to $800,000 for Engineering research units.

Research Incentive Program: $500,000

Recent successful proposal activity implies a 25% growth in College sponsored research volume in FY84-85. A research incentive index of 15% of sponsored research volume suggests a $500,000 increase in the research pool to keep pace with this increased research activity.

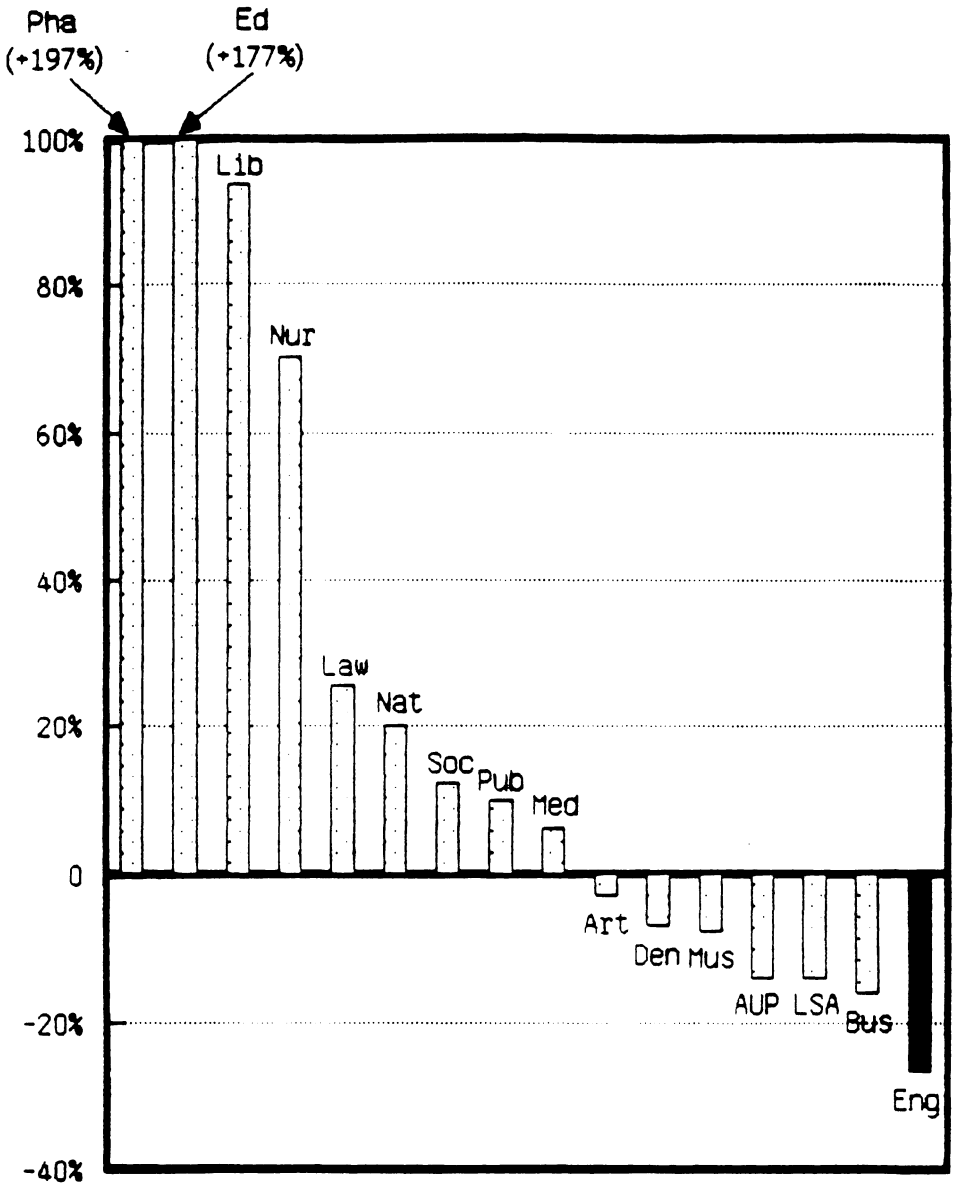
Programmatic Matters: To be determined

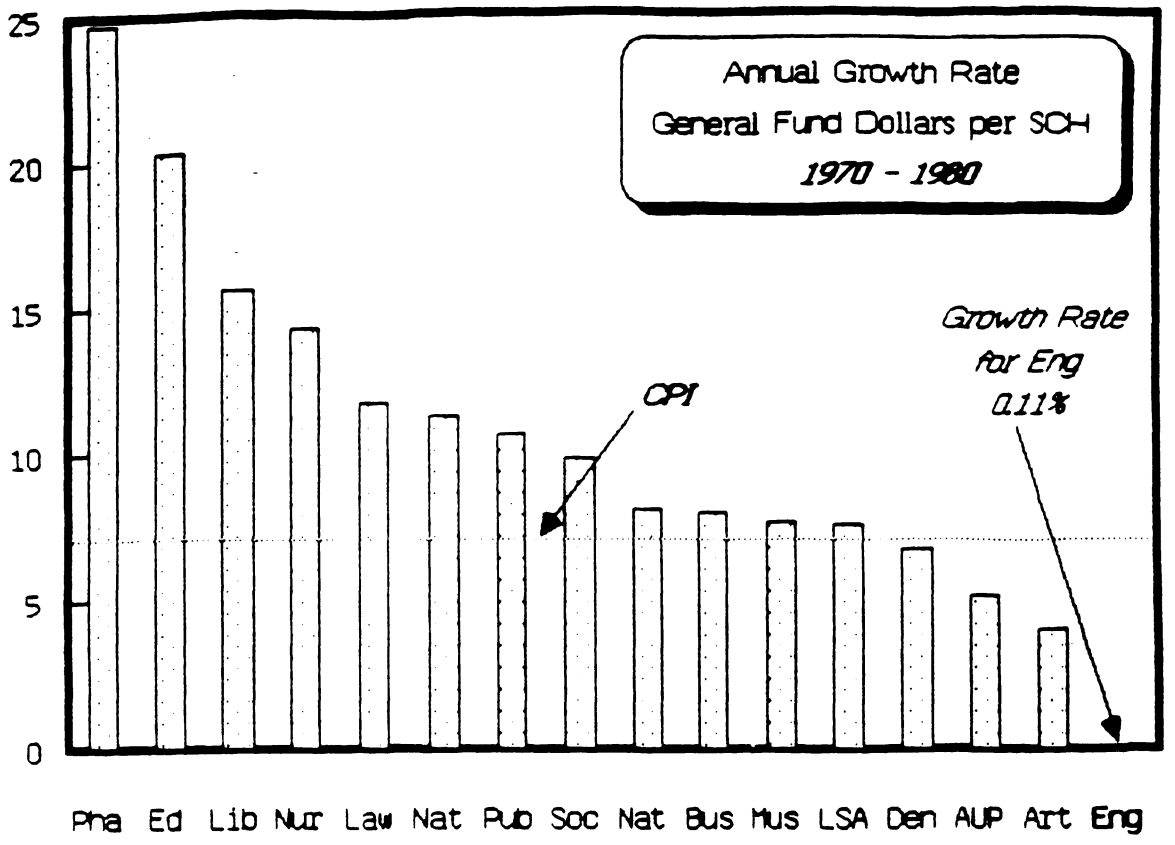
Transfer of CCS to Engineering and merger into Department of Electrical Engineering and Computer Science will require transfer of entire budget line associated with CCS. The major increase in computer instruction for LSA students agreed to by Engineering will also require budget growth downstream.

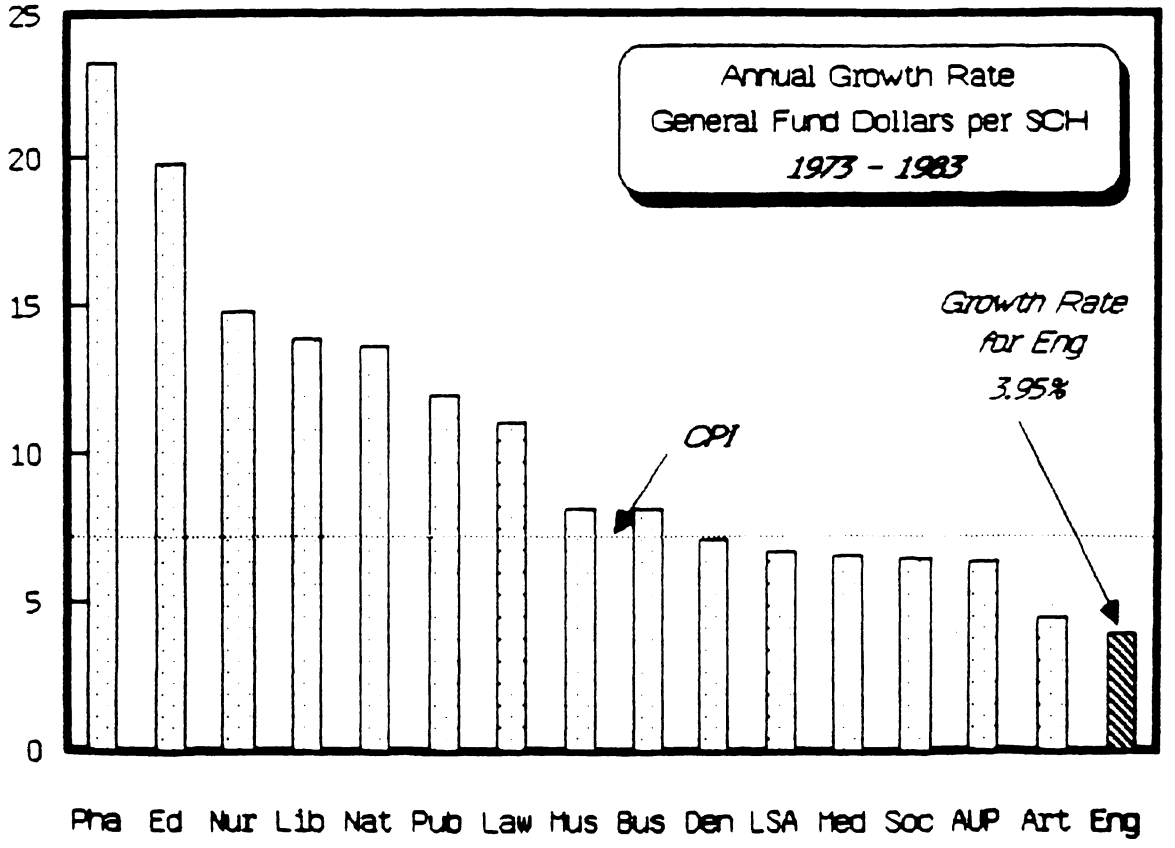
LONGER TERM REQUESTS:

Over the longer term, the College of Engineering requests that it, along with other selected schools and colleges, be identified as cost/revenue control units responsible for both expenditures and revenues. In such an "every tub on its own bottom" budget strategy, the College would be allowed to retain all revenues (e.g., tuition and fees, indirect cost recovery, private gifts, and General Fund support of instruction, research, utilities, libraries). It would then be assigned responsibility for meeting both direct and indirect operating costs (e.g., internal instructional and research activities, service instruction provided by other units, utilities, libraries, and central administrative services).

Change in CPI-Adjusted General Fund $ per Student 1970 - 1983




Annual Growth Rate
General Fund Dollars per SCH
1970 - 1980
Growth Rate
for Eng
0.11%
CPI
25
20
15
10
5
0
Pha Ed Lib Nur Law Nat Pub Soc Nat Bus Mus LSA Den AUP Art Eng


Annual Growth Rate
General Fund Dollars per SCH
1973 - 1983
Growth Rate
for Eng
3.95%
CPI
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20
15
10
5
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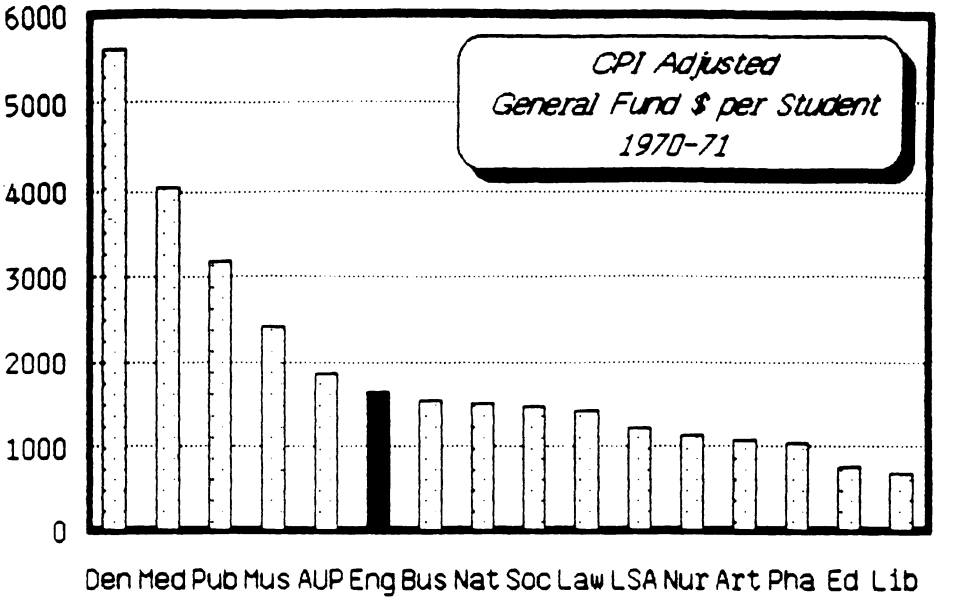
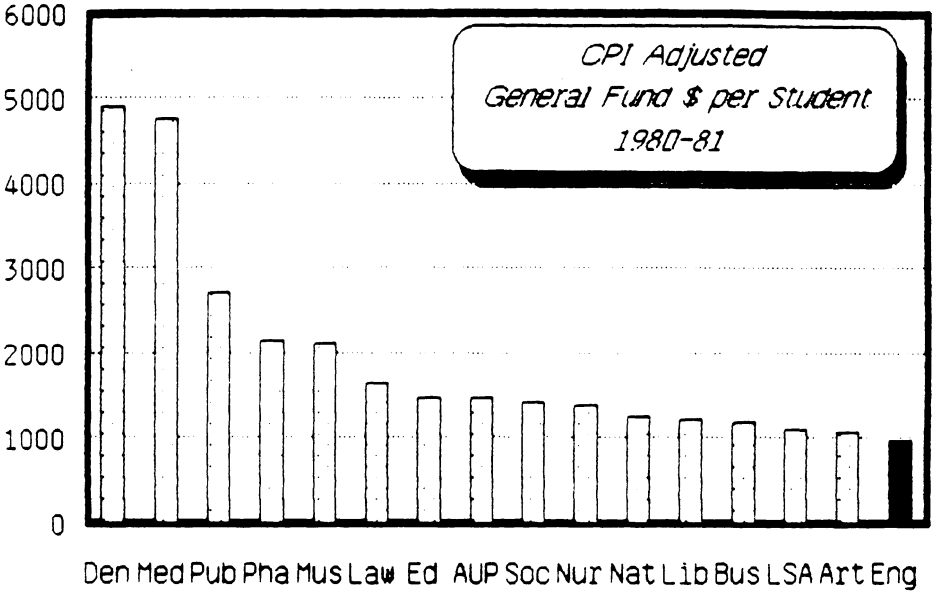
Pha Ed Nur Lib Nat Pub Law Mus Bus Den LSA Med Soc AUP Art Eng


CPI Adjusted
General Fund $ per Student
1970-71
6000
5000
4000
3000
2000
1000
0
Den Med Pub Mus AUP Eng Bus Nat Soc Law LSA Nur Art Pha Ed Lib


CPI Adjusted
General Fund $ per Student
1980-81
6000
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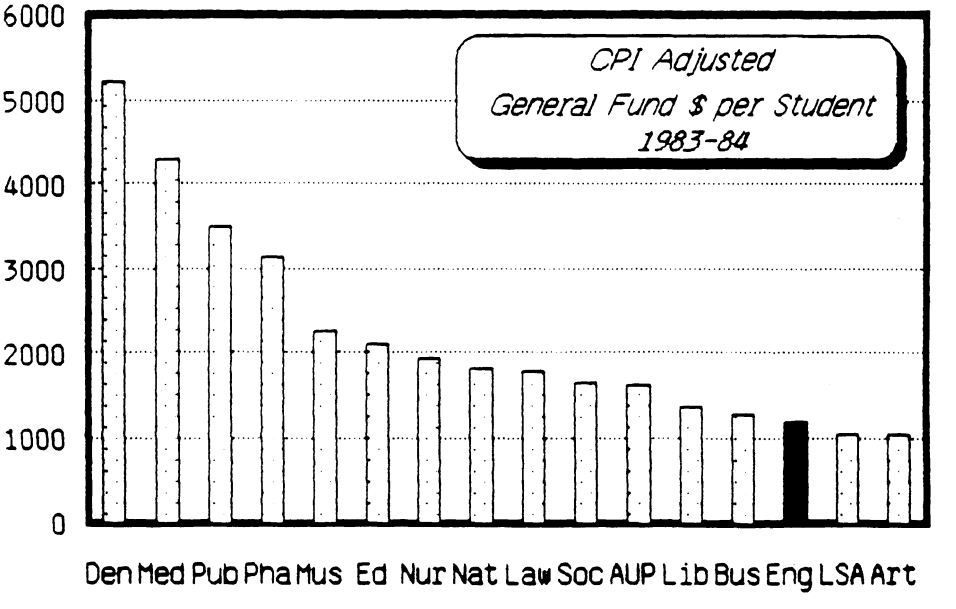
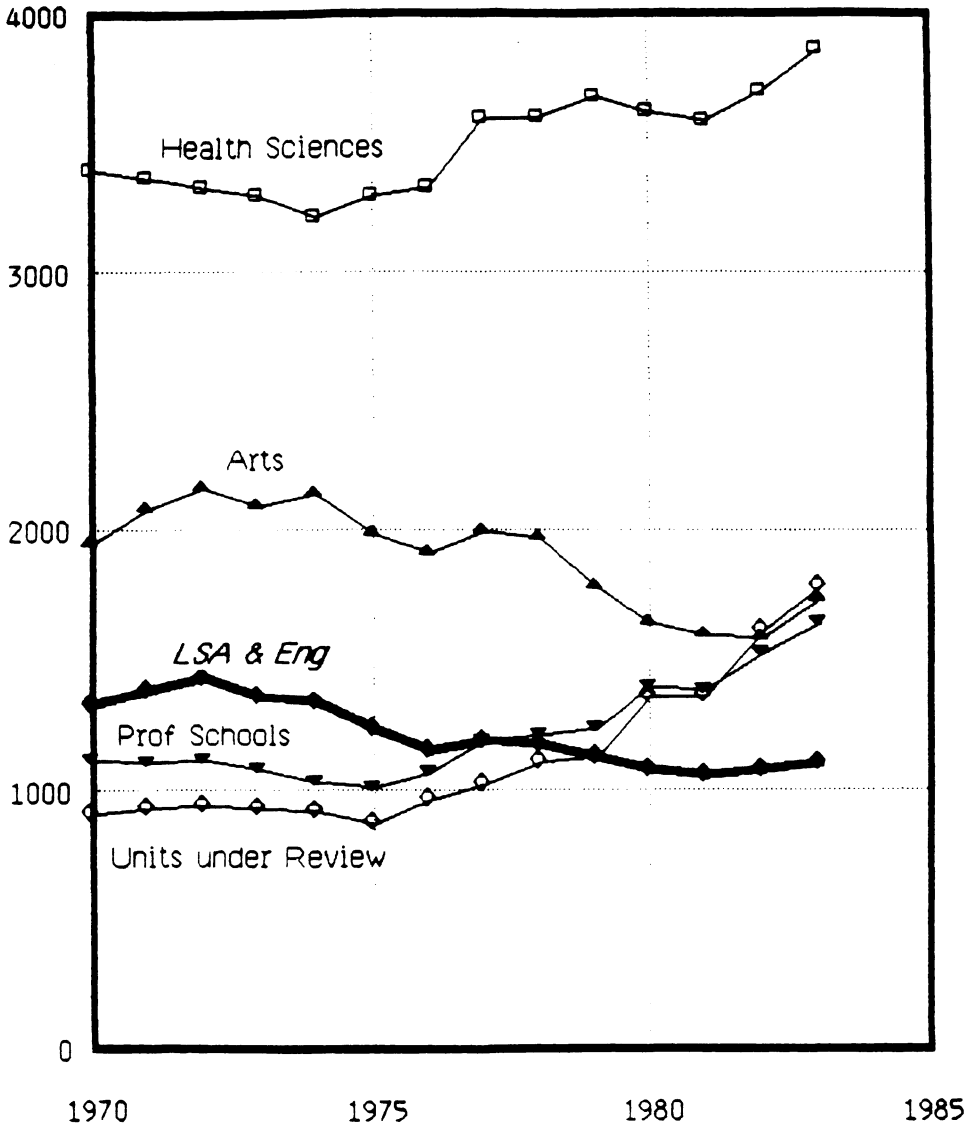
Den Med Pub Pha Mus Law Ed AUP Soc Nur Nat Lib Bus LSA Art Eng

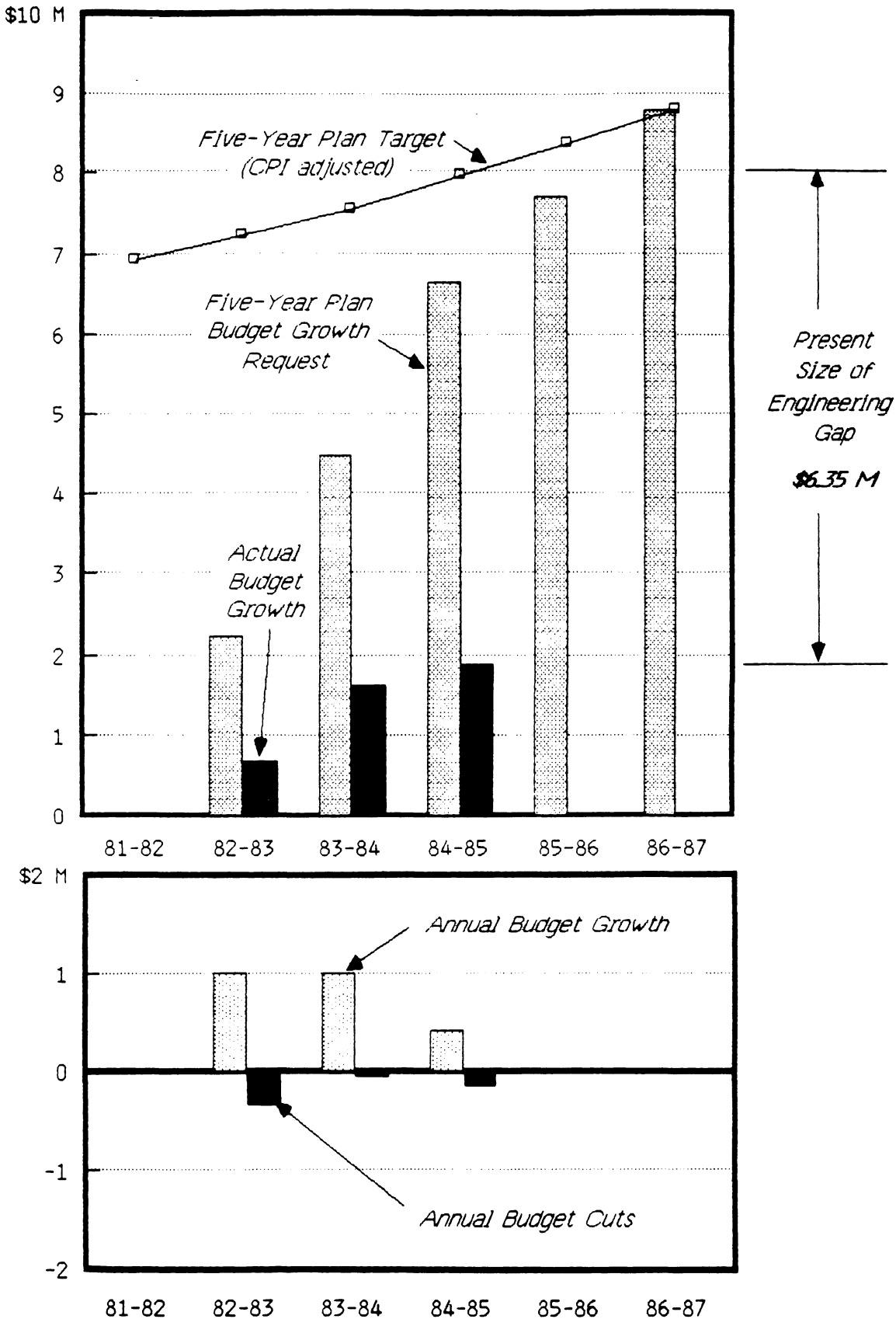

CPI Adjusted
General Fund $ per Student
1983-84
6000
5000
4000
3000
2000
1000
0
Den Med Pub Pha Mus Ed Nur Nat Law Soc AUP Lib Bus Eng LSA Art
School or College

CPI Adjusted General Fund per Student

(Groups of Schools by Discipline)



College of Engineering Five-Year Plan



ENROLLMENT TRENDS

2

Enrollments

ENROLLMENTS

FIGURES:

- 30-Year Enrollment History of College
- Recent Enrollment Trends of College
- Graduate Enrollments
- Absolute Enrollment Changes (University Comparison)
- Enrollment Comparisons of Departments and Colleges

COMMENTS:

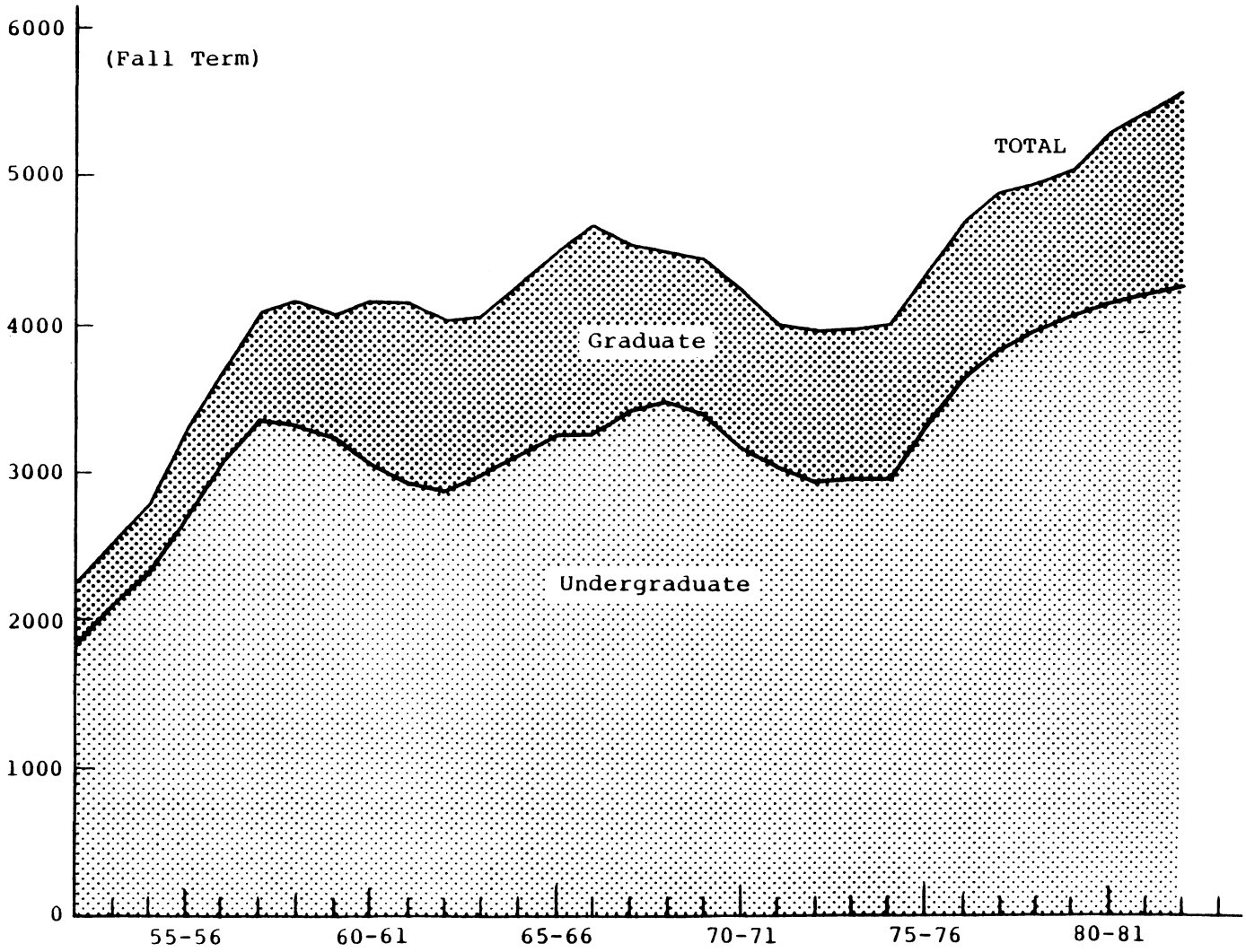
1. The College continues to experience enrollment growth, although this mix is changing to heavier graduate enrollments.

2. While undergraduate enrollments appear to have stabilized at 4,200 students, graduate enrollments have increased by 20% in past three years (due to the College's response to the critical national need for engineering doctorates).

3. The present College enrollment is 5,607. With the addition of Computer Science students (whether enrolled in LS&A or Rackham), the College will be responsible for the degree programs of over 6,000 students by Fall of 1984 -- slightly over one-sixth of the enrollment of the entire University.

4. Enrollment growth (2,000 students) in the College of Engineering over the past decade has exceeded that of all other schools and colleges combined. (However this enrollment growth does not completely compensate for the major enrollment losses in units such as Education, Natural Resources, Social Work, Library Science, Nursing, and Pharmacy so that the University has still undergone a net loss of roughly 1,500 students.)

5. The College has two departments with enrollments larger than most schools and Colleges. Indeed, one of these departments, Electrical Engineering and Computer Science with 1,800 students, is larger than all schools and colleges except LS&A, Engineering, and Business Administration.

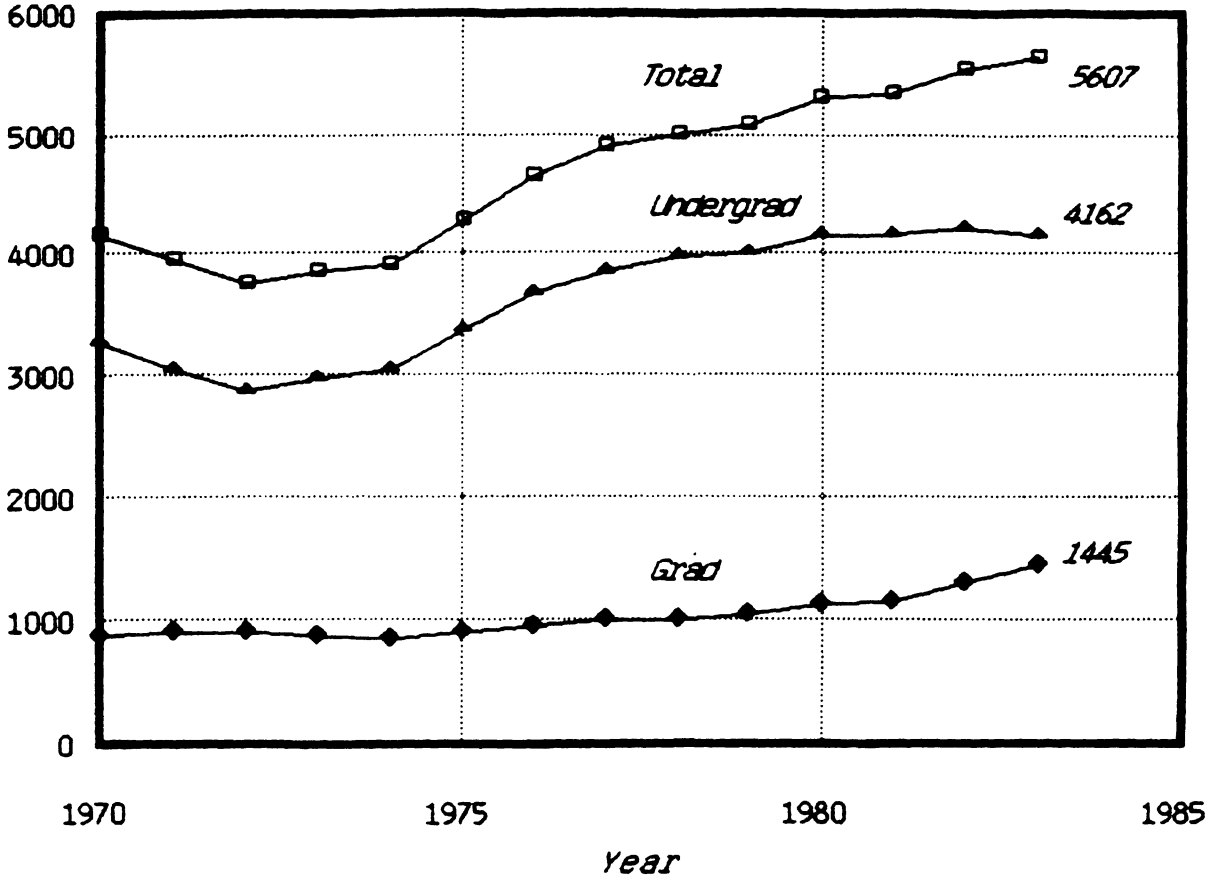


ON-CAMPUS HEADCOUNT ENROLLMENT

Aside from a 10% drop during the late 1960s, Engineering enrollments have been monotonically increasing since the end of WWII.

Enrollments

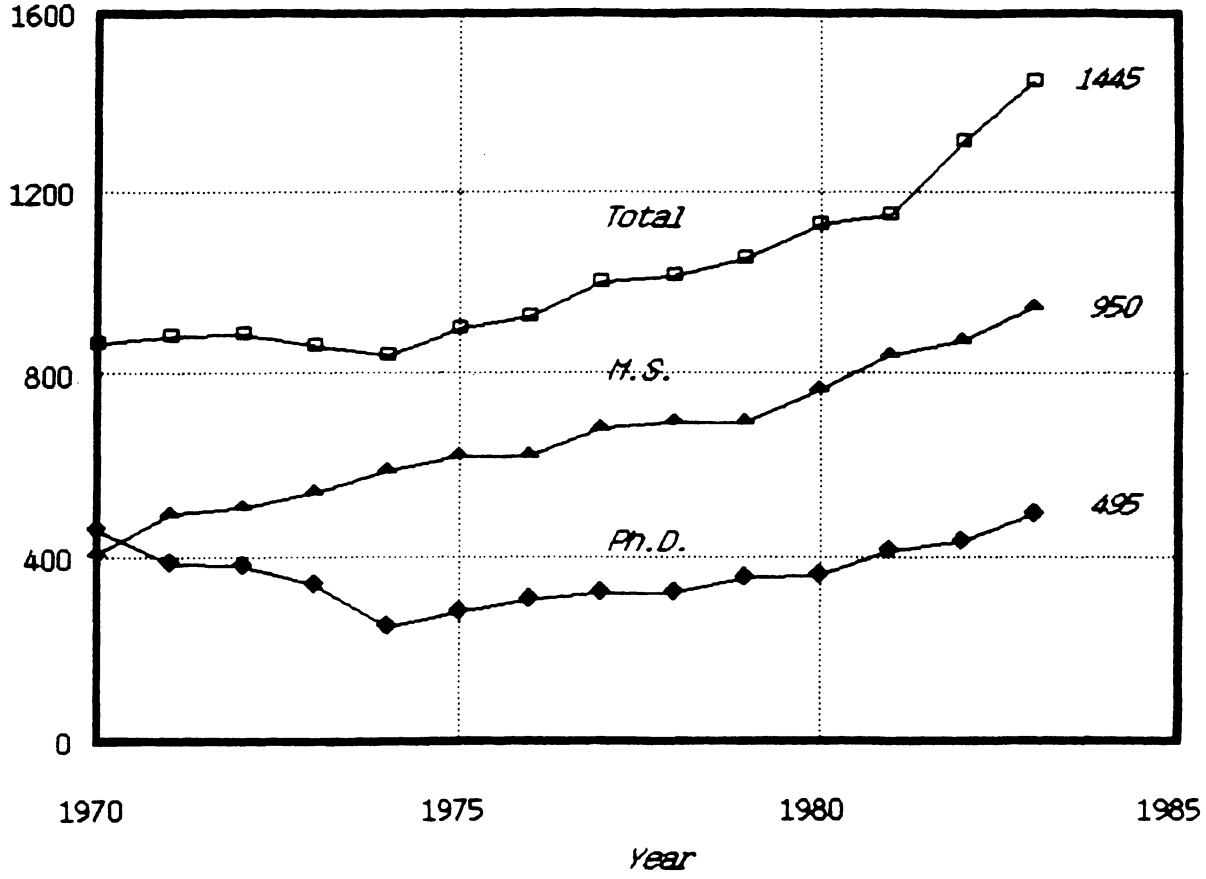
College of Engineering



Total College enrollment is at an all time peak. Undergraduate enrollment has stabilized. (However transfer of CCS to Engineering will cause a major jump in effective undergraduate enrollments.)

Graduate Enrollments

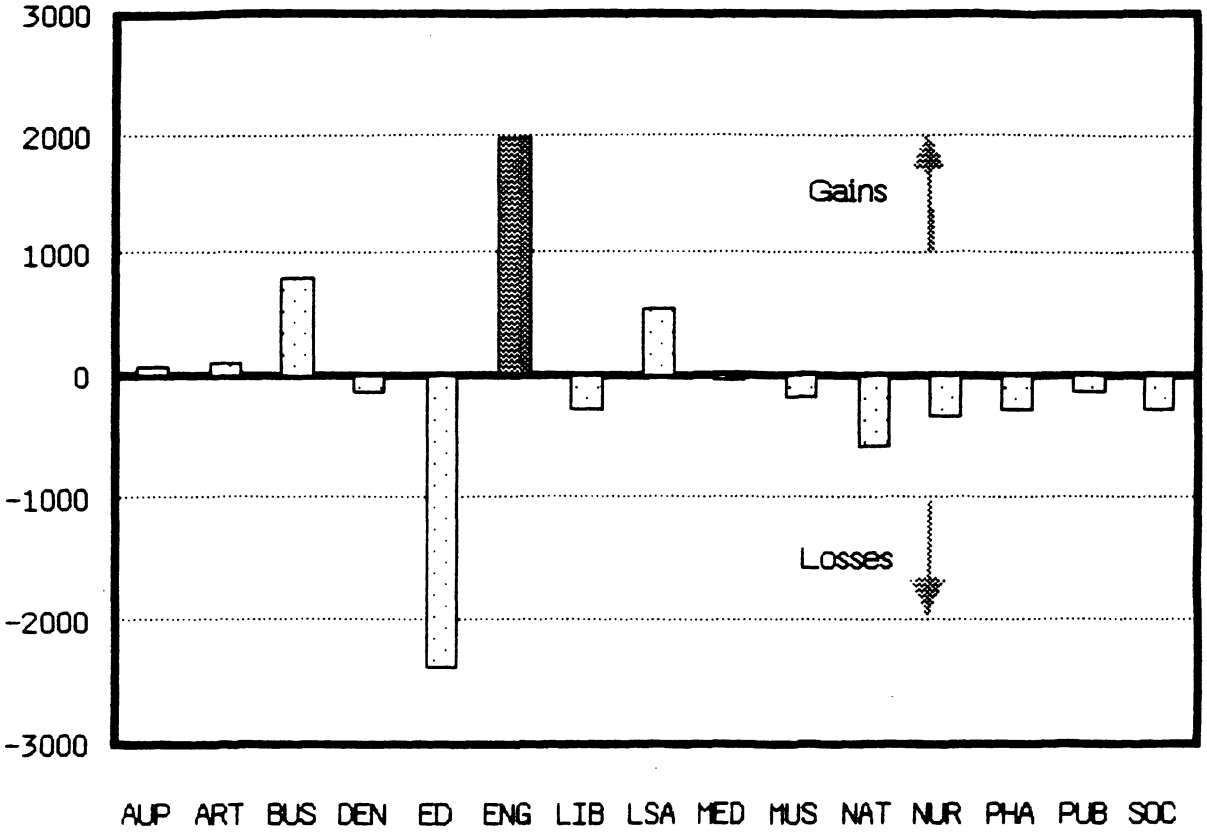
College of Engineering



Graduate enrollment is increasing, particularly at the PhD level, to achieve a better balance between undergraduate and graduate enrollments and to respond to serious national needs for engineering doctorates.

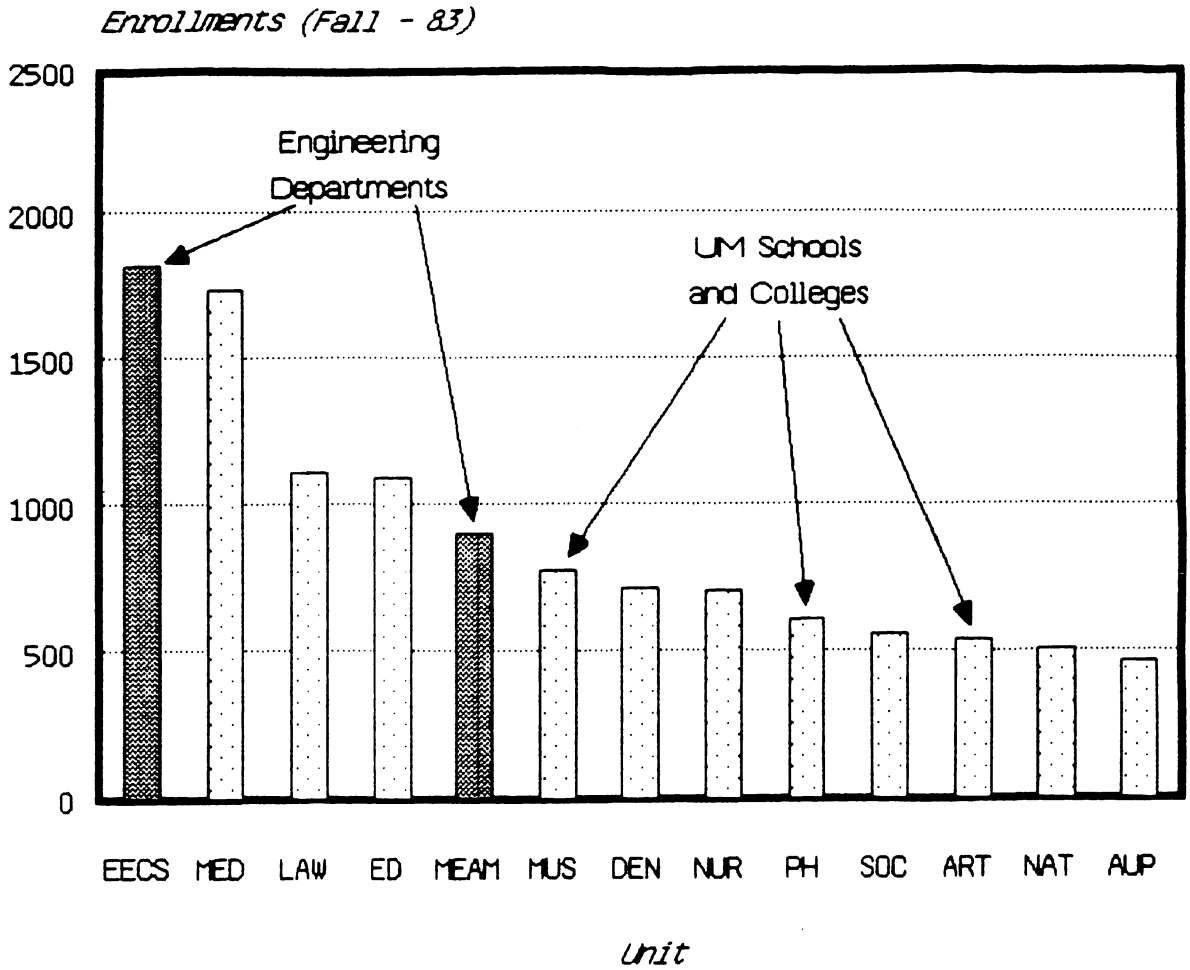
Absolute Enrollment Changes

1973 - 1983



College enrollment growth over the past decade (> 2,000) exceeds growth in all other UM schools and colleges combined.

Some Enrollment Comparisons



Engineering now has several departments larger than most schools and colleges in the University (albeit with only a fraction of the General Fund budget allocated these smaller schools).

Degree Production

DEGREE PRODUCTION

FIGURES:

- Degree Production (All Levels)
- Graduate Degree Production

COMMENTS:

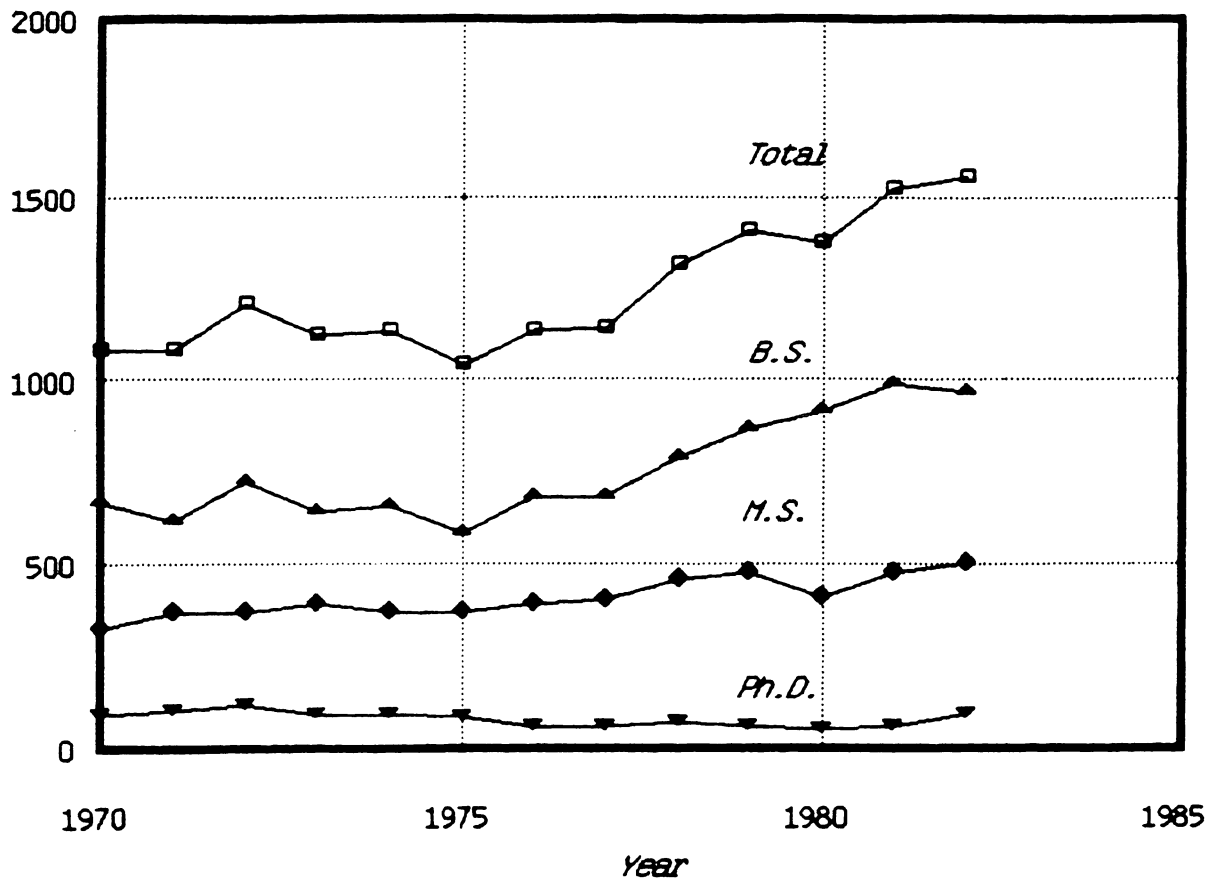
1. Undergraduate degree production appears to be stabilizing at roughly 1,000 B.S. degrees per year.

2. M.S. degree production is continue to grow, consistent with the growth in graduate enrollments.

3. After almost a decade of decline, PhD degree production has taken a sharp upturn, due in large part to efforts to respond to critical national needs for engineering doctorates.

Degree Production

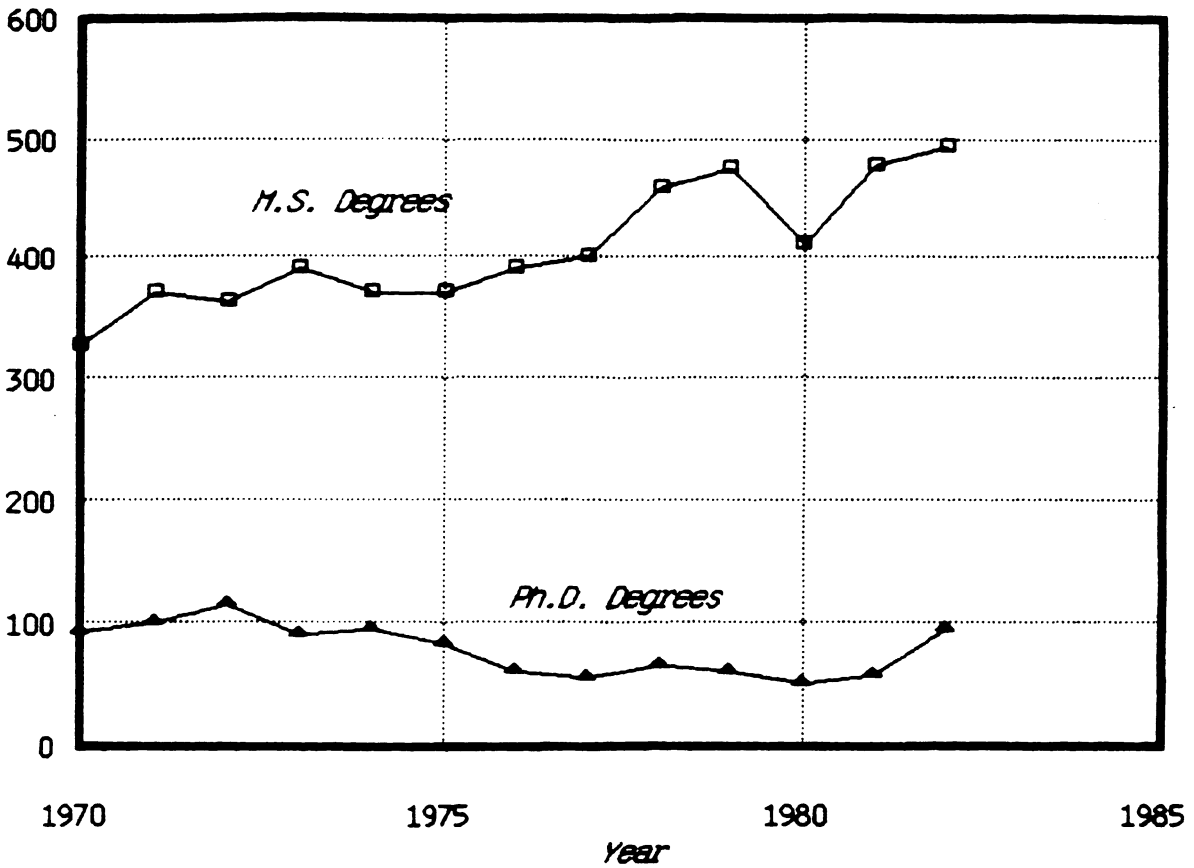
College of Engineering



Engineering degree production has reached 1600 per year: roughly 1,000 BS, 500 MS, and 100 PhD (ranking UM 5th nationally in each category).

Graduate Degree Production

College of Engineering



After a decade of decline, PhD production has increased sharply due to strong efforts to stress the College's doctorate programs.

Student Quality

STUDENT QUALITY

FIGURES:

- Applications for Admission
- Trends in SAT Scores of Entering Freshmen
- Trends in Class Ranking of Entering Freshmen
- Rackham Quality Factor of Selected Graduate Programs

COMMENTS:

1. Applications for admission to all degree levels of the College continue to be very strong.

2. By any quantitative measure, the most outstanding students in this University are choosing to enroll in the College of Engineering.

3. SAT Scores of entering engineering freshmen are now over 100 points higher than those entering any other unit on campus.

4. Over 25% of entering engineering rank in the 99th percentile of their high school graduating class (compared to 12% of students choosing to enroll in LS&A).

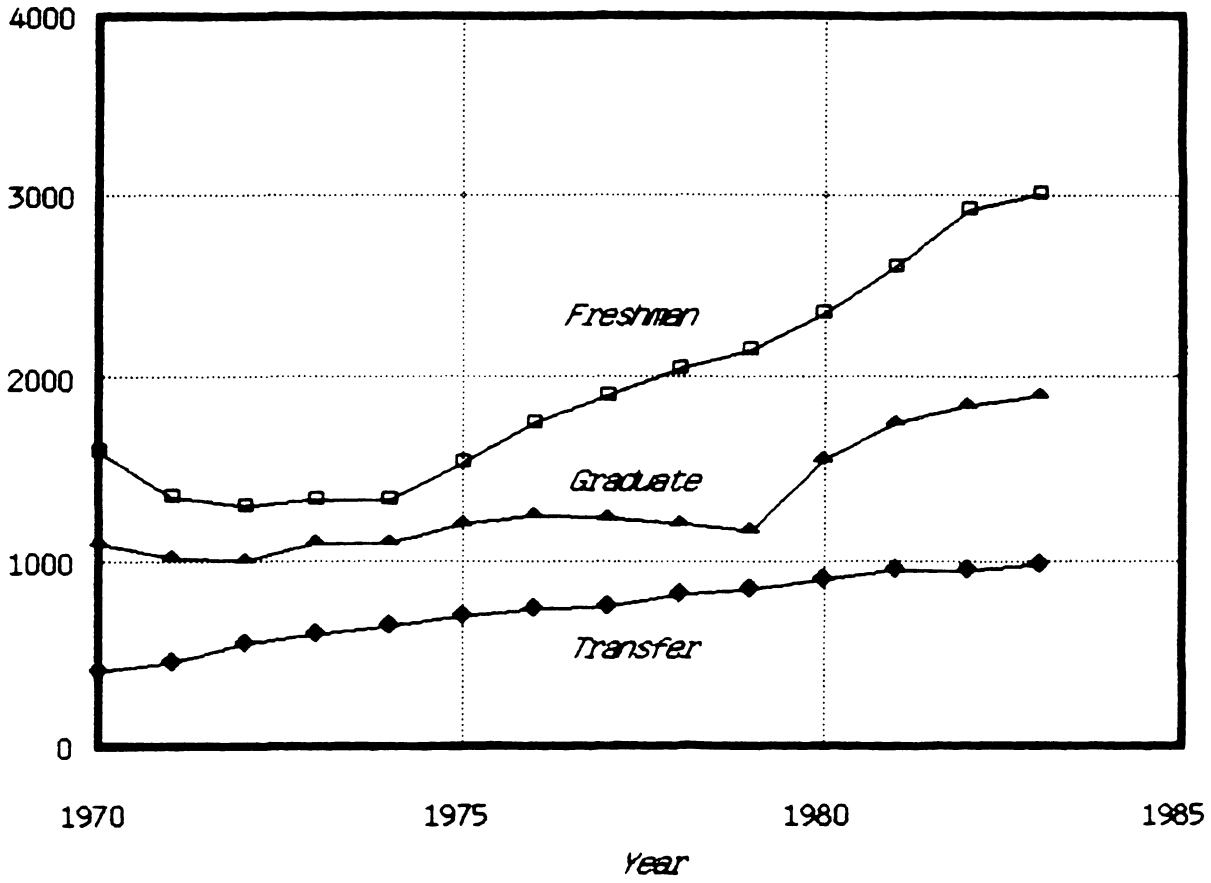
5. It is probable that the College enrolls the largest groups of truly outstanding engineering students in the United States. As such, it represents a unique resource for both this State and the nation.

6. Quantitative quality indices such as entering GPA or GRE scores indicate that graduate students enrolling in the College are comparable to those enrolling in other Division II programs (e.g., Mathematics, Physics, Astronomy).

7. The extraordinary abilities and commitment of the students enrolled in the College demands the <u>best</u> from this University and this State -- and certainly not the lowest level of General Fund support of any of Michigan's schools and colleges.

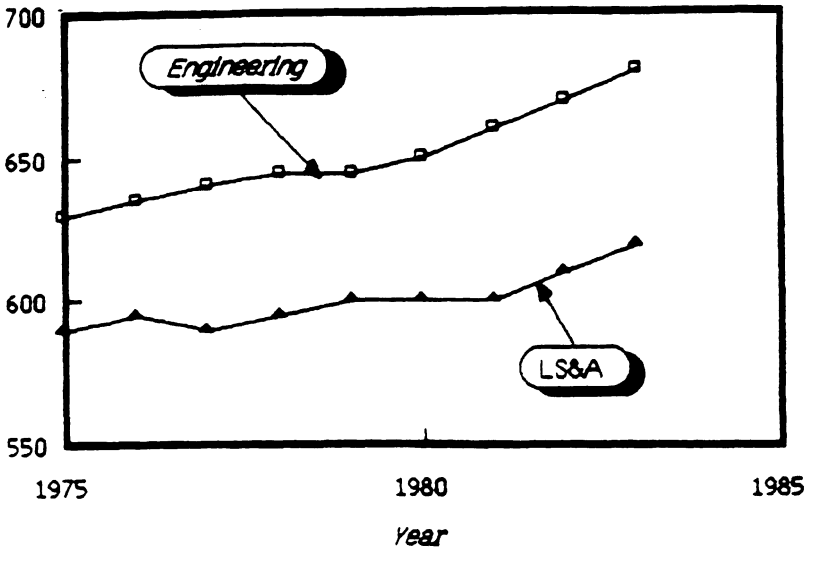
Applications for Admission

College of Engineering

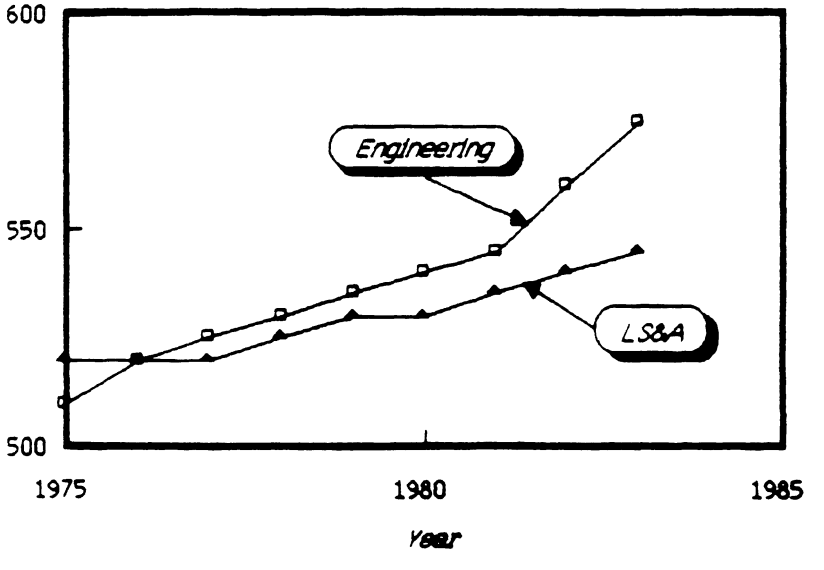


The number of applications for admission to the College continues to increase at all levels (freshman, transfer, and graduate).

SAT Math Scores for Entering Freshmen
College of Engineering

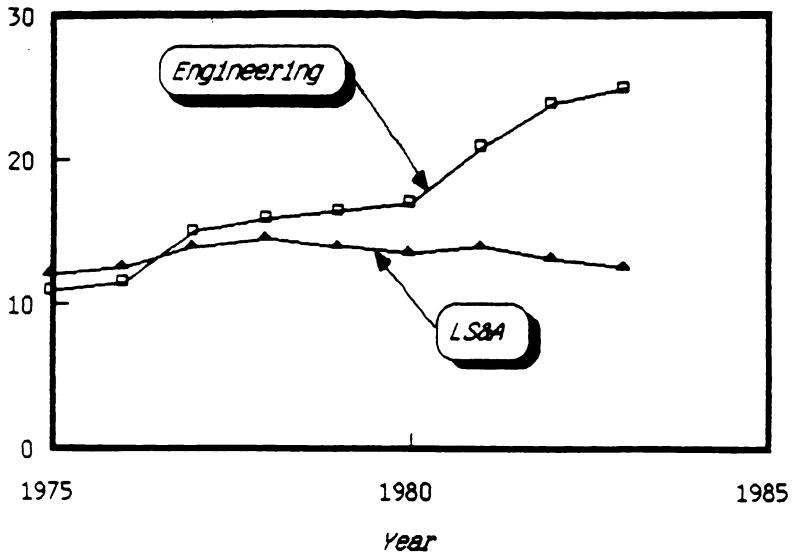


SAT Verbal Scores of Entering Freshmen
College of Engineering

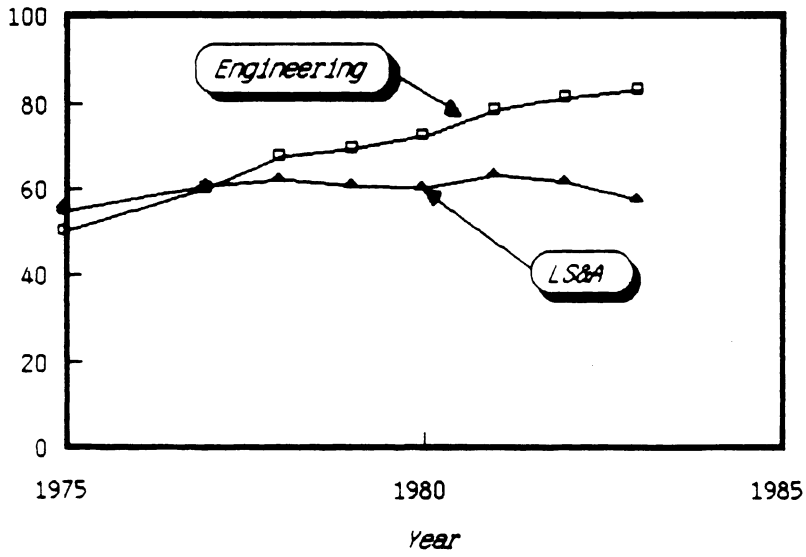


The SAT scores of freshmen entering the College are now over 100 points higher than those characterizing any other UM unit (and comparable to Ivy League standards).

Percent of Entering Freshman in 99th Percentile
College of Engineering



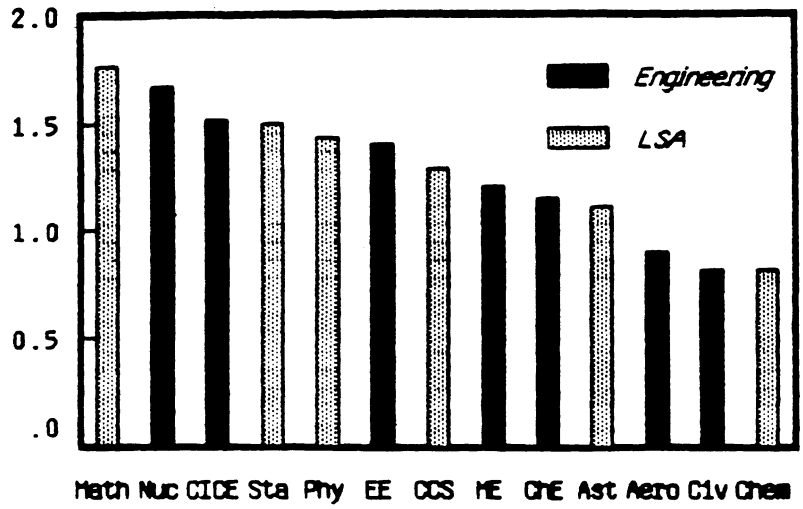
Percent of Entering Freshmen in 90th Percentile
College of Engineering



The most outstanding high school graduates in Michigan are now seeking admission to the College.

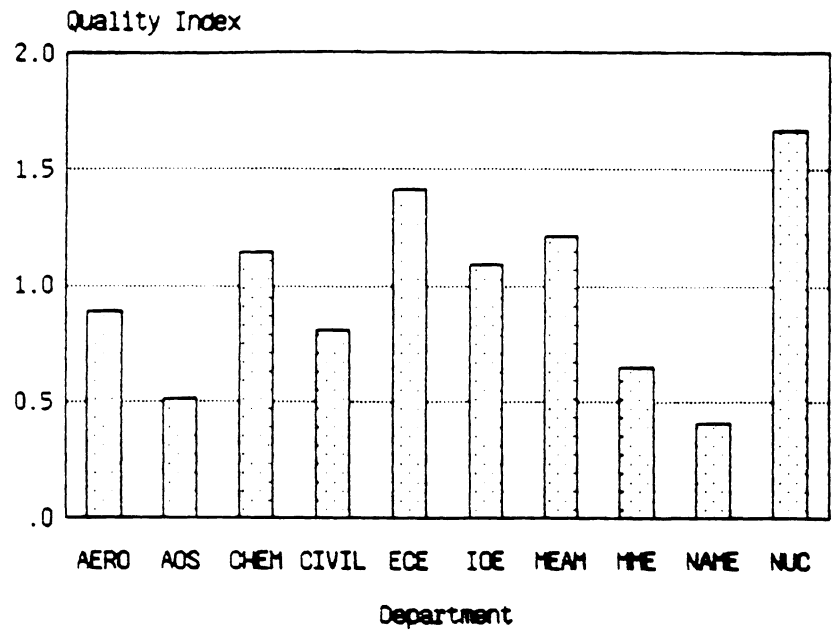
Rackham Quality Factor

(Division II 60% Cut Point)



Unit

Rackham Graduate Student Quality Index



The quality of graduate students enrolled in the College is comparable to other Rackham Division II units (e.g., Mathematics, Physics, Chemistry).

STAFFING TRENDS

3

Instructional Loads

INSTRUCTIONAL LOAD

FIGURES:

- Student Credit Hour Production
- Fiscal Year Equated Students (FYES)
- Instructional FTEs (Faculty + GTAs)
- FYES/FTE Trends

COMMENTS:

1. Student credit hour and FYES production continue to increase at all levels.

2. General Fund budgeted instructional staff (FTE) continues to drop at an alarming rate due to seriously inadequate funding (-32 FTE over the past decade). Both national accreditation models and the State Formula Funding model (Owen-Huffman) suggest the College has less than one-half the level of FTE instructional staffing required to meet its present enrollments.

3. The combination of rising FYES levels and declining instructional FTEs in recent years has led to an all-time high in FYES/FTE of 18.1 -- once again roughly twice the national goal of 8 proposed both by the Accreditation Board of Engineering and Technology and the National Academy of Engineering.

5. The College's instructional load is now higher than even LS&A -- despite the fact that most of the College's instruction occurs at the upper class and graduate levels and involves extensive laboratory and design coursework and the use of GTAs is at a minimum (due to inadequate flexible staff funding).

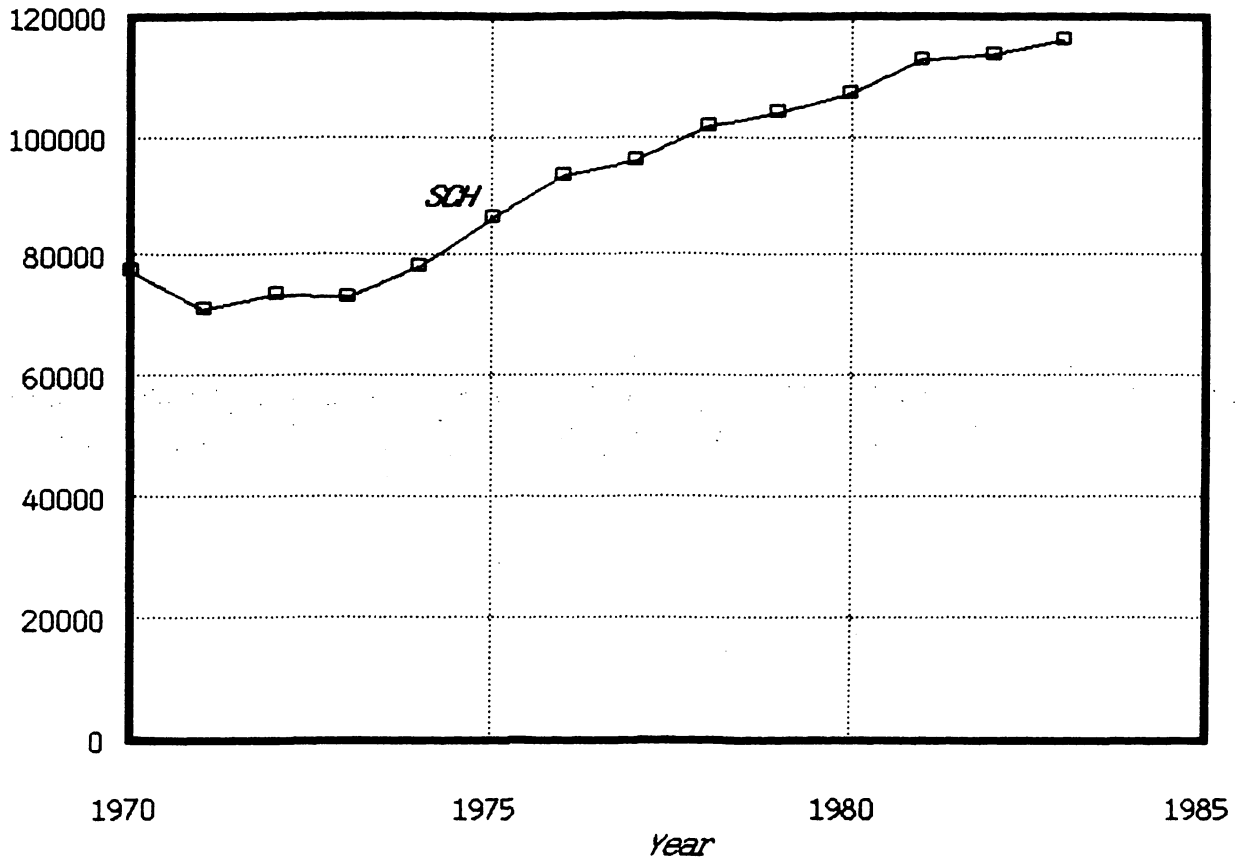
6. Due to inadequate General Fund support, the College is now being forced to fund a substantial component of its flexible instructional staff from discretionary funds (private support, research offset) -- at a level far below its actual needs.

7. The inability of the University to provide an adequate level of General Fund support for the College's instructional programs continues to be one of the most serious problems faced by the College.

8. Such a persistent, unacknowledged degree of understaffing is both unique and unprecedented among the schools and colleges of this University.

Student Credit Hour Production

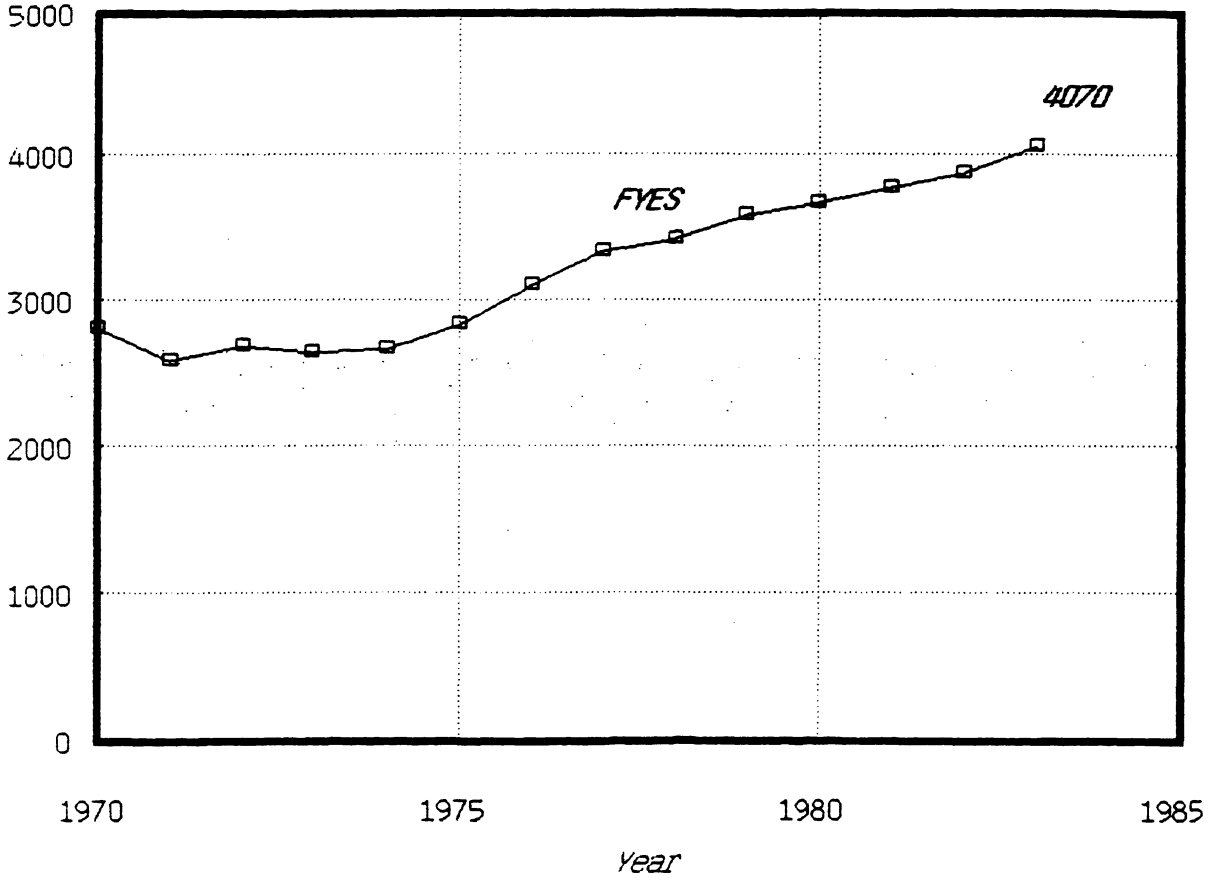
College of Engineering



Student credit hour production in the College continues to increase (with primary growth at the upperclass and graduate level).

Fiscal Year Equated Students (FYES)

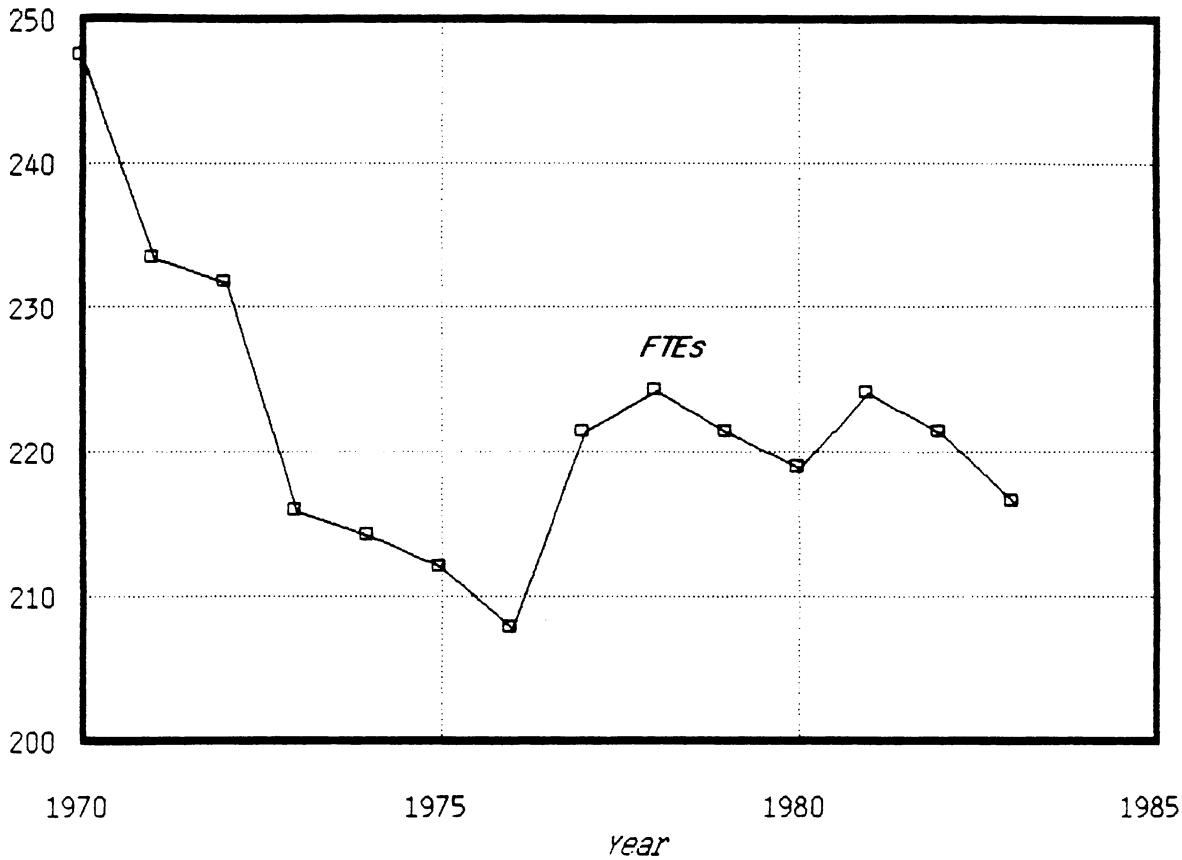
College of Engineering



College FYES levels have reached an all-time high

FTE Instructional Staff (Faculty + TAs)

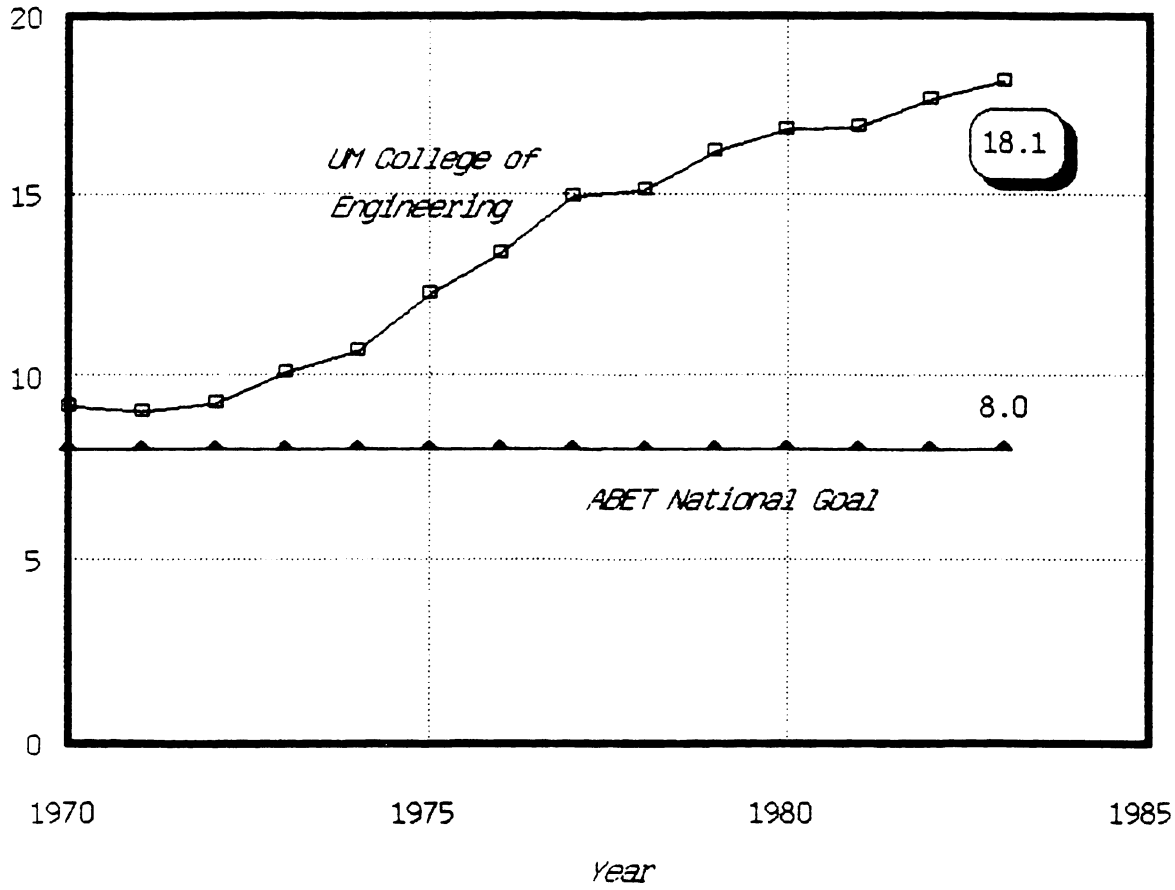
College of Engineering



Inadequate General Fund support has led to a steady decline in College instructional FTEs over the past several years, despite staggering instructional overloads and steady enrollment growth.

FYES/FTE

College of Engineering



College instructional load (FYES/FTE) is now roughly twice that recommended by State and national guidelines.

Faculty Attrition and Hiring

FACULTY ATTRITION AND HIRING

FIGURES:

- Projected and Actual Faculty Retirements
- Faculty Attrition
- A Roster of New Faculty

COMMENTS:

1. The College is now well into the first wave of retirement of senior faculty, with a sharp decline occurring in the number of full professors, well in advance of that occurring in other UM units.

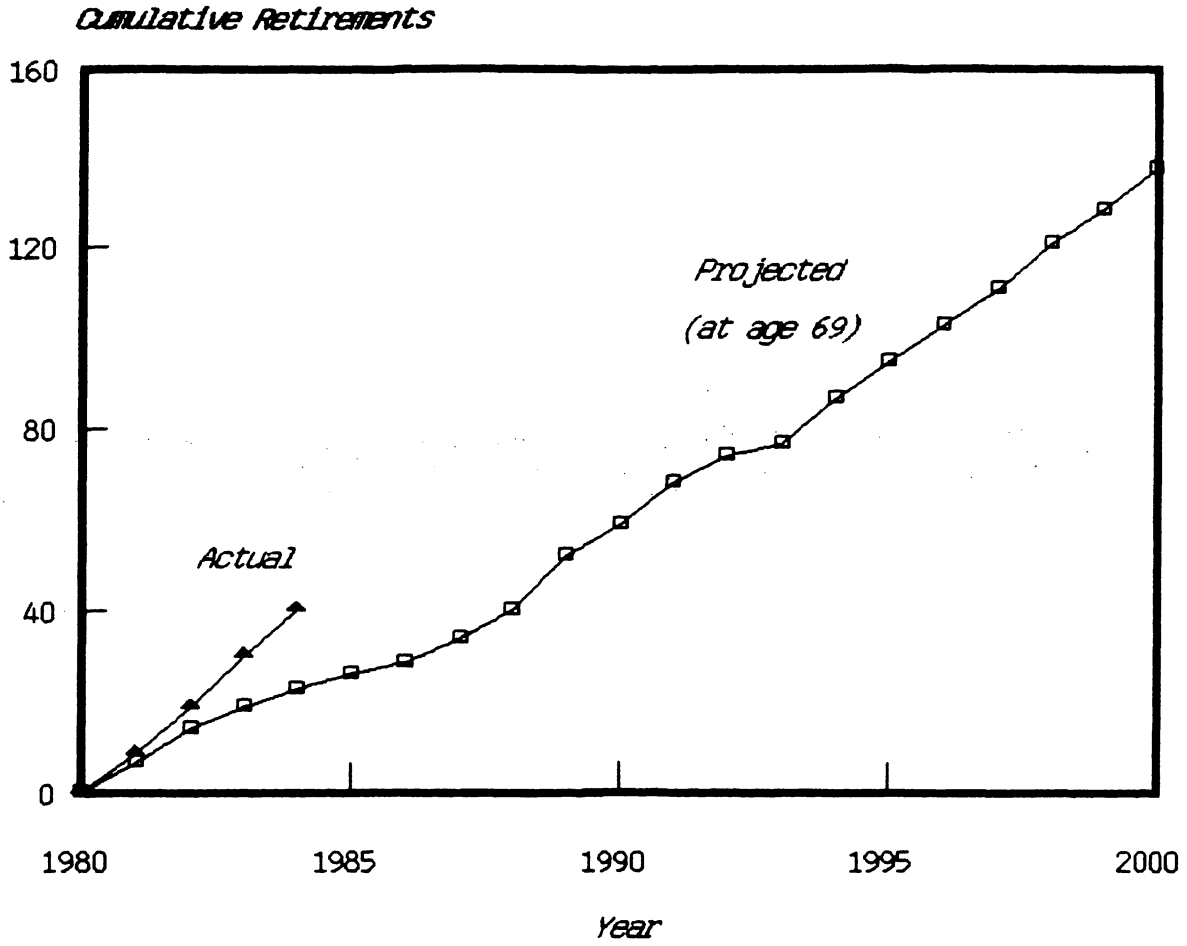
2. An aggressive merit salary program, coupled with flexible and responsive early retirement policy, has led to a retirement rate roughly double that expected from age distributions alone.

3. The College has broken from its policy of the 1970s (restricting new hires to the assistant professor levels) and now recruits faculty at all levels (including endowed chairs).

4. The quality of new faculty added to the College during the past two years has been extraordinarily high. These new faculty members have already had a major impact on the College's programs.

Projected Faculty Retirements

College of Engineering



An aggressive merit salary program coupled with a responsive approach to early retirements has led to a retirement rate double that expected from faculty age distributions.

FACULTY ATTRITION (1982-84)

MANDATORY RETIREMENT:
- Ayers (AOS)
- Sinnott (Chem)
- D'Archangelo (NAME)
- Lesher (Aero)
- Lyon (ECE)

EARLY RETIREMENT
- Berg (Civil)
- Kikuchi (Nuclear)
- Benford (NAME)
- Alvord (MEAM)
- Wilson (IOE)
- Leslie (MME)
- H. Smith (MEAM)
- Kazda (ECE)
- Holcombe (Hum)
- Ross (Hum)
- J. Powers (ChE)

OTHER (RESIGNATION AND NONREAPPOINTMENT)
- MacGowan (Hum)
- Hucken (Hum)
- Zappen (Hum)
- Mattes (ECE/MME)
- Boydstun (IOE)
- Kostyniuk (Civil)
- Hilliard (MEAM)
- Latorre (NAME)
- Ganapathy (ECE)
- Segal (Hum)
- Devries (MEAM)
- Swearingen (Hum)
- Hand (ChE)
- Blakey (ECE)

OTHER (DEATHS)
- Martin (ChE)
- Low (MEAM)

LOSS TO OTHER INSTITUTIONS
- Springer (MEAM)
- Stedman (AOS)
- Peterson (ECE)

PROBABLE ATTRITION IN 1984-85
- Mandatory Retirements: Tai
- Early Retirements: Kazda, H. Smith, Wilson, Leslie, ?

PROBABLE ATTRITION IN 1985-86
- Early Retirements: Evaldson, Hammitt, Richart, Weil, ?

NEW FACULTY

NAME	RANK	DEPARTMENT	PhD (PREVIOUS POSITION)
L. Bernal	aP	Aerospace	Caltech
J. Smith	P	Aerospace	Caltech (ONR)
P. Kabamba	aP	Aerospace	Columbia (Belguim)
C. Kravaris	aP	Chemical	Caltech
R. Ziff	aP	Chemical	Rockefeller
W. Hansen	aP	Civil	Illinois
A. Naaman	P	Civil	MIT (U Illinois)
R. Kapuscinski	aP	Civil	Harvard (U Vermont)
J. Hayes	P	Computer	Illinois (USC)
R. Jain	AP	Computer	ITI (India)
D. Smith	aP	Computer	Cornell
M. Wesley	P	Computer	Cambridge (IBM)
R. Alferness	AP	Electrical	Michigan (Bell Labs)
P. Bhattacharya	AP	Electrical	Sheffield (Oregon St U)
J. Breitenbach	aP	Electrical	UCLA
M. Elta	aP	Electrical	Michigan (Lincoln Labs)
G. Hansell	aP	Electrical	MIT
K. Shin	AP	Electrical	Cornell (RPI)
W. Stark	aP	Electrical	Illinois
D. Kelton	aP	Industrial	UCLA
M. Keyserling	aP	Industrial	Michigan (Harvard)
J. Liker	aP	Industrial	Cornell (U Mass)
C. Yano	aP	Industrial	Stanford (Bell Labs)
R. Gibala	P	Mat-Met	Case
J. Wallace	aP	Materials	Stuttgart
E. Kannatey-Asibu	aP	Mechanical	UC-Berkeley
A. Schultz	P	Mechanical	Yale (U. Illinois)
S. Slezak	aP	Mechanical	Illinois
J. Stein	aP	Mechanical	MIT
I. Beier	AP	Naval	Berlin
J. Dillingham	aP	Naval	UC-Berkley
A. Perakis	aP	Naval	MIT
D. Wehe	aP	Nuclear	Michigan (Oak Ridge)

INTELLECTUAL THRUSTS

4

Basic Philosophy

OBJECTIVES

- Excellence in education, research, and service
- Stress quality over breadth and capacity
- Focus resources to achieve leadership in selected areas
- Goal: To be the best in what we choose to do!

STRATEGY

- To build "essential singularities" of excellence!
- To identify those areas in which we have the capacity, the potential, or the mission to become the best, and then to focus resources to build and strengthen these areas.

Key Thrust Areas

PROGRAMS OF THE COLLEGE

SOME FIRSTS OF THE COLLEGE:

Metallurgical Engineering (1854)
Naval Architecture (1881)
Chemical Engineering (1901)
Aeronautical Engineering (1916)
Nuclear Engineering (1953)
Computer Engineering (1965)

DEPARTMENTS AND PROGRAMS:

Aerospace Engineering
Applied Mechanics
Atmospheric Sciences
Bioengineering
Chemical Engineering
Civil Engineering
Construction Engineering
Computer Engineering
Computer Science
Electrical Engineering
Engineering Physics
Industrial and Operations Engineering
Manufacturing Engineering
Marine Engineering
Materials Science and Engineering
Mechanical Engineering
Metallurgical Engineering
Naval Architecture
Nuclear Engineering
Oceanic Sciences

RESEARCH LABORATORIES, CENTERS, AND INSTITUTES

MAJOR RESEARCH UNITS

Automotive Laboratory
Center for Catalysis and Surface Science*
Center for Ergonomics
Center for Robotics and Integrated Manufacturing
Computer Aided Engineering Network
Computing Research Laboratory
Gas Dynamics Laboratory
Great Lakes Research and Marine Waters Institute*
Laser-Plasma Interaction Laboratory
Macromolecular Reserach Center*
Rehabilitation Engineering Center
Phoenix Memorial Laboratory*
Solid State Electronics Laboratory
Space Physics Research Laboratory
Ship Hydrodynamics Laboratory
UM Transportation Reseach Institute*
Water Resources Laboratory

RESEARCH UNITS UNDER DEVELOPMENT:

Center for Applied Optics
Center for Scientific Computation*
Materials Processing Research Institute*
(NSF Materials Research Laboratory*)

*Intercollege activity

RESEARCH AREAS OF POSSIBLE MAJOR THRUST

TRADITION OF NATIONAL LEADERSHIP:

- Applied Optics
- Aerospace Engineering
- Atmospheric Sciences
- Construction Engineering
- Image Processing
- Industrial Engineering (ergonomics, operations research)
- Naval Architecture
- Nuclear Engineering
- Solid State Electronics (sensors, microwave devices)
- Thermal Sciences

MISSION FOR NATIONAL LEADERSHIP:

- Integrated Manufacturing
- Materials Processing (metals, composites, polymers)
- Computer Science and Engineeering

POTENTIAL FOR NATIONAL LEADERSHIP:

- Advanced Scientific Computation (supercomputers)
- Biotechnology (particularly biomedical)
- Industrial Automation
- Opto-electronics (integrated optics)

KEY INTERDISCIPLINARY THRUST AREAS

Engineering and LSA:

Computer Science and Engineering (CCS + ECE --> EECS)
Applied Physics (Physics, Nuclear, ECE, MEAM)
Materials Research (Physics, Chemistry, MME, ChE)
Numerical Analysis and Scientific Computation (Eng, Math)
Earth and Planetary Sciences (Geo Sci, A&OS)
Biotechnology (Bio Sci, Chem, ChE, ECE)

Engineering and Medicine:

Biotechnology (Med, ChE, ECE)
Image Processing (Med, ECE, Nuclear, MEAM)
Biomechanics (Med, MEAM)

Other Interactions:

Ergonomics (Eng, Pub Health, Med)
Biochemistry (Eng, Phar, Med)
Computer Networks (Eng, LSA, Bus Ad, Med)
Transportation (Eng, Pub Health, UMTRI)
Water Sciences (Eng, LSA, Pub Health, Nat Res, GRMLK)

Research Activity

RESEARCH ACTIVITY

FIGURES:

- Sponsored Research Funding Trends
- Proposal Activity
- Research Awards per Faculty Member

COMMENTS:

1. The heavy instructional loads on College faculty, coupled with the appalling deterioration in the research environment on campus, led to an actual decline in sponsored research funding in 1980 and 1981.

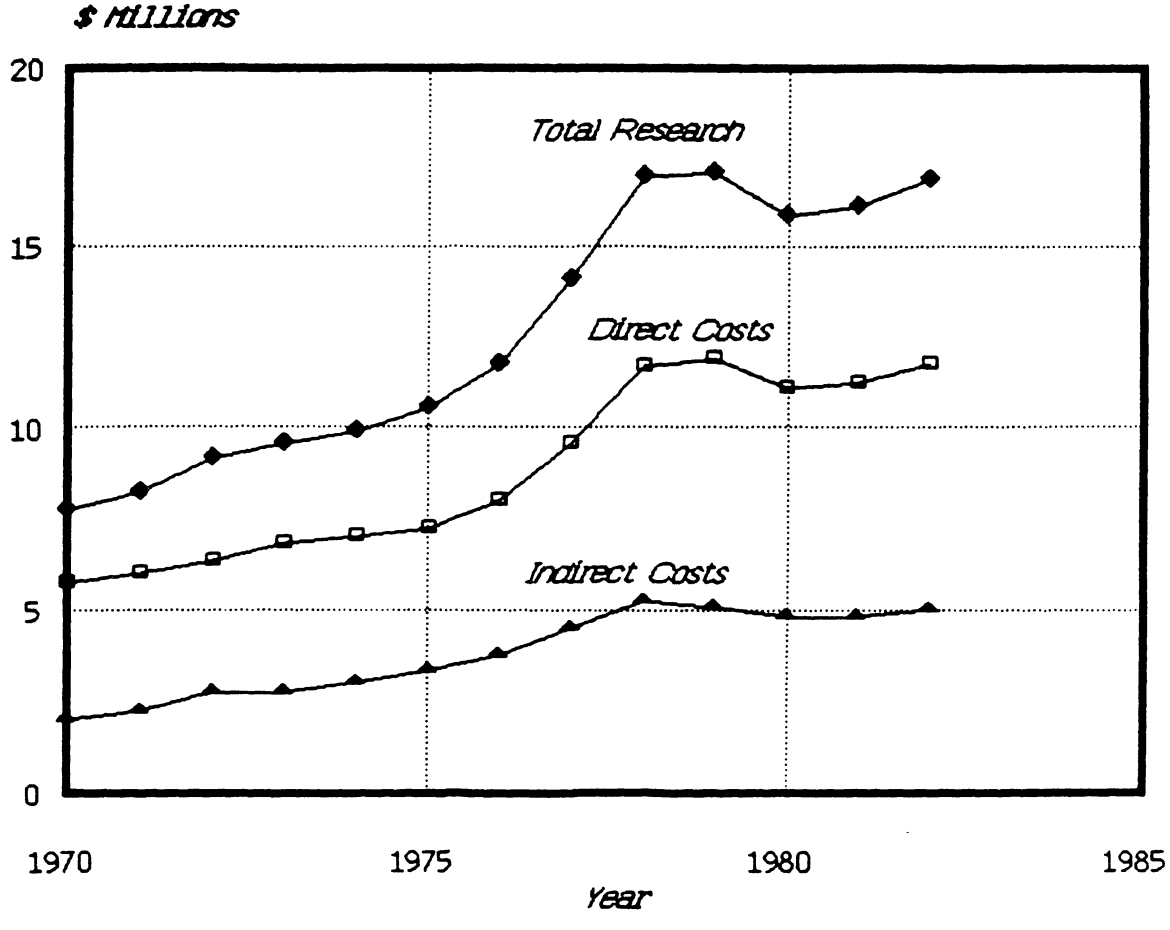
2. Aggressive research incentive programs coupled with strong encouragement and support of research activities has turned this around during 1982 and 1983.

3. Research awards for the College increased by 25% this past year.

4. Nevertheless, the serious instructional overload of College faculty is continuing to plague our efforts to build research activity.

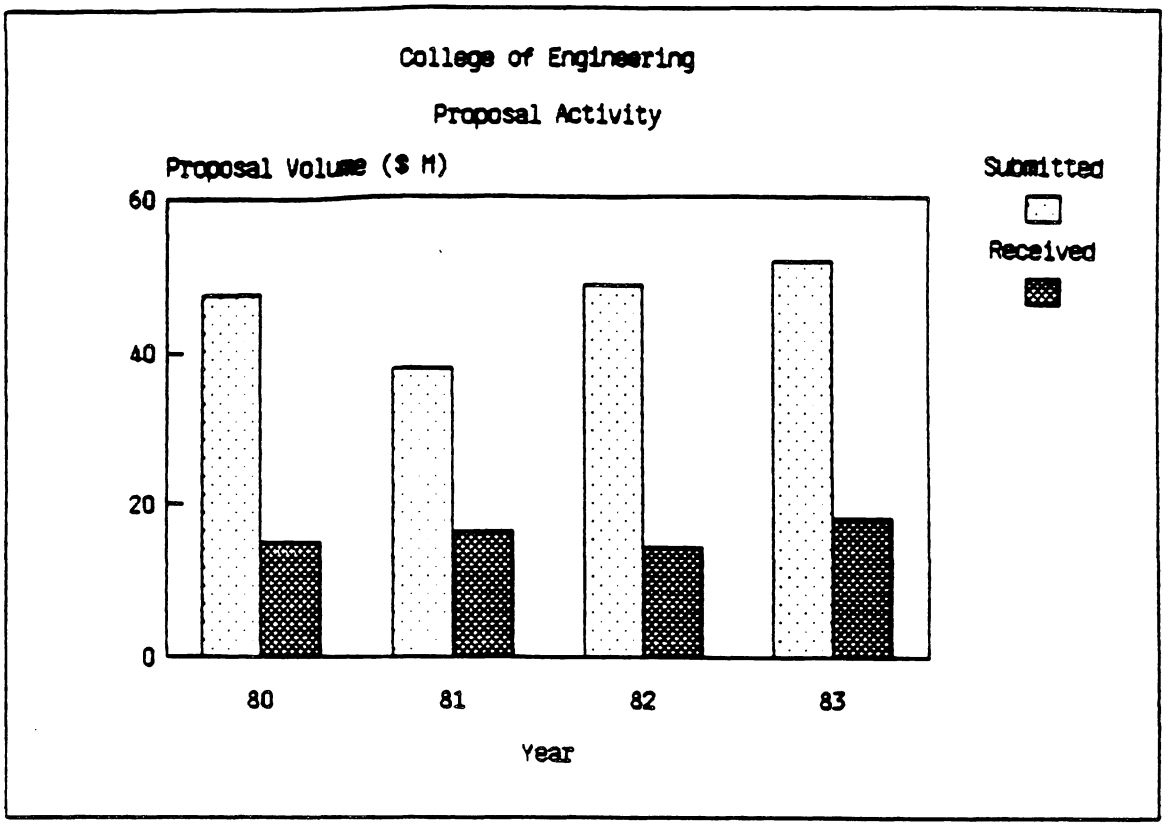
Sponsored Research Volume

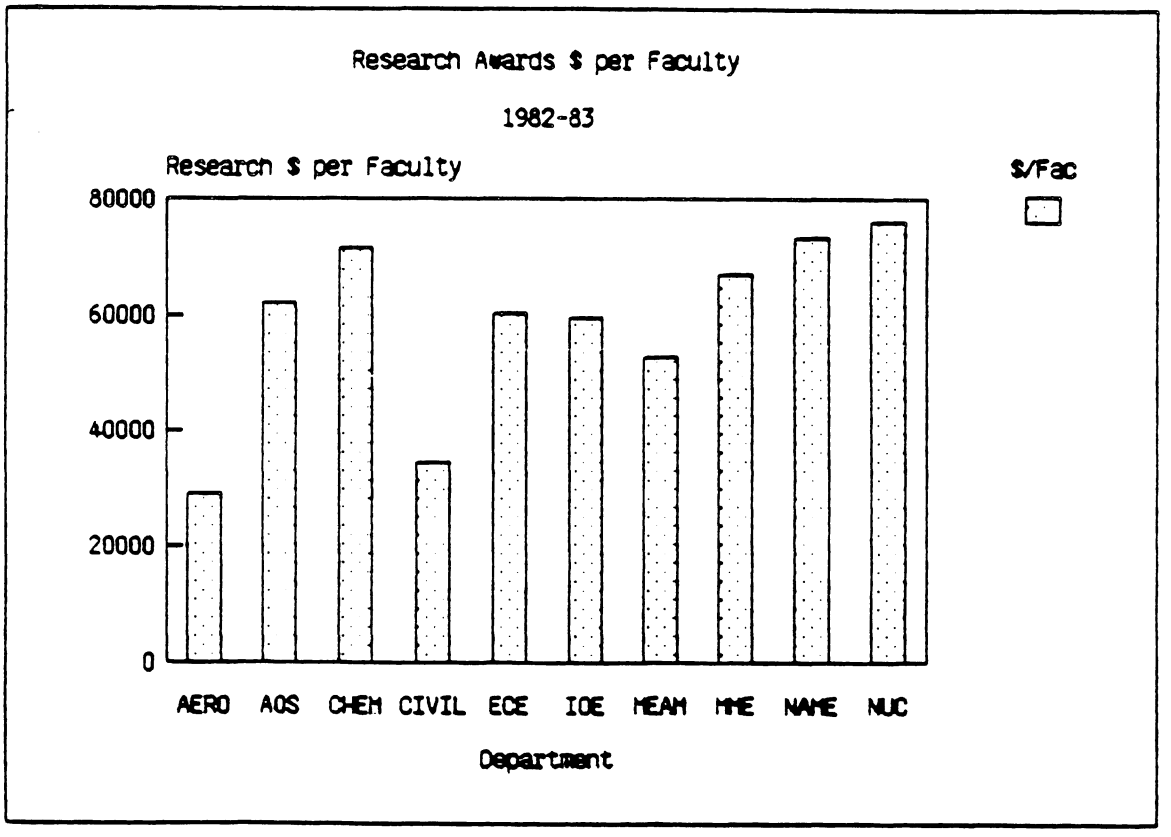
College of Engineering



Heavy instructional loads and deterioration in research environment on campus led to a decline in research funding in 1980-82.

Aggressive research incentive programs and strong administrative support have turned around the recent decline in sponsored research volume.





College proposal activity (both submission and success volume) increased by 25% this year.

Major Research Concerns
and
Action Requested

MAJOR RESEARCH CONCERNS AND ACTION REQUESTED

GENERAL ACTION REQUESTED:

Get the "Research Agenda" back on track!

SPECIFIC ACTIONS AND CONCERNS:

Department Administration:

Recent Federal Funding Accounting audits have confirmed what the College has been telling the University for years: The University has not been providing the General Fund support for "department administration" required by the indirect cost recovery rate negotiations. This is a serious matter since support of these activities through direct cost charges is a direct violation of federal contracts and could jeopardize future negotiations of indirect cost recovery rates.

It is essential that the University begin at once to fund through specific accounts for the support of department administration for major research units within academic units.

Research Incentives:

There is now general agreement among the faculty and deans that the University should move rapidly to provide strong incentives and support for sponsored research activities through allocation of General Fund resources in a manner indexed to research productivity (e.g., indirect cost recovery).

We would prefer that this allocation be provided through a redistribution of existing General Fund support (e.g., an amount corresponding to 35% of ICR presently allocated for cost-sharing, or subsidizing overrruns, disallowances, and underrecovery of indirect costs) since this would not incur any additional burden to the General Fund. However, if political factors prevent this, then new resources will required to fund the research incentive program.

Decentralizing Research Administration and Support:

The University should overhaul its present ad hoc approach to allocation of General Fund support for sponsored research. For example, academic units should be allocated funds on an equitable basis for cost-sharing, underrecovery of indirect costs, overruns and disallowances, and equipment and renovation, rather than allocating these funds on a case-by-case (first come, first serve) basis centrally.

Clarification of the Role of Nonacademic Research Units:

The University should clarify the role of research units which are independent of academic units (i.e., report to the Vice-President for Research rather that through an academic unit). In particular, the following areas should be clarified:

- The relevance of each such unit to the academic mission of the University.
- The degree to which such units should be allowed to compete with academic units for General Fund resources, physical facilities, and faculty effort.
- The degree to which such units impact (either positively or negatively) the research efforts of academic units.

BUDGET CHARACTERISTICS

5

A Decade of Neglect

A DECADE OF NEGLECT

FIGURES:

- Deterioration of General Fund Support of the College
- Decrease in CPI Adjusted General Fund Support per Student
- Cumulative Base Budget Cuts Sustained by the College

COMMENTS:

1. The decade of the 1970s saw a series of base budget cuts of the College's General Fund support at the same time its enrollments were increasing dramatically.

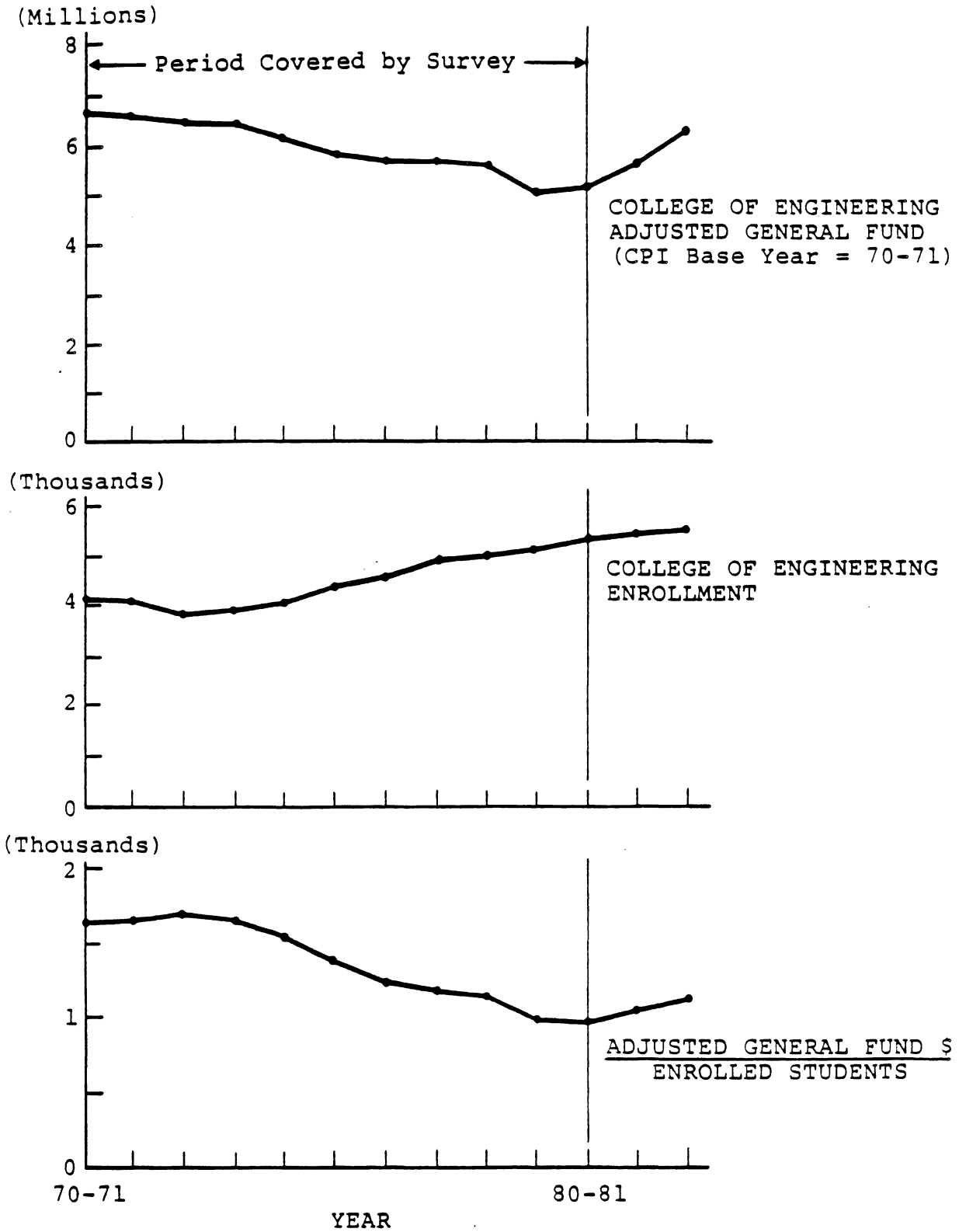
2. During the 1970s, the effective General Fund support per engineering student was methodically cut in half!

3. Despite recent efforts, the University has been able to provide only modest restoration of the budget cuts experienced by the College during the 1970s (in part because it insists on cutting the College's budget still further even as it attempts to restore it...)

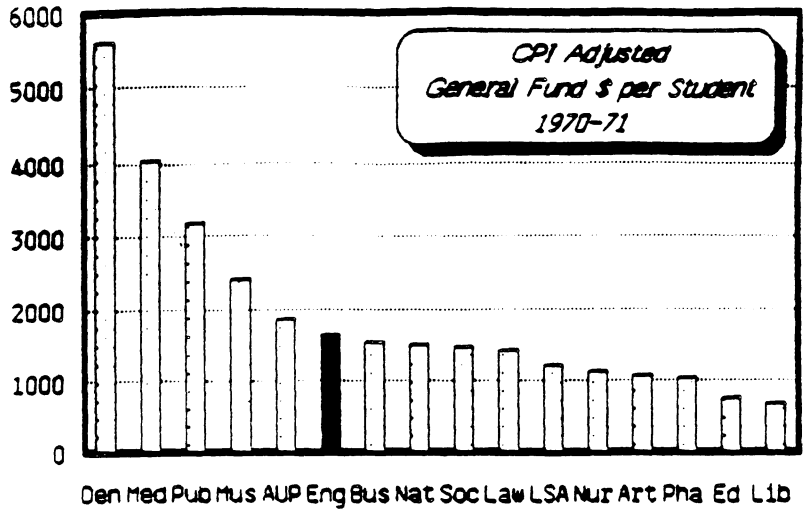
4. The College of Engineering remains the most seriously underfunded unit on this campus -- and, almost certainly, in any public institution in this State.

5. Despite best efforts, the University has been unable to find the College's State support. It remains, in effect, a privately-funded institution, forced to support its programs entirely from tuition revenue, sponsored research support, and private gifts.

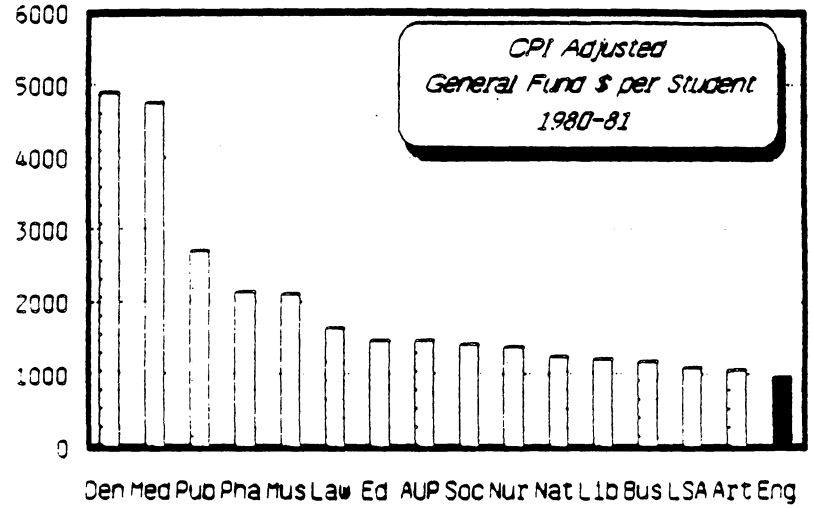
6. The impact of this neglect -- and the inability to deal with it on a timely basis -- has been devastating -- to the University, the State, and the nation. The College today continues to find itself struggling to meet the intense demand from the best of Michigan's high school graduates -- and the employers seeking talented, broadly-educated engineers -- in the face of inadequate funding, decaying physical facilities, obsolete equipment, and a badly overloaded faculty.



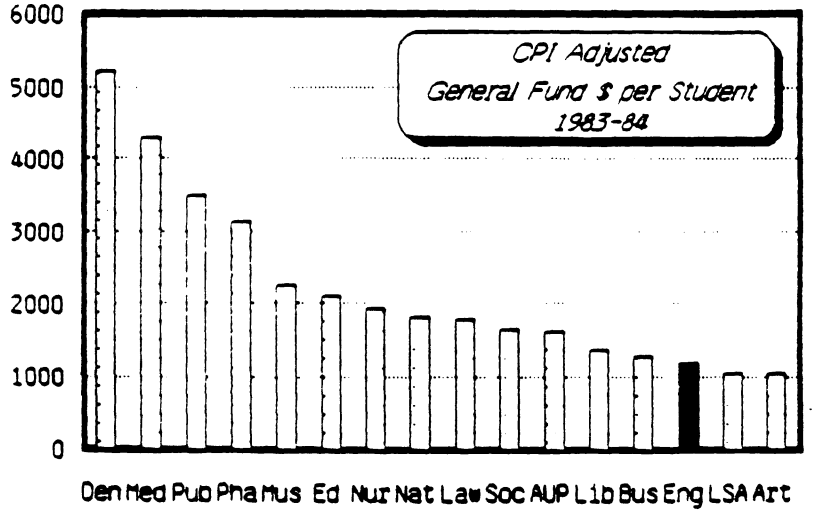
During the 1970s, the effective (CPI-adjusted) General Fund support per engineering student was cut in half!



During the 1970s, the General Fund support of Engineering students was methodically reduced to the lowest level of any UM school or college.

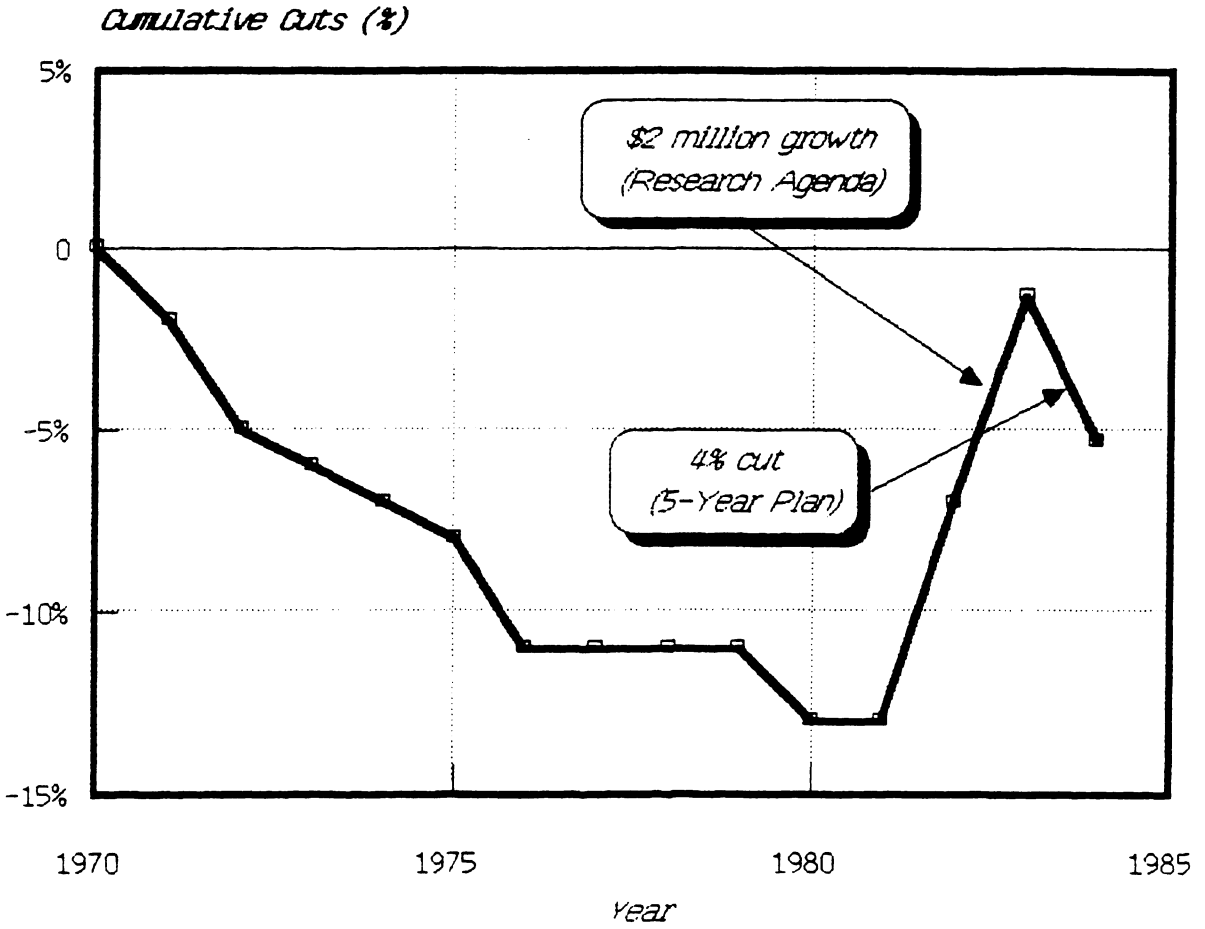


Despite recent efforts to deal with this problem, the University has been unable to restore an adequate level of General Fund support for the College.



Cumulative Base Budget Cuts

College of Engineering



Over the 1970s the College's General Fund budget was methodically cut relative to other units. The Five-Year Plan has continued this disturbing trend of the past 15 years with further cuts which cancel attempts to restore an adequate level of General Fund support.

Comparative Budget History

COMPARATIVE BUDGET HISTORY

FIGURES:

- Change in CPI-Adjusted General Fund Support (1970-1983)
- CPI-Adjusted General Fund Support by Discipline
- Annual Growth Rate in General Fund $ per SCH
- Annual Growth Rate in General Fund $ per Student
- General Fund $ per SCH
- General Fund $ per Student

COMMENTS:

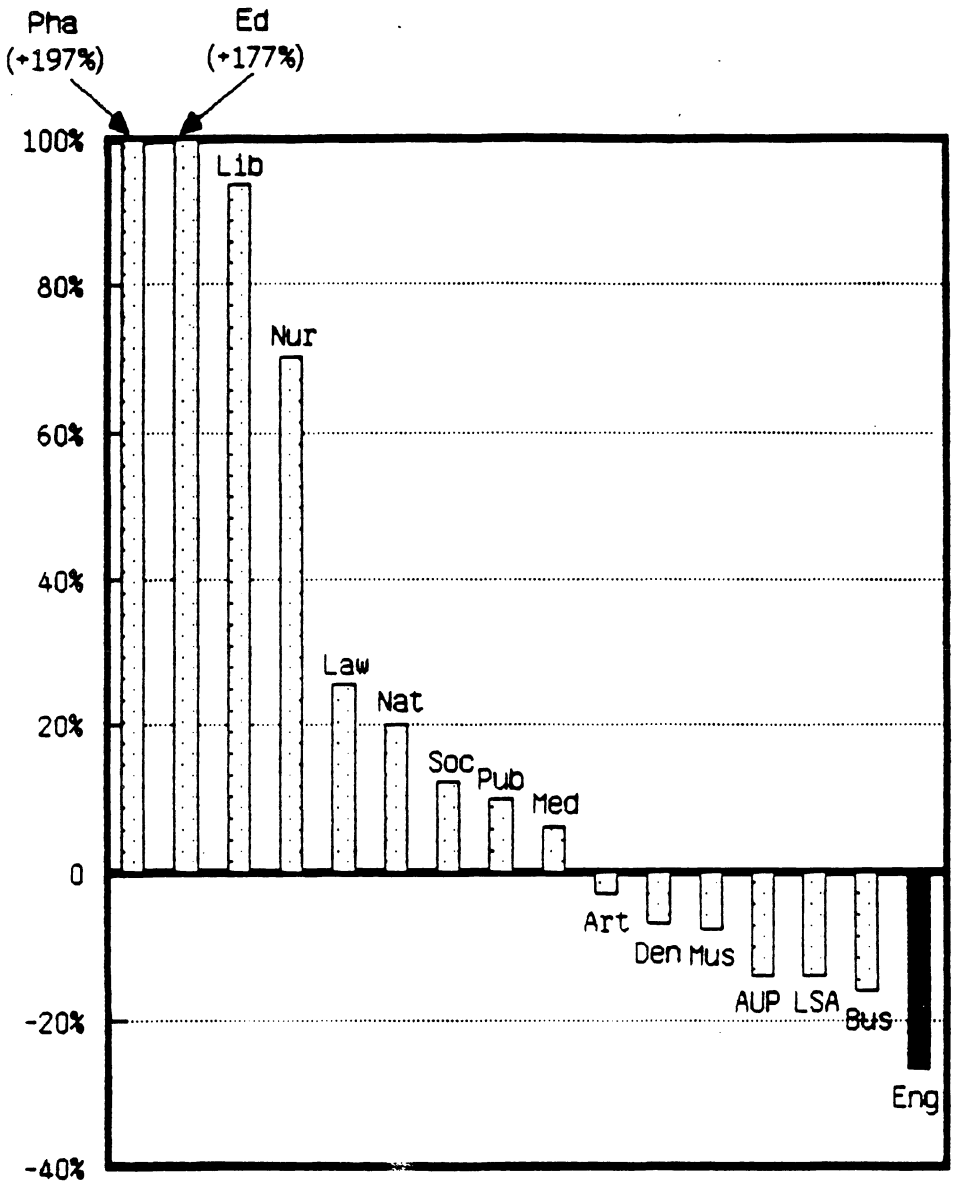
1. The annual growth rate in General Fund $/SCH during the decade of the 1970s was essentially nonexistent -- only 0.11%, compared to a University-wide average of 7% and a Consumers Price Index of 8.6%. Despite some effort to restore General Fund support of the College during the past three years, the College still ranks at the bottom of all University schools and colleges, with an annual growth rate of 3.9% for the period 1973 - 1983.

2. The same trends appear when comparing the annual growth rate in General Fund $ per enrolled student, where the College again continues to be last among all schools and colleges. It should be noted, by way of comparsion, that those units experiencing most growth (aside from units such as Pharmacy and Nursing which intentionally have reduced undergraduate enrollments) are Education and Natural Resources -- units recently under review.

3. The same pattern appears once again when comparing an instantaneous snapshot of General Fund support per SCH or enrolled student. It is a bit mystifying why Engineering, a unit focussing on upperclass and graduate education with extensive laboratory and design seminar requirements, should continue to be funded at levels below units such as Education, Music, Natural Resources, Law, Social Work, and Library Science.

4. These comparative data suggest the College of Engineering (and its students and faculty) continues to lose ground in General Fund allocations relative to other University units -- despite the Five-Year Reallocation Plan.

Change in CPI-Adjusted General Fund $ per Student 1970 - 1983

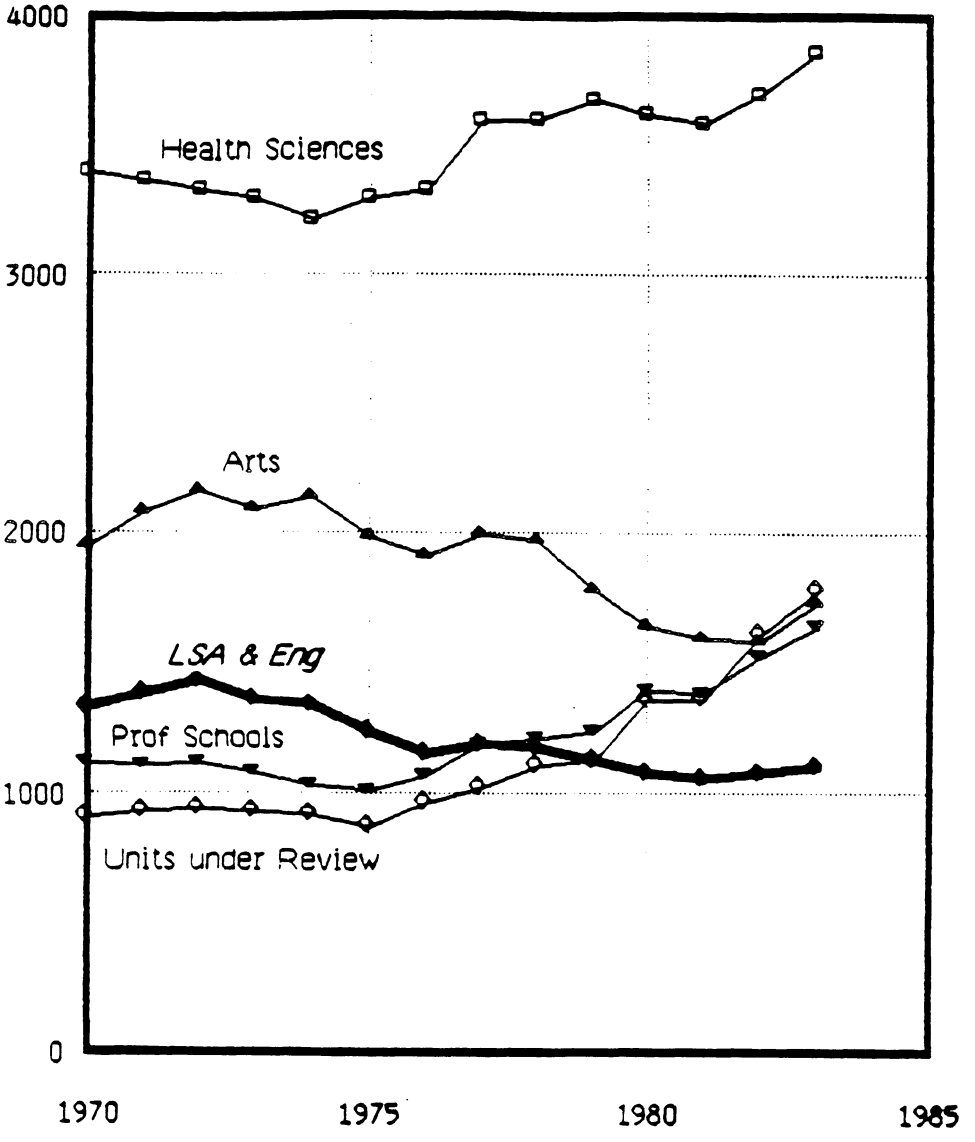


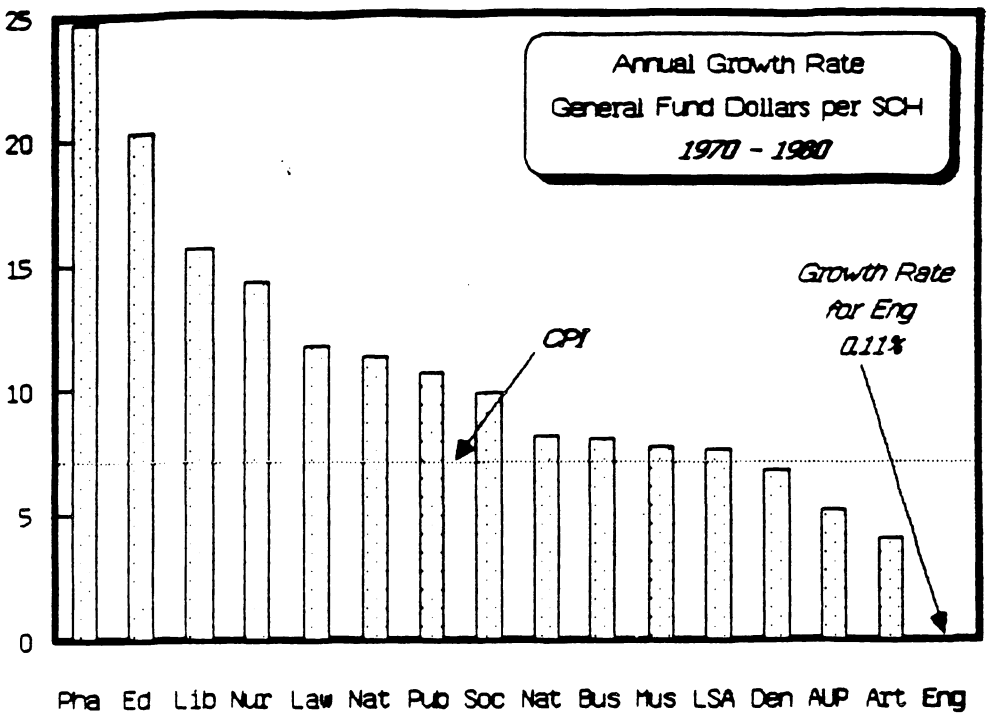
Comparative data clearly indicate that the College of Engineering has borne the brunt of the University's loss of State support over the past 14 years.

This discrimination in the support of Engineering students is particularly disturbing since, by any measure, they are most outstanding students enrolled at this University.

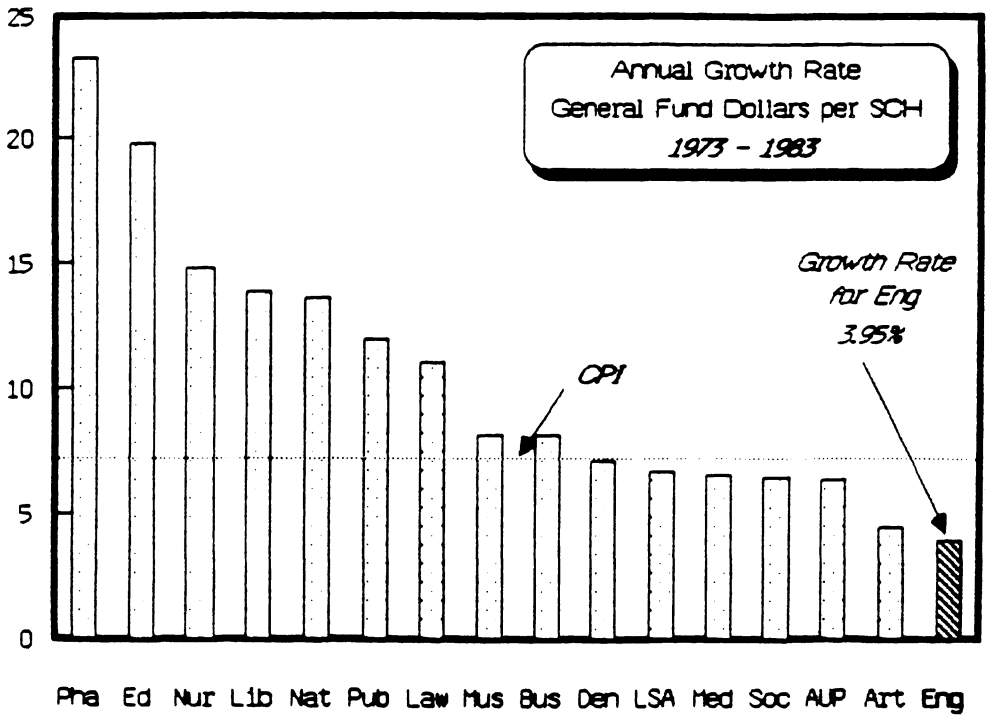
CPI Adjusted General Fund per Student

(Groups of Schools by Discipline)

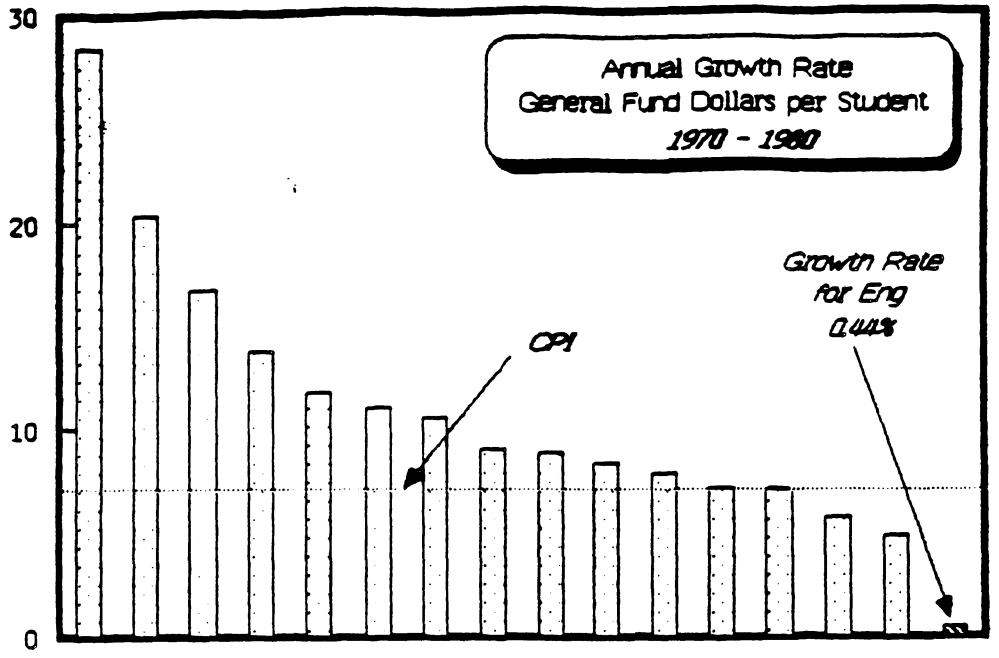


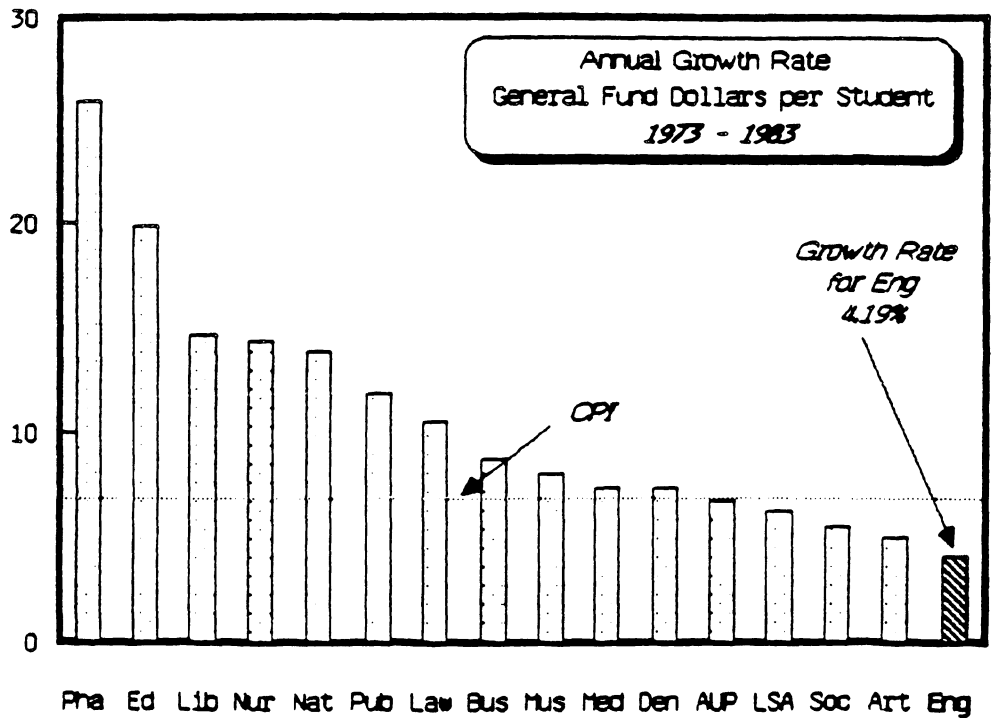


During the 1970s, the College's annual growth rate in GF$/SCH was non-existent -- compared to a UM-wide average of 7% and CPI of 8.6%.

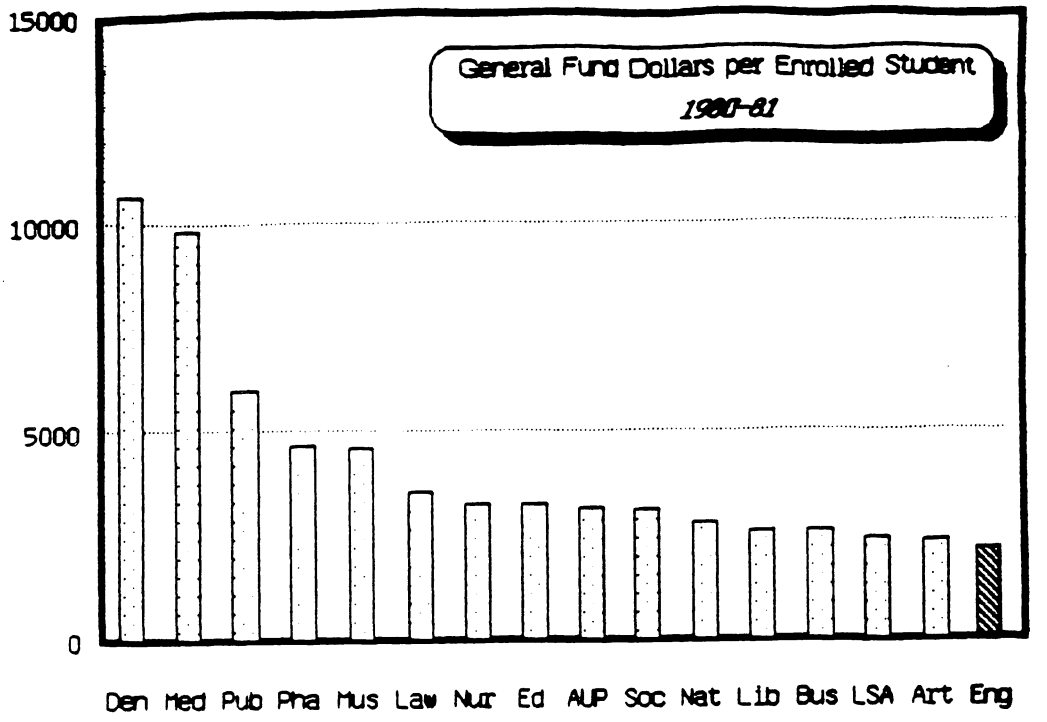


Despite recent efforts, the College still ranks at the bottom of all UM units in this important index.

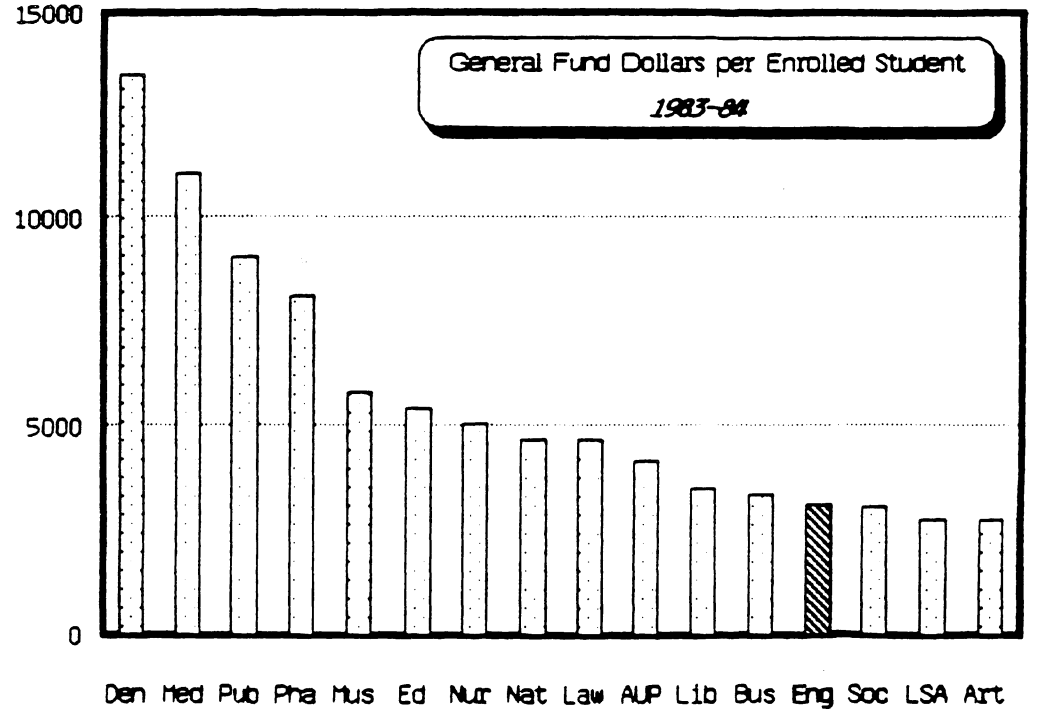




Comparison of annual growth rates in GF$/Enrolled Student again reveal the extent to which the General Fund support of the College was withdrawn during the 1970s -- and the limited degree to which this has been restored in recent years.

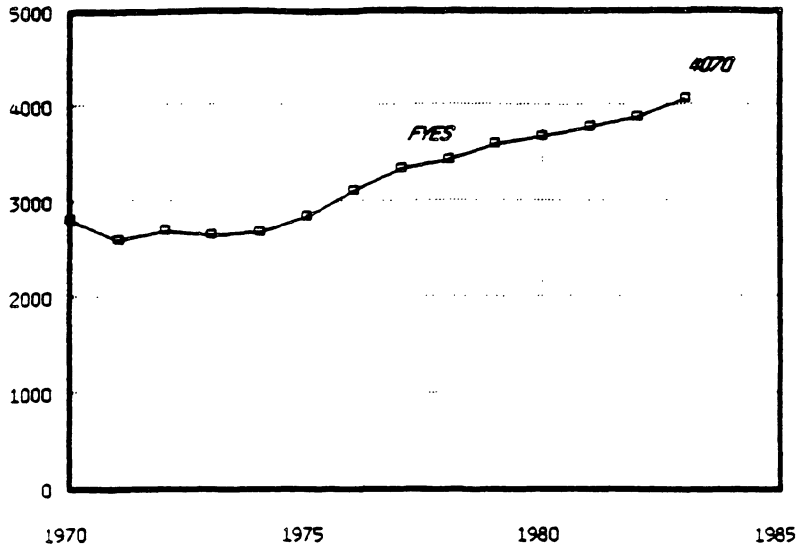


It is appalling to note that the General Fund support per student for Engineering declined to the lowest among all UM units in 1980.

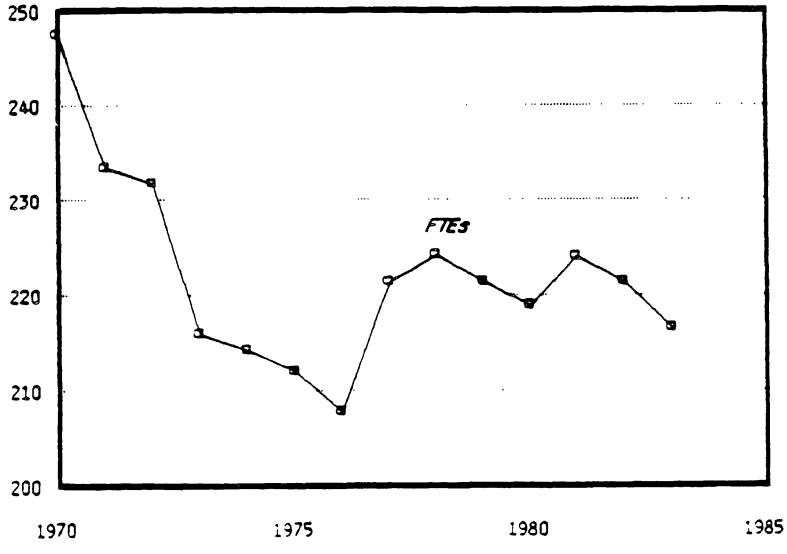


Today, despite efforts to restore some measure of General Fund support, the College continues to receive only about one-half of the level of support per student received by peer engineering institutions.

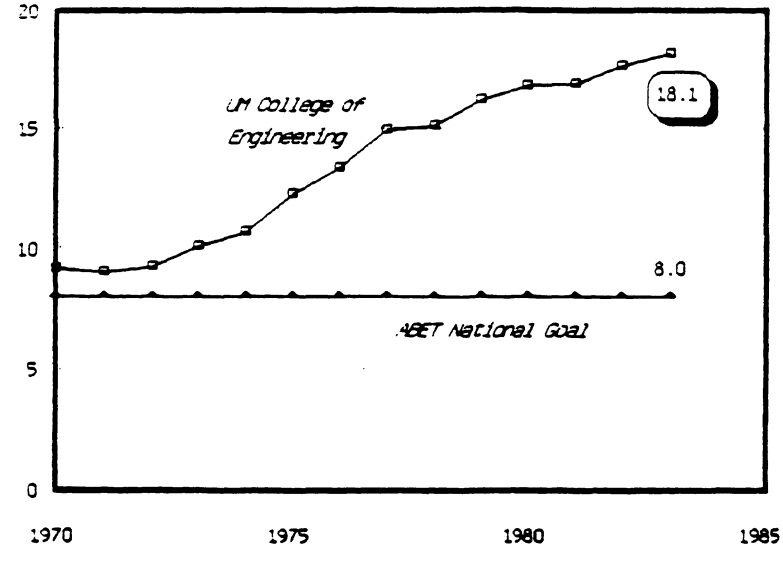
Fiscal Year Equated Students (FYES)



FTE Instructional Staff (Faculty + TAs)



FYES/FTE



FY1984-85
GENERAL FUND
BUDGET NEEDS

6

COLLEGE OF ENGINEERING
FY1984-85 BUDGET REQUEST

STATUS OF UNIVERSITY RESPONSE TO COLLEGE FIVE-YEAR PLAN

Roughly two years ago the College of Engineering developed what it regarded as a realistic and justified plan to restore an adequate level of General Fund support over a five-year period starting with the 1982-83 academic year. Throughout the past three years we have been quite consistent in our estimate of the degree of underfunding of the College -- the "Engineering Gap". In 1981-82 the Engineering Gap amounted to $6.93 million in base General Fund budget, exclusive of salary growth needs.

Unfortunately, inadequate levels of State support coupled with limited abilities to reallocate internally have hindered the University's ability to respond to this Five-Year Budget Plan. As a result, the actual budget growth provided to the College over the past three years has been quite modest:

FY82-83:	$1 million	Research agenda
FY83-84:	$1 million	Research agenda
FY84-85:	$400,000	Equipment support

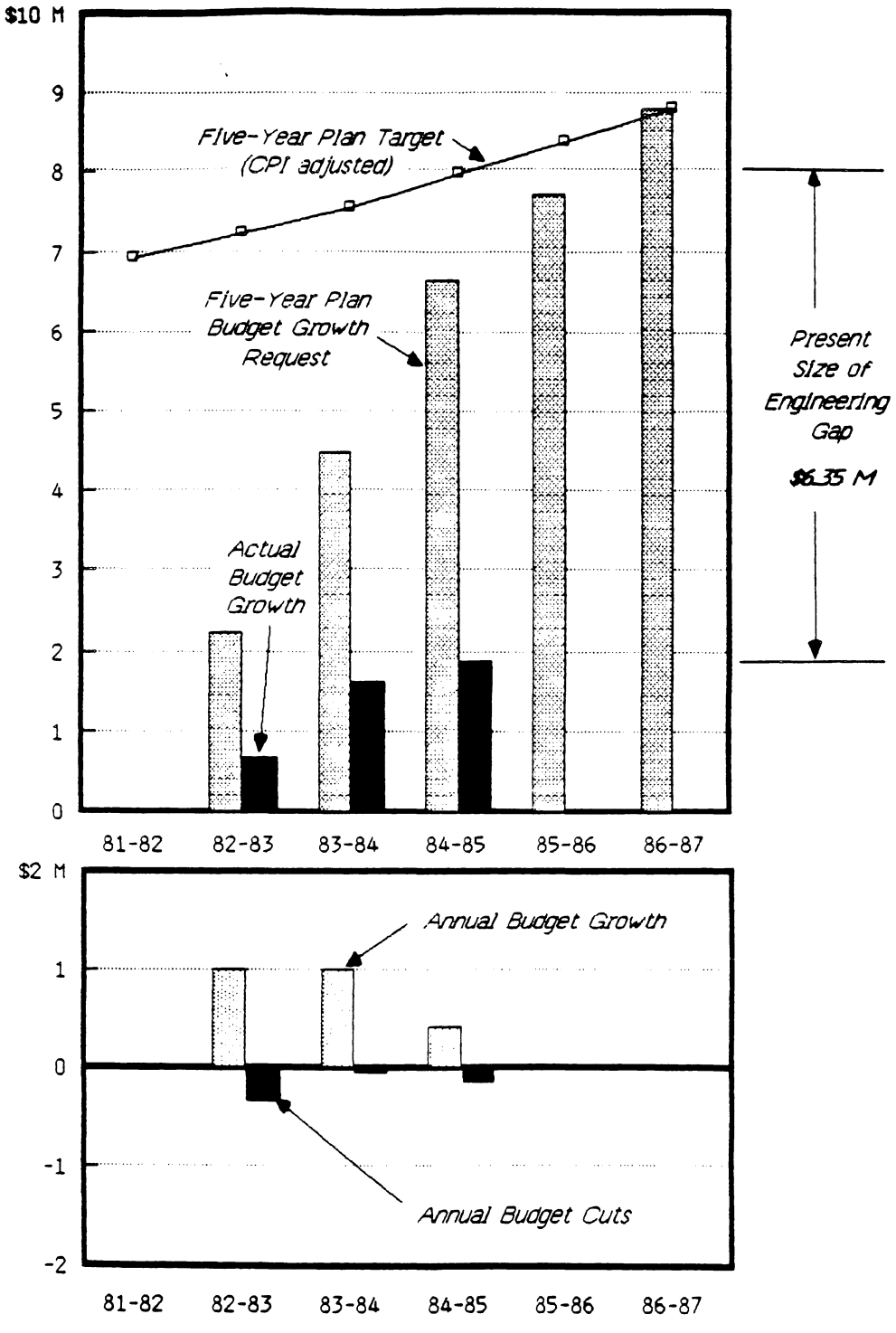
This growth excludes merit/market salary programs (common to all University units) as well as programs funded through special tuition assessments (i.e., the Student Computer Network).

This inadequate response has been aggravated by additional budget cuts. For what can only be regarded as political reasons, the University has required that the College, despite its status as the most seriously underfunded unit on this campus, be assessed major budget cuts as a full participant in the Five-Year Budget Reallocation Plan. These cuts have amounted to $530,604 over a three-year period.

Hence the net General Fund budget growth of the College -- taking into account the equipment commitment for FY84-85 -- has been only $1,869,000. A summary of the status of the University responseto the College of Engineering Five-Year Budget Restoration Plan is shown in an accompanying figure.

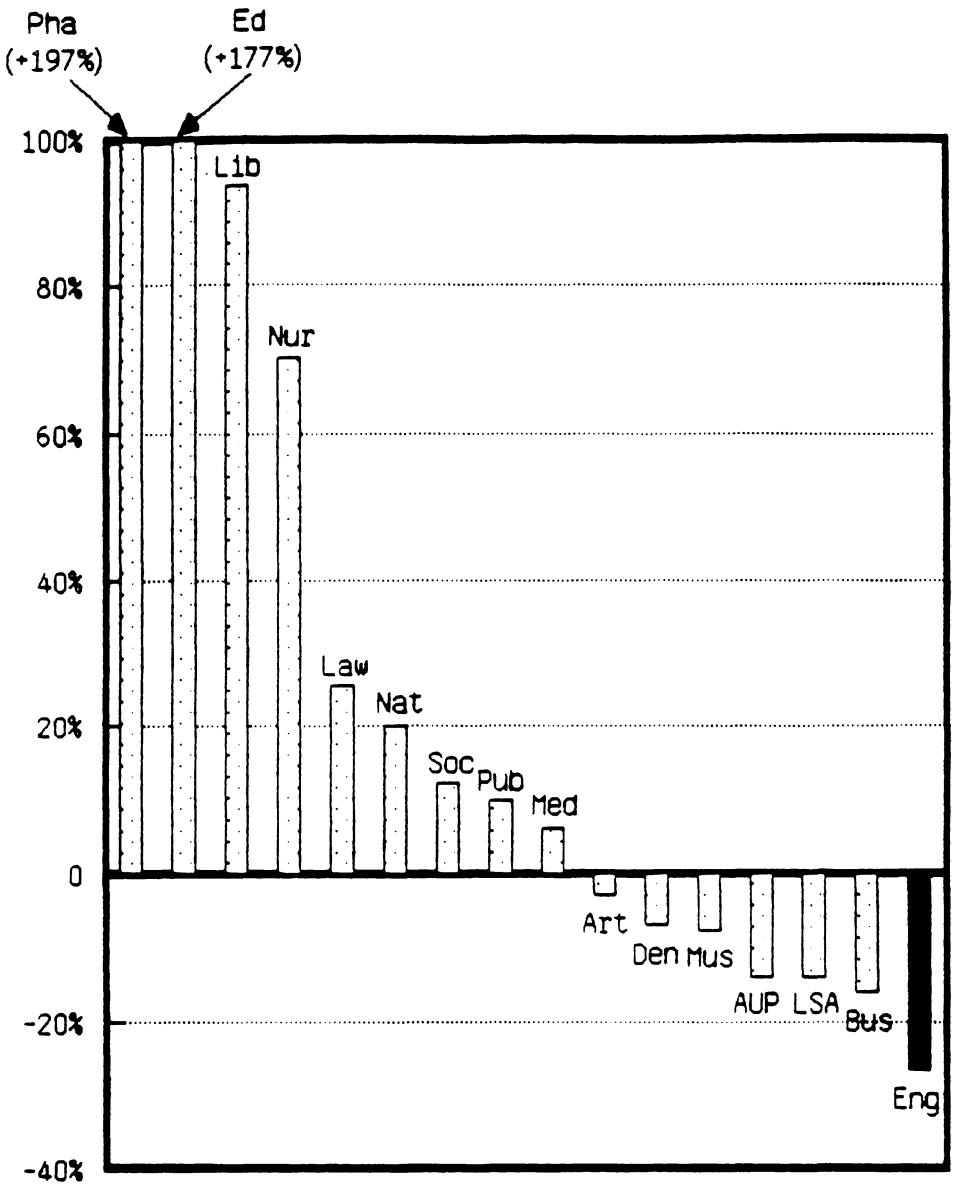
As a result, the College has now fallen $4.7 million behind its targeted budget growth, despite our best efforts to bridge wherever possible using discretionary funds derived from our private giving program. For the past three years we have been struggling just to stay above water in the face of mounting enrollments and unusual responsibilities both this State and the nation.

College of Engineering Five-Year Plan



Inadequate University response to the College of Engineering's urgent budget growth needs, coupled with still further budget cuts (4%), have thrown it far behind its Five-Year Budget Restoration Plan. The Engineering Gap is not being closed!

Change in CPI-Adjusted General Fund $ per Student 1970 - 1983



CONSEQUENCES OF AN INADEQUATE UNIVERSITY RESPONSE

The consequences of an inadequate University response to the urgent funding needs of the College have been quite serious. The "Engineering Gap" continues to seriously hinder our efforts to provide the quality of instruction and research expected of one of the leading engineering schools in the nation. Furthermore it has seriously jeopardized our ability to respond to the needs of this State and its citizens:

- The College presently enrolls the most outstanding students in this University -- by any measure. Indeed, the 5607 students in the College represent an extraordinary resource of this State. The talents of these students demand an engineering education of exceptional quality. Yet the University continues to respond to this situation with one of the lowest levels of General Fund support per enrolled student (FYES) of any unit in the University.

- Over the past three years the critical degree of underfunding of the College has compelled us to target the limited General Fund budget growth provided by the University to meet only our most urgent needs -- namely, those for competitive faculty salary programs and sponsored research support -- because of their importance in maintaining the quality of our faculty and attracting the external resources on which we have become so heavily dependent. Other critical needs such as equipment, instructional staff, and support staff have gone unmet.

- To meet the shortfall in our budget needs, the College has funded an increasing fraction of its administrative and instructional activities from discretionary resources (primarily income derived from our annual giving program -- gifts which should instead be preserved for student financial aid and other special needs).

- Despite continued growth in engineering enrollments, our instructional staffing has continued to decline. For example, during this past year the College,s instructional staff dropped once again to an all-time low of 213 FTEs. Models developed both by the State of Michigan and by the national Accreditation Board for Engineering and Technology suggest we are presently understaffed by roughly a factor of two. (These models suggest an instructional staffing requirement of of 435 FTEs for our present enrollment of 5,607 (4003 FYES).

- While it is true that over the past two years the faculty of the College of Engineering has become "smaller but better", it is also true that our enrollments have continued to increase -- particulary at the graduate level. Our students are plagued by overcrowed and closed-out classes, while the faculty is burden with a staggering instructional overloads. It is now clear that both the College and the University

must soon come to grips with the staggering degree of understaffing and equipment shortages which cripple our instructional programs.

- There seems general agreement at the local, State, and national level that the College must play a critical role in Michigan's industrial and economic development. In the face of such an instructional overload (which is roughly twice that of peer institutions), faculty of the College simply do not have the time to participate in external activities aimed at economic development (not to mention the development of major new research initiatives).

- Our attempts to rebuild the intensity, momentum, and quality the faculty, instructional programs, and research activities have been seriously damaged by an inadequate level of General Fund support.

The College of Engineering has been crippled in its efforts to respond to the intense demand of Michigan's most outstanding students for engineering educations, to meet its responsibilities to participate in rebuilding the economy of this State and nation, by inadequate support from this University. Indeed, it is extraordinary that the University has been unable -- or unwilling -- to mount a more aggressive effort to deal with the crippling degree of underfunding of the College in the face of these responsibilities, as have most other peer institutions.

The time to procrastinate has passed. The University must commit itself NOW to restore a level of General Fund support of the College which is not only equitable compared to other schools and colleges on this campus, but which furthermore is consistent with the unique opportunities and responsibilities which lie before the College.

SPECIFIC BASE BUDGET REQUESTS FOR FY1984-85

Flexible Instructional Staff: $1 million

The University must move rapidly to deal with the crippling instructional overloads of the College. It must restore to some degree the FTE losses the College was forced to sustain in recent years. As we have noted, the College managed to survive last year only by picking up substantial flexible instructional staff support through private gift funds. This cannot continue.

The urgency of this request cannot be overstressed. Even massive enrollments cuts cannot deal with this matter in the short term.

Technical Support Staff: $300,000

Budget cuts leveled against the College during the 1970s reduced technical support staff by a factor of two. We have attempted to rebuild support staffing, but inadequate General Fund budget growth during the past year has brought this effort to a halt. Just to honor present commitments will require a base budget increase of $300,000 for FY84-85.

Laboratory Equipment Support: $3.5 million

As a rule of thumb, an engineering college such as ours requires roughly $2,000 per graduate each year just to maintain its equipment inventory. This would imply that the College should have been budgeting $3.2 million each year for instructional equipment needs alone. Yet, throughout most of the 1970s, General Fund equipment support was less than $200,000 per year. As a result the College's inventory of equipment needs has now grown to over $30 million -- just to restore us to the level we had attained during the 1960s. In addition, the College will require roughly $40 million in computing equipment over the next five years.

Obviously these staggering equipment needs cannot be met by General Fund support alone. However without such support -- or special State initiatives -- we will not have the funds necessary to leverage equipment gifts from industry and the federal government.

The University must either commit major General Fund resources to address the urgent equipment needs of the College in FY84-85 or make a major commitment to work with the College to obtain special State appropriations for this purpose.

Department Administration of Sponsored Research: $800,000

Recent Federal Fund Accounting audits have confirmed the College's contention that the University has failed to fund the Department Administration of sponsored research, as claimed (and required) by indirect cost rate negotiations. The University must begin to line-item department administration of major research centers and laboratories within the College of Engineering effective with FY84-85.

Using an estimate of 24% of indirect cost recovery, this will amount to roughly $800,000 for FY84-85.

Research Incentives: $500,000

As we have indicated on numerous occasions, the College depends to an unusual degree on sponsored research support

from both government and industry to maintain the quality of its instructional and scholarly activities. Indeed, over 50% of our total operating budget (roughly $23 million) can be attributed directly to sponsored research or equipment grants. Yet during the 1970s we had been forced to cannibalize all of the funds necessary to stimulate and support sponsored research activities, to attract these external resources.

We have consistently maintained the need for a General Fund line item indexed to a level of roughly 15% of our total research volume to stimulate and support this activity. It was this reason that led us to make such a strong appeal to the University two years ago to obtain such support. It has also been for this reason that we have steadfastly resisted the temptation to reallocate the $2 million budget growth commitment made at that time to meet other needs of the College. Without the external resources we have been able to leverage with these seed funds, our General Fund budget growth needs would escalate dramatically (by a factor of 2 or 3).

Preliminary estimates based on projects recently funded indicate a growth in sponsored research activity of 25% in FY84-85. Hence we will require an increase of $500,000 to maintain in these research incentive funds to keep pace.

Programmatic Matters: To be determined.

In Fall of 1984 the Department of Computer and Communication Sciences will come into the College and be merged into a new Department of Electrical Engineering and Computer Science. This merger will not only transfer to the College the responsibility for instruction to roughly 400 computer science majors in LS&A, but it will bring as well the primary responsibility for computer instruction to all students in LS&A. The equipment and staffing needs implied by this new role are considerable. Although the College will attempt to meet these responsibilities with the General Fund budget accompanying the CCS faculty transfer, careful monitoring of the budgetary needs of this program is essential.

In a similar sense, the humanities instructional efforts of the College will be transferred to LS&A effective Fall, 1985. Once again the budgetary implications of this transfer should be carefully assessed.

ALTERNATIVES:

It is apparent that time is running out, both for the College of Engineering and the University of Michigan. To be certain, the other needs of the University are immense. However we believe that none are as critical nor as important, to this

University, to the State of Michigan, and to the nation, as the urgent needs of the College of Engineering for restoration of its General Fund support. There is unanimous agreement among leaders of state and federal government and industry that the College of Engineering must be recognized as the highest priority of this University, and that this priority be addressed by an aggressive program to restore an equitable and adequate measure of General Fund support.

The alternatives before the University are limited:

1. Budget Restoration through Internal Reallocation

Since one of the stated intentions of the Five-Year Budget Reallocation Plan was to meet the needs of critical academic units, we believe it appropriate to earmark a substantial component of the resources provided through the Five-Year Plan to restore General Fund support of the College. Quite frankly, we believe that the past three years have demonstrated the fallicy and inadequacy of less direct mechanisms which attempt to "hide" such General Fund budget restoration. The data we have provided in this document establish without question the serious and continuing underfunding of the College relative to every other unit on this campus. Budget restoration to the College is not only justifiable on the basis of quality, capacity, and responsibility. It is also justified as a matter of equity.

2. Budget Restoration through Special State Action

Other universities have been successful in requesting special state action to meet the urgent needs of their engineering schools. For example,this past year the University of Illinois requested and obtained special action to double the budget of their engineering school over a three year period. At this point in time, over 30 states have taken similar action to meet this crisis in engineering education.

As we have suggested on numerous occasions, we believe that the State of Michigan would respond positively to a similar request. However this will not occur until the University indicates quite clearly to Lansing its understanding of the unique role the College is expected to play in economic development in Michigan and commits itself to aggressive effort to restore adequate public support for engineering education.

3. Inadequate Budget Restoration -- Enrollment Cuts

In the absence of an accelerated University effort to restore General Fund support, there will be no alternative but to begin at once a phased enrollment reduction of 30% or greater. However the consequences of such an enrollment reduction will be catastrophic:

- It would deny admission to Michigan's most outstanding high school graduates. Since most of these applicants would seek admission to engineering programs at other institutions, the University would lose large numbers of its most able students (and the general quality of the student body on this campus would decline accordingly).

- There would be massive public and political reaction against a decision by the University to reduce engineering enrollments during a period of peak student demand and societal need.

- The tuition loss associated with the necessary reduction ($7 million or larger) would be greater than the General Fund budget growth necessary to sustain this enrollment.

- The impact of enrollment cuts would take several years (unless one proceeds immediately to cease all freshman, transfer, and graduate admission). The urgency of the problems faced by the College demand action NOW!

The rest of this decade will see a continuation of the unprecedented demand on the part of Michigan's most outstanding high school graduates for an engineering education. This will be coupled with the urgent need of our State and nation for talented, broadly-educated engineers. We believe that a decision to reduce enrollments at Michigan, long recognized as one of this nation's leaders in engineering education, in the face of such intense societal demand and need would be an action of extreme irresponsibility.

We could not endorse such an action.

CONCLUDING REMARKS:

Let us once again conclude by extracting a quote from our Five-Year Budget Planning Document which stresses both the magnitude and seriousness of this matter:

"The total (cumulative) increment to the College's General Fund base over a five-year period continues to be targetd at $6,930,000 (adjusted for inflation). We believe this to be the minimum General Fund restoration program necessary to enable the College of Engineering to remain among the leading engineering schools in the nation and respond to the major opportunities and responsibilities that lie before it in the decade ahead. Without such a prompt and substantial increase in General Fund support, it is almost certain that the College will be unable to maintain its national reputation and meet its serious obligations to provide the engineering graduates and technological innovation so desperately needed by this State and the nation. It furthermore would be forced to deny the opportunity for engineering careers to the most outstanding of our high school graduates -- and, in

the process, deny to the University the opportunity to count these truly extraordinary students among its future alumni, since they would almost certainly seek engineering educations at other institutions."

Failure to respond today to restore an adequate and equitable measure of General Fund support for the College of Engineering would be a tragedy of major proportions, for this University, for the State of Michigan, and for our nation.

FACILITIES AND EQUIPMENT NEEDS

7

Facilities Issues Ahead

FACILITIES ISSUES AHEAD

North Campus Instructional Center

We are requesting assistance in starting construction of the $3M North Campus Instructional facility in the unfinished basement of the Dow Building. We are committed to funding this privately and wish to start construction during the summer of 1984. The design is currently under development by Sims-Varner Associates. This facility will include a satellite library facility to serve research, instructional and study space needs, with the main collections remaining on Central Campus. It will also contain the primary collection of computer work stations of the Computer Aided Engineering Network, computer instruction classrooms and the facilities of the Instructional Television System.

ENGINEERING LIBRARY

The need for a major library on the North Campus will be very great once Engineering Building I is completed. This, of course, is our major facility request included in the Campaign for Michigan.

LABORATORY SPACE AND QUALITY

In order to accomplish the consolidation of the College on the North Campus in a timely and cost-effective manner, we have had to greatly reduce the amount of large-scale, flexible laboratory space. In general, we consider this to be workable if we are able to update and reequip laboratories with modern, miniaturized equipment. Nonetheless, as new experimentalists join the faculty, we do anticipate pressure for some larger facilities. Two actions are needed to make this situation workable:

1. Construct the Engineering Library as soon as possible to enable us to convert half of the Dow basement to laboratory functions, and

2. Perform urgently needed maintenance and modest renovation work to upgrade the buildings housing the Aerospace Engineering laboratories.

3. The Industrial Technology Institute must indeed vacate the former Printing Services building, as agreed, immediately upon completion of Engineering Building I. All of our plans are absolutely contingent upon this.

STEARNS BUILDING

We have requested that the Stearns Building be made available to the College until completion of Engineering Building I. This is needed to allow the Engineering Placement Service and student organization offices to move to North Campus, thereby making more space in West Engineering available to Central Campus units of the University. This unit needs to be located on North Campus in order to serve students and industry properly. This will bring a large number of corporate recruiters (the very clientele Housing hopes to attract to this building) and potential development prospects to attractive facilties on the North Campus. In addition, it is inevitable that some "surge space" for faculty offices will be needed during the transition period as our remaining departments move from Central to North Campus. These needs could be met and still leave some space for other units with temporary needs for office space, if necessary.

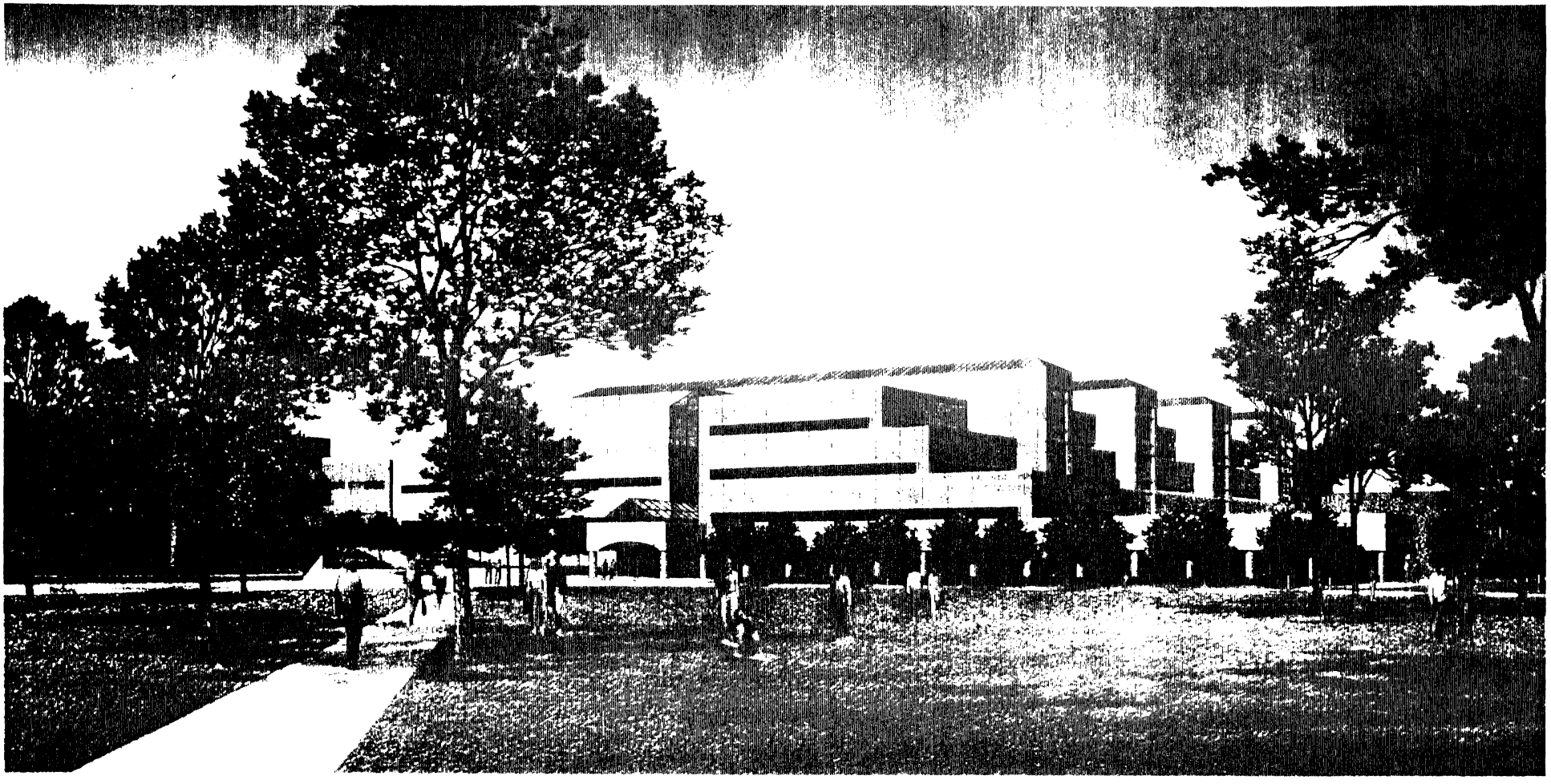
CLASSROOM FACILITIES

When the consolidation of the College is completed by the construction of Engineering Building I, we will have access to 35% fewer classrooms than we did on Central Campus. We believe that more flexible scheduling made possible because the entire College is on one campus will allow us to function with these facilities. However, we will continue to have problems with a lack of very large lecture facilities if the student/faculty ratio remains so high, especially in Electrical Engineering and Computer Science. We also will be unable to let departments such as Mathematics carry out much service teaching on North Campus, although that would be very desirable. It also is understood that LS&A must provide space on Central Campus for Computer Science instruction.

We believe that it will be necessary, and desirable to include some modest additional classroom space in the new Engineering Library.

SOPHISTICATED NEW RESEARCH FACILITIES

The advance of science and technology will continue to generate needs for sophisticated, expensive new experimental facilities. The most obvious examples at the moment are the Solid-State Electronics Laboratory, to be housed in Engineering Building I, and the Electron Microscopy and Analysis Laboratory. Major direct support by the University and major assistance with State, Federal and industrial equipment initiatives will be required to meet these needs. We recognize that the solution to these problems must involve close cooperation among researchers and units within the University, and welcome the opportunity to solve such problems together.



ENGINEERING BUILDING I

Detailed Equipment Needs

December 1, 1983

TOTAL LABORATORY EQUIPMENT AND COMPUTER NEEDS

COLLEGE OF ENGINEERING

THE UNIVERSITY OF MICHIGAN

ANN ARBOR

Laboratory Equipment Needs	$30,030,000
Computing Environment Needs	$40,930,000
Total Estimated Needs	$70,960,000

THE UNIVERSITY OF MICHIGAN
COLLEGE OF ENGINEERING

DEPARTMENTAL LABORATORY EQUIPMENT NEEDS SUMMARY

November 1983

DEPARTMENT	LABORATORY	NEED
AEROSPACE		$1,530,000
	Computer, Information and Control	
	Gas Dynamics	
	High Altitude Engineering	
	Structural Dynamics	
ATMOSPHERIC and OCEANIC SCIENCE		$1,100,000
	Air Pollution and Instrumentation	
	Atmospheric Chemistry	
	Data Processing and Synoptic	
	High Altitude Engineering	
	Marine Chemical	
	Marine Geological	
	Michigan AirGlow Observatory	
	Physical Oceanography	
	Space Physics	
CHEMICAL ENGINEERING		$4,050,000
	Applied Polymer	
	Biochemical Engineering	
	Bioengineering	
	Catalysis and Spectroscopy	
	Chemical Engineering	
	Coal Slurry and Energy Logistics	
	Ecosystem Simulation	
	Electrochemical	
	Heat Transfer	
	Laser Light Scattering	
	Oil Shale Research	
	Petroleum Research	
	Process Dynamics	
	Sonochemical Engineering	
	Thermal Properties of Fluids	

CIVIL ENGINEERING		$2,400,000
	C.E. Materials	
	Concrete Research	
	Construction Engineering	
	Geotechnical Engineering	
	Hydraulic Transients	
	Coastal Hydraulics	
	Sanitary Engineering	
	Solid Wastes	
	Structural Dynamics	
	Structures	
	Water Resources Engineering	
ELECTRICAL and COMPUTER ENGINEERING		$7,700,000
	Bioelectrical Sciences	
	Cooley Electronics	
	Electro-Optics	
	Electron Physics	
	Power Systems	
	Technology Assessment	
	Radiation	
	Robotics	
	Space Physics	
	Systems Engineering	
	Ultrasonic Imaging	
	Vehicular Electronics	
INDUSTRIAL and OPERATIONS ENGINEERING		$1,500,000
	Center for Ergonomics	
	Information Systems Design and Optimization Systems	
	Manufacturing Systems	
MATERIALS and METALLURGICAL ENGINEERING		$3,100,000
	Carbon	
	Cast Metals	
	Chemical Metallurgy	
	Electron Microscopy	
	Heat Treating	
	High Temperature Metallurgy	
	Metallography	
	Physical Ceramics	
	Physical Testing	
	Polymers	
	Scanning Electron Microscope, Microprobe and Mass Spectroscopy	
	X-Ray Diffraction	

MECHANICAL ENGINEERING and APPLIED MECHANICS		$6,100,000
	Acoustic Emissions and Fatigue	
	Automatic Control	
	W.E. Lay Automotive Engineering	
	Cavitation and Multophase Flow	
	Computer-Aided Design	
	Emission Research	
	Failure Analysis and Composite Materials	
	Fluid Dynamics	
	Fluid Mechanics	
	Heat Transfer	
	Interferometry	
	Machine Tool	
	Material Processing	
	Mechanical Analysis	
	Mechanical Design	
	Non-destructive Testing	
	Numerical Control	
	Plastic Deformation of Materials	
	Power and Fluids	
	Rehabilitation Engineering	
	Solid Mechanics	
	Thermodynamics	
	Tribology	
	Welding	
NAVAL ARCHITECTURE and MARINE ENGINEERING		$970,000
	Ship Hydrodynamics	
NUCLEAR ENGINEERING		$1,580,000
	Laser-Plasma	
	Mossbauer Measurements	
	Neutron Experimental Bay	
	Neutron Spectroscopy	
	Plasma Experimental Bay	
	Radiation Measurement	
	Diffusion	
	Material Preparation	
	Photoneutron	
	TOTAL:	$30,030,000

UNIVERSITY OF MICHIGAN
COMPUTER-AIDED ENGINEERING NETWORK

The emerging generation of computing systems, stimulated by dramatic advances in integrated circuit and communication technology, is now focusing on enhancing the productivity of people rather than merely the producitivy of operations. Engineering and computer science teaching, research, and practice will increasingly depend upon routine access to networks of individual computer workstations with powerful local processing, interactive high-resolution graphics, and rapid access to enormous technical databases.

The College of Engineering has accepted the challenge to build the next generation distributed computing environment which will be necessary to maintain leadership in research and instruction. This environment is known as the Computer-Aided Engineering Network (CAEN). Through the CAEN the College is committed both to enhancing the productivity of the educational process and to educating students who will use, develop, and propagate computer-aided engineering tools. This environment is also prototypical of the distributed computing environment which is at the core of the "factory or business of the future."

Based upon prices of newly announced "engineering workstations" such as the Hewlett-Packard 9000, the Sun Microsystems stations, and the Apollo Domain family, we have developed a detailed plan for the building of the CAEN over the next 3-5 years. We are quoting list prices but based upon past experience, would expect significant discounts from the vendors. An adequate number of workstations for faculty, staff, and students is estimated to cost $27.3 million. Storage and printing servers for the network are $12 million, and network interfaces and software licenses are $1.6 million. The total is $40.9M. More detail is shown on the next page. The maintenance of such a facility requires about 10% of equipment cost per year, i.e. about $4M.

CAEN 3-5 YEAR PLAN

ITEMS	UNIT $	FAC	STF	STU	TOTAL	TOTAL $
Workstations						
Basic mono	10,000.00	200	200	500	900	9,000,000.00
Basic color	40,000.00	25		100	125	5,000,000.00
Hi per mono	45,000.00	50		100	150	6,750,000.00
Hi per color	70,000.00	25		50	75	5,250,000.00
Comp. Nodes	35,000.00	10		25	35	1,225,000.00
Total wrkstat					1250	
PC/terminal	1,200.00		100		100	12,000.00
Sub-total						$27,345,000.00
File servers						
Node adapters	7,000.00	28	25	75	128	896,875.00
300 MB	15,000.00	56	50	150	256	3,843,750.00
158 MB	15,000.00	85	0	175	260	3,900,000.00
Tape	12,000.00	15	15	15	45	540,000.00
Sub-total						$ 9,180,625.00
Print servers						
Laser print	25,000.00				105	2,625,000.00
Color printer	35,000.00				10	350,000.00
LQ matrix	6,000.00				0	0.00
Sub-total						$ 2,975,000.00
Backbone						
Interface	2,000.00				15	30,000.00
Cable	500,000.00				1	500,000.00
Sub-total						$ 530,000.00
Software						
Core Site	100,000.00				1	100,000.00
Application	800,000.00				1	800,000.00
Sub-total						$ 900,000.00
Grand Total						$40,930,625.00

State of Michigan

Engineering Equipment Initiative

STATEMENT OF REQUESTED ACTION:

The State of Michigan will establish an Engineering Excellence fund to support the acquisition and maintenance of laboratory equipment for the engineering schools of Michigan's public universities. Annual appropriations to the fund would be at a level of $2,000 per engineering degree recipient in these institutions in the previous fiscal year. Disbursement of funds from the Engineering Excellence Fund would require matching grants of equipment support for each institution. The maximum matching grants appropriated from the Fund to any eligible institution would be limited to $2,000 per engineering graduate per year.

The annual cost of this program is estimated to be $8,500,000 based on 4,250 graduates per year (and 100% success in raising matching support).

NOTES:

- Similar Engineering Excellence Funds or related legislative actions for the purpose of rebuilding engineering college laboratories have been implemented in most states (including actions last year taken in Illinois, Ohio, Pennsylvannia, Texas, Arizona, New Mexico, Iowa, Oklahoma, Colorado, Minnesota, Tennessee, Washington, and Wyoming).

- These initiatives have been encouraged by the National Society of Professional Engineers and its affiliated societies.

- The NSPE, along with other national groups including the National Academies, have recommended the base support level of $2,000 per engineering degree recipient as the amount necessary to sustain engineering college laboratories. (Obviously, the restoration of the equipment inventories after the past decade of neglect requires an even larger commitment.)

SUPPORTING RATIONALE:

Both our nation and our State are becoming increasingly dependent upon science and technology. Government and industry are turning to institutions of engineering education to provide the intellectual creativity so fundamental to technological innovation and the talented, broadly-educated engineers who can understand and implement this technology. It is therefore disturbing -- indeed, frightening -- to note the degree to which our engineering schools have been crippled by sadly obsolete laboratories and equipment inventories in their efforts to respond to such responsibilities.

Nowhere has this crisis become more serious than in the State of Michigan. Although our State is heavily dependent upon technology, a decade of deteriorating public support has left the laboratories of our engineering schools in a shambles. Industry in this State faces unprecedented needs for engineering graduates with knowledge of the sophisticated equipment critical to productivity. Yet the laboratories of our engineering college have deteriorated to a crisis level. A recent report of the Michigan Society of Professional Engineers notes:

> Continuing obsolescence of laboratory equipment and instruments has placed many schools in the position of not being representative of modern professional practice. New technologies, apparatus, and methodologies are evolving more rapidly in industry, and lack of up-to-date equipment and instruments within the university exacerbates the situation. Rapid evolution of such fields as robotics, microelectronics, computer aided design, optics, spectrographics, electron microscopy, computer graphics, ... etc., has left the universities in a teaching mode far behind current professional practice.
>
> A decade-long decline in the flow of resources to laboratory equipment for higher education has taken its toll. the university is no longer at the "cutting edge", and current graduates will not be the contributors that their predecessors were. Some have said engineering education is distressed, but a more apt description is a <u>crisis state</u>.

The laboratory equipment inventories of Michigan's colleges have deteriorated to a level that can no longer sustain high quality education or research, thereby crippling these institutions' efforts to respond to the needs of Michigan industry. National studies of engineering education suggest that an amount equivalent to $2,000 per engineering graduate should be budgeted each year just to sustain an adequate equipment inventory. Studies by the Michigan Society of Professional Engineers placed the laboratory equipment backlog in Michigan's engineering schools in excess of $80 million.

Prompt and substantial action at the State level is desperately needed to restore and sustain Michigan's engineering

schools' laboratory equipment inventories to a level adequate to support quality engineering education and the needs of this State.

POSSIBLE IMPLEMENTATION MECHANISMS

MICHIGAN ENGINEERING LABORATORY EQUIPMENT PROGRAM

We have listed below several different approaches for implementing the proposed Michigan Engineering Laboratory Equipment Program. The list is given in order of decreasing preference.

MOST PREFERRED MECHANISM:

The State of Michigan would establish an Engineering Excellence Fund to support the acquisition and maintenance of laboratory equipment for the engineering schools of Michigan's public universities. Annual appropriations to the fund would be at a level of $2,000 per engineering degree recepient in these institutions in the previous fiscal year. Disbursement from this Fund to the General Fund of each eligible academic institution would be according to the same formula.

Annual Cost: $9,000,000 per year (4,500 graduates)

Additional Request: During the first two years of the program, the Fund should be appropriated and disburse a higher level of funding (proposed at $13,500,000, or $3,000 per graduate, to allow institutions to restore badly depleted laboratory equipment inventories.

Reference: Sample draft legislation (Exhibit B)

LESS PREFERRED MECHANISM:

Same as above, except the disbursement of funds from the Engineering Excellence Fund would require matching grants of equipment support for each institution. The maximum matching grants appropriated from the Fund to any eligible institution would again be limited to $2,000 per engineering graduate per year.

Annual Cost: $9,000,000 per year (4,500 graduates)

Industrial Match: $9,000,000 per year

Reference: Legislation from States of Illinois and Ohio (Exhibit C)

ACCEPTABLE BUT LEAST PREFERRED MECHANISM:

Funds would be included in the Higher Education Appropriation Bill along with "boilerplate language" to support the Engineering Laboratory Equipment Program Revision Requests submitted by each eligible institution. (The presidents of each of these institutions have agreed to include such language in their annual State Budget Requests.)

Annual Cost: $9,000,000 per year (base adjustment)

First Year (Startup) Cost: $13,500,000

Reference: University of Michigan State Budget Request (including Engineering Laboratory Equipment PRR) (Exhibit D)

APPENDICES

Special Initiatives Taken

by Other States

A SUMMARY OF STATE INITIATIVES FOR SUPPORTING ENGINEERING SCHOOLS

Essentially every state in the nation has acknowledged the crisis in engineering education by responding with major initiatives. These initiatives can be grouped into several categories: either base budget increments or line item amounts for laboratory equipment, new faculty, faculty salaries, or major new research ventures. Below we have listed several of these initiatives, in most cases corresponding to legislation either approved or in process. (Note these do not include capital outlay projects which have occurred in almost all states over the past three years.)

FLORIDA:

$ 6 million	program support (1982-83)
$12 million	lab equipment (1982-83)
$18 million	lab equipment (1983-84)

ILLINOIS (see attached description):

$18 million (BASE line item increase phased over three years to two U of Illinios Engineering Colleges (Champaign-Urbana and Chicago) (new faculty, faculty salaries, equipment) (1984-86)

Special equipment initiative funded at a level of $1200 per engineering graduate per year

TEXAS:

$20 million	lab equipment (1983-84)
$ 6 million (BASE -- Perm Univ Fund)	(1983-84)
Engineering Schools, U. Texas & Texas A&M	
$ 5 million (BASE) + 30 chairs -- computer science and engineering	(1983-85) -- U. Texas

ARIZONA:

$32 million	electrical and computer (1982-85) Arizona State University
34 new faculty positions	
$ 8 million (private sector match)	

NEW MEXICO:

$25 million	lab equipment (1979-85)

MINNESOTA:

$20 million State + $20 million industry -- (1982-84) special programs (microelectronics and computers)

CALIFORNIA:

Special action to decouple engineering and business faculty salaries
$15 million for microelectronics and biotech programs
$ 3 million (BASE line item) lab equipment (1982-83)

COLORADO:

Differential tuition and salary structure
$25 million lab equipment (1983-86)

MASSACHUSETTS:

American Electronics Association (2% of R&D)
Massachusetts Microelectronics Center

NORTH CAROLINA:

Comprehensive review of engineering education in State
Microelectronics Center ($41 million)

PENNSYLVANNIA:

$40 - $60 million Regional center development

IOWA:

Special lab equipment appropriation (in process)
$16 million (bonded) capital outlay

KANSAS:

Special allocation for engineering faculty salaries

MARYLAND:

Special State efforts ($3.6 million BASE line item) to address lab equipment, capital facilities, and faculty needs at University of Maryland College of Engineering.

MISSOURI:

$3 million (BASE line item) Eng faculty salaries

NEBRASKA:

$434,000 (BASE line item) Eng faculty salaries

OKLAHOMA:

$6 million (BASE) lab equipment

OREGON:

$4.6 million (BASE)	Eng faculty expansion

SOUTH CAROLINA:

$1 million (BASE)	Eng salaries
$2 million (BASE)	lab equipment

TENNESSEE:

$15 million	lab equipment

UTAH:

Major expansion of engineering programs at University of Utah.

WASHINGTON:

$1 million (BASE)	lab equipment (1979)

WYOMING:

$3.5 million	lab equipment

A RECENT EXAMPLE OF SUCH INITIATIVES

THE STATE OF ILLINOIS

This year the State of Illinois approved a line-item base appropriation increase for Illinois' two principal engineering schools (U. of Illinois - Champaign-Urbana and U. of Illinois - Chicago). The appropriation will increase the base budgets of these schools by $18 million over a three year period ($6 million in base increment per year, at a level of $3.7 million to Champaign-Urbana and $2.3 million to Chicago). This base support is being used to provide an adequate level of faculty and equipment support necessary to sustain enrollments at these institutions.

In addition, the State of Illinois approved a matching grants program at a level of $1,200 per engineering graduate per year for engineering laboratory equipment.

Both action items are taking effect in the 1983-84 academic year (1984 Fiscal Year).

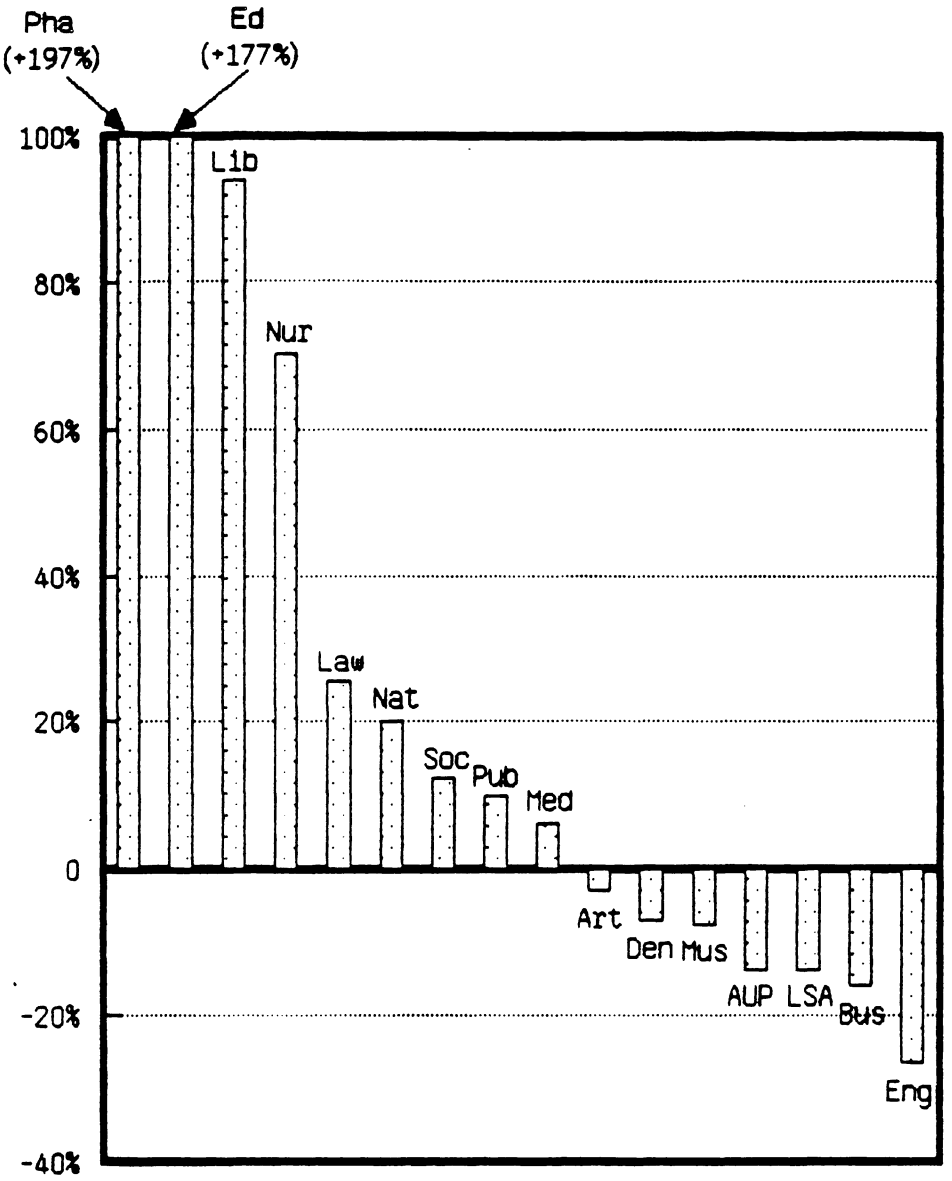
Comparative Budget Statistics
of
Schools and Colleges

COMPARATIVE UNIVERSITY BUDGET TRENDS

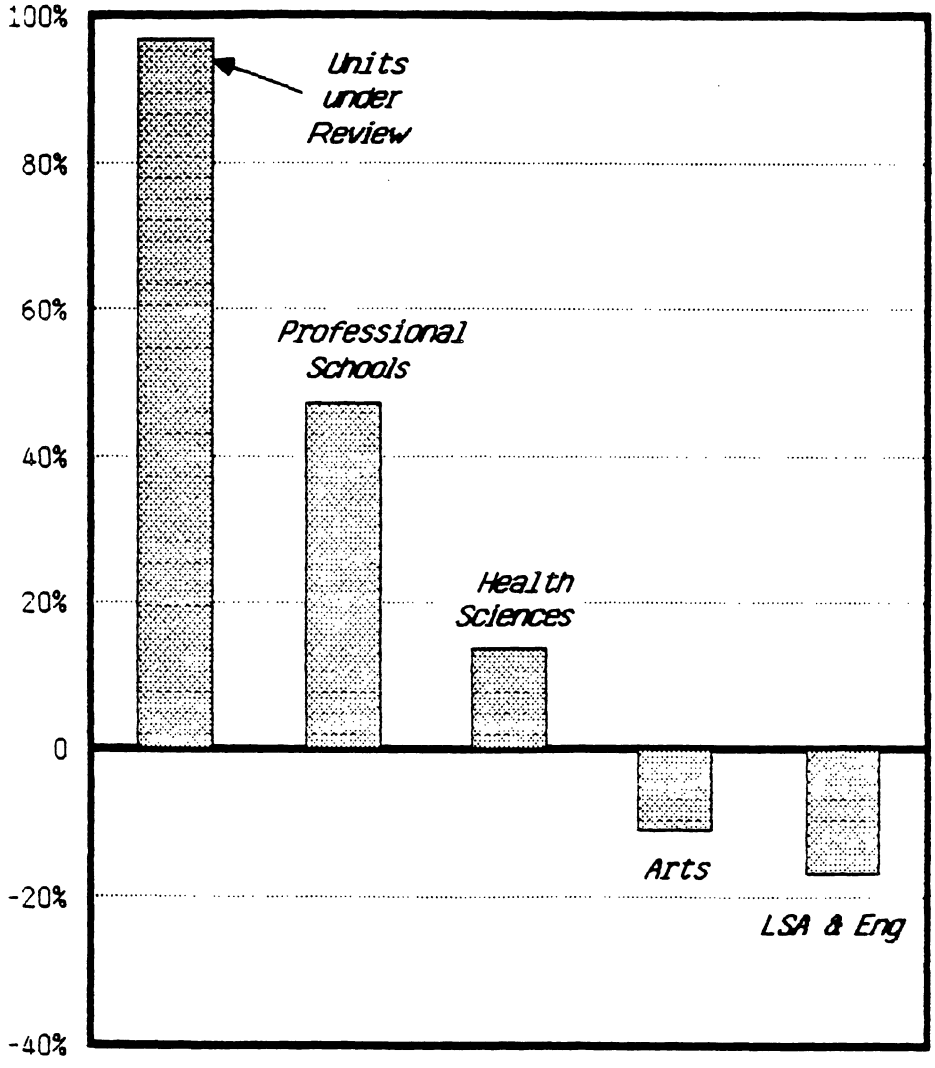
FIGURES:

- Change in CPI-Adjusted GF$/Enrolled Student (1970-83)
- Change in GF$/Student by Discipline
- GF$/Student by Discipline
- Snapshots of CPI-Adjusted GF$/Student
- Annual Growth Rate in GF$/SCH
- Annual Growth Rate in GF$/Enrolled Student
- GF$/SCH
- GF$/Enrolled Student

Change in CPI-Adjusted General Fund $ per Student 1970 - 1983

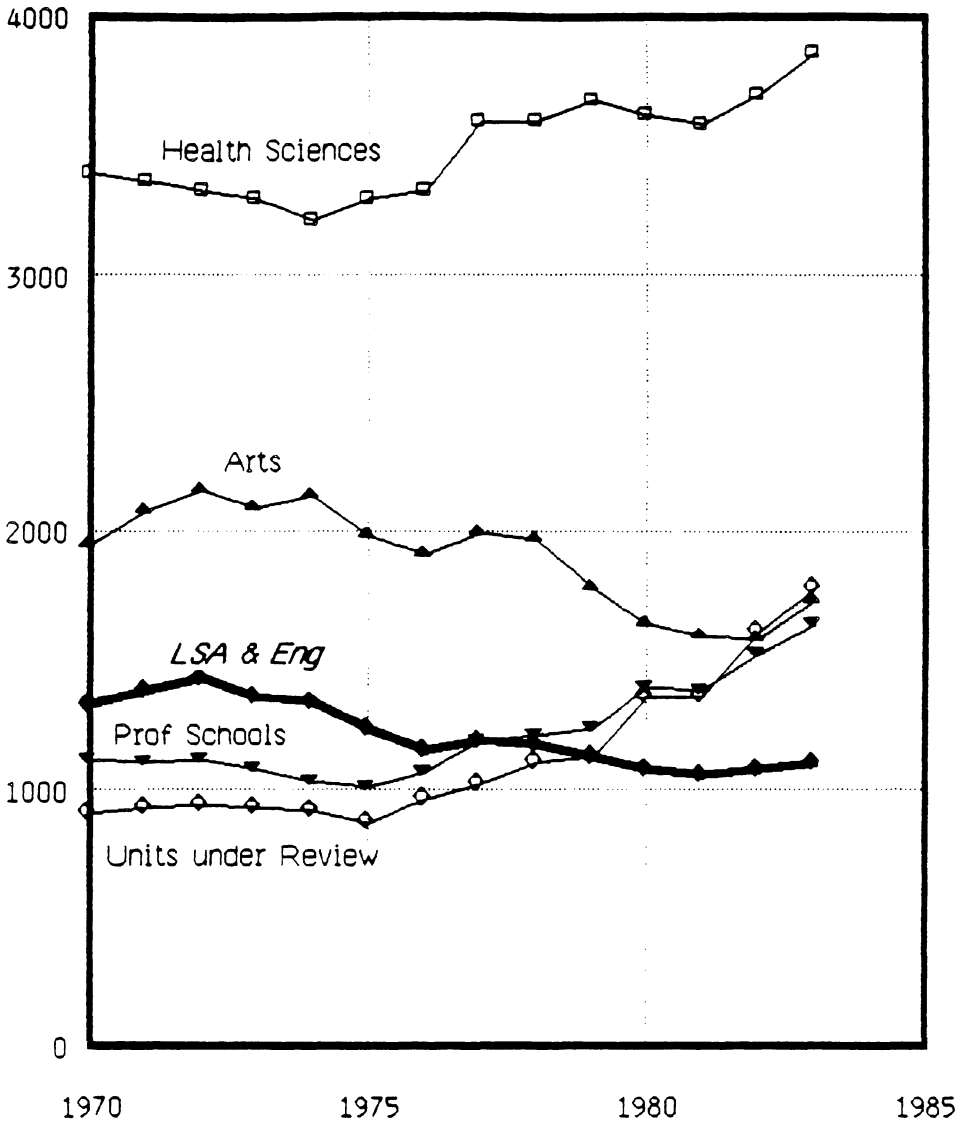


Change in CPI-Adjusted General Fund per Student 1970 - 1983



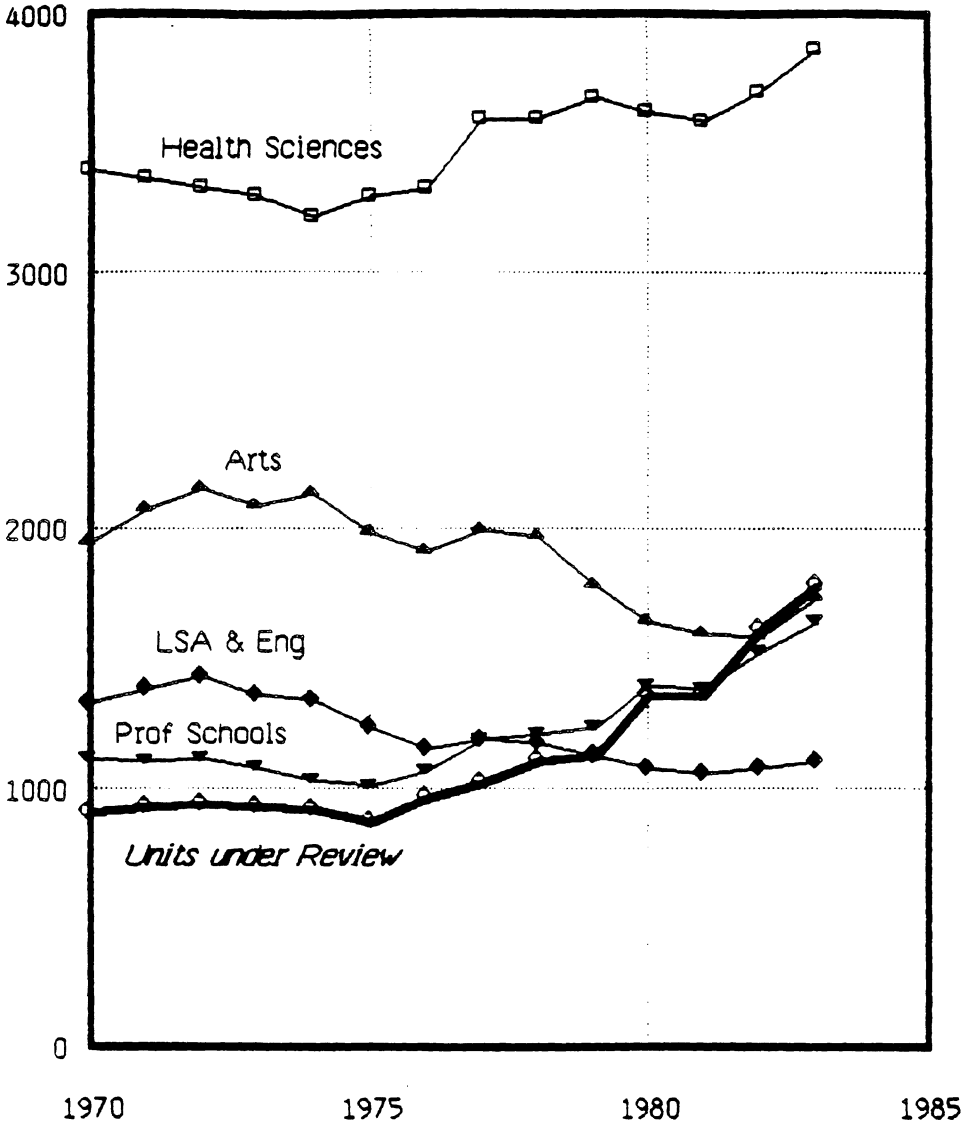
CPI Adjusted General Fund per Student

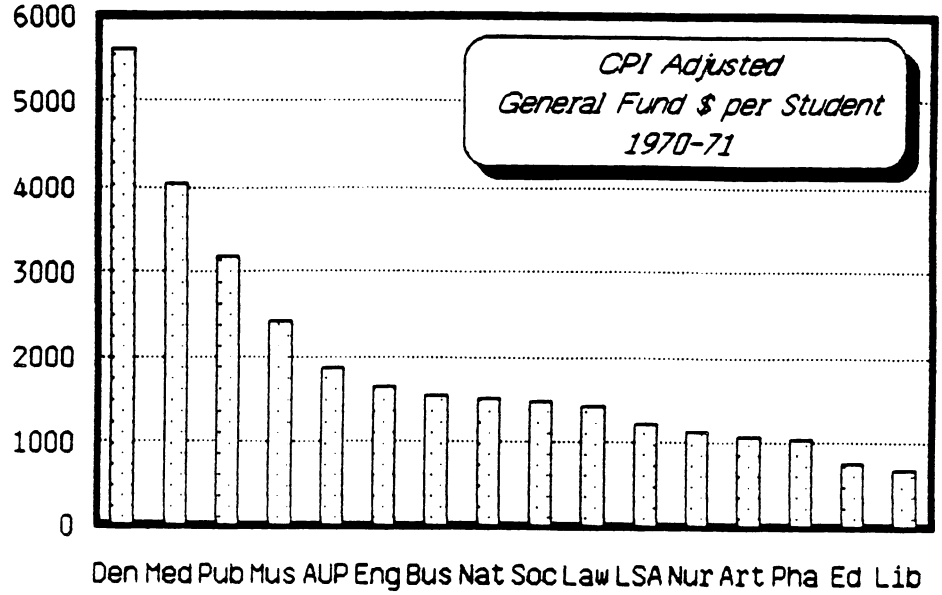
(Groups of Schools by Discipline)

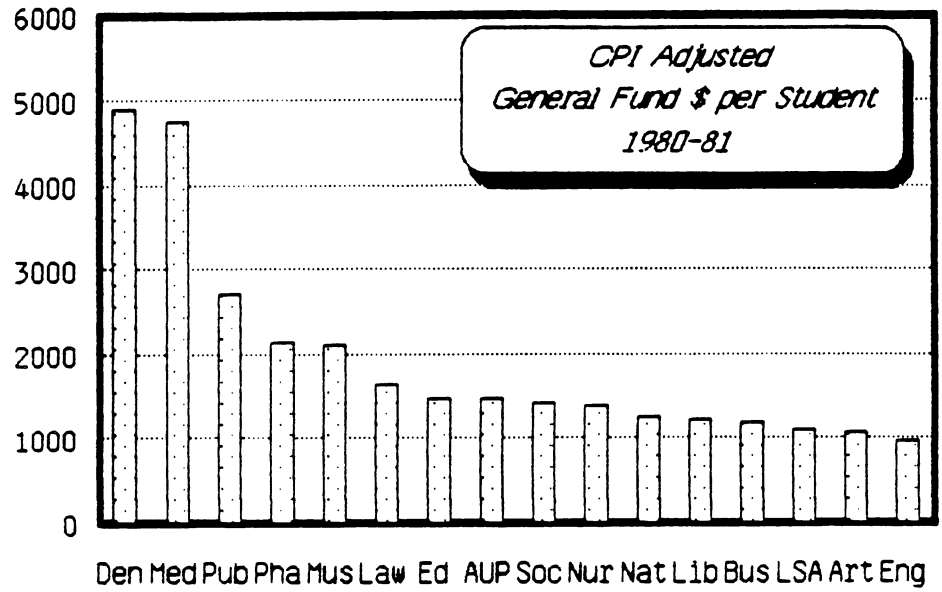


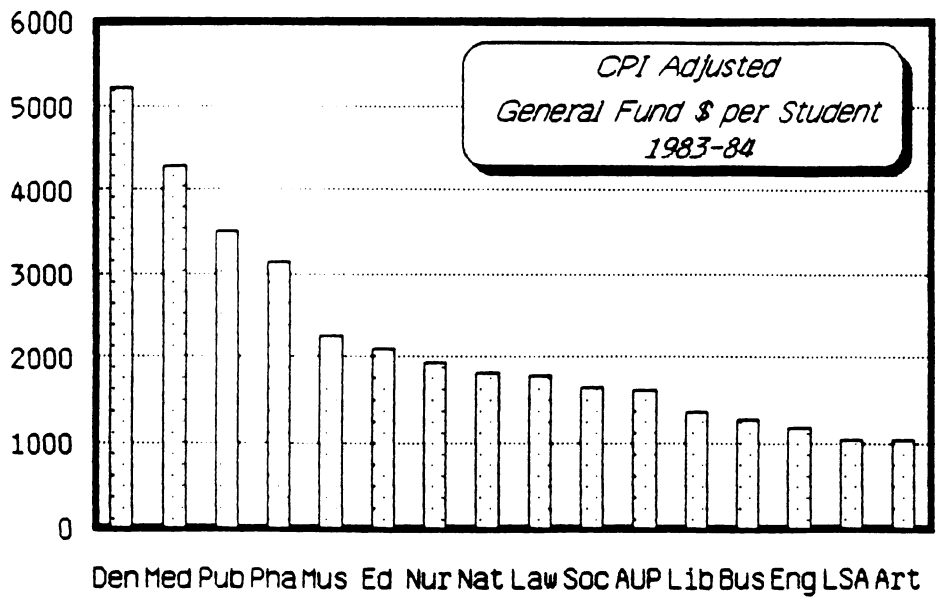
CPI Adjusted General Fund per Student

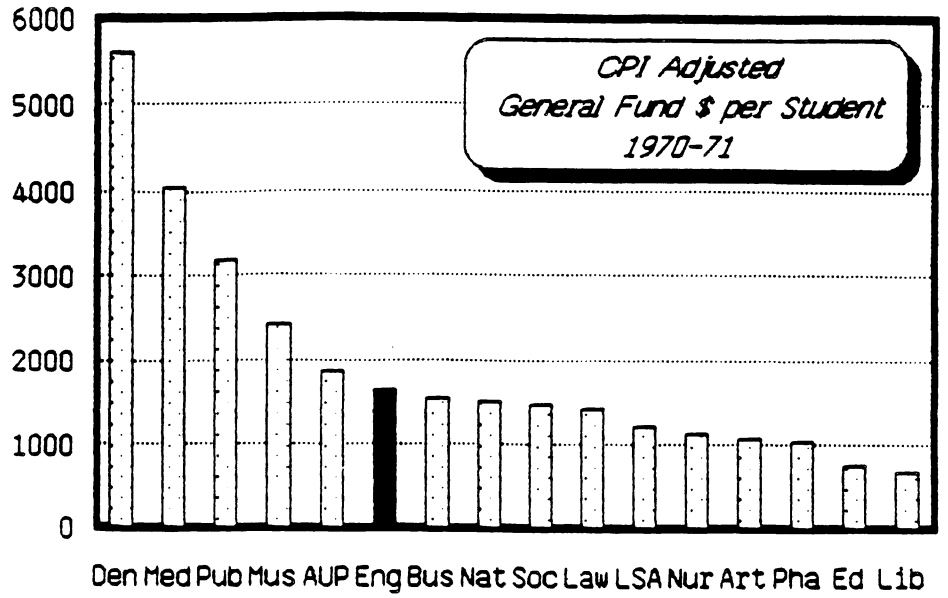
(Groups of Schools by Discipline)

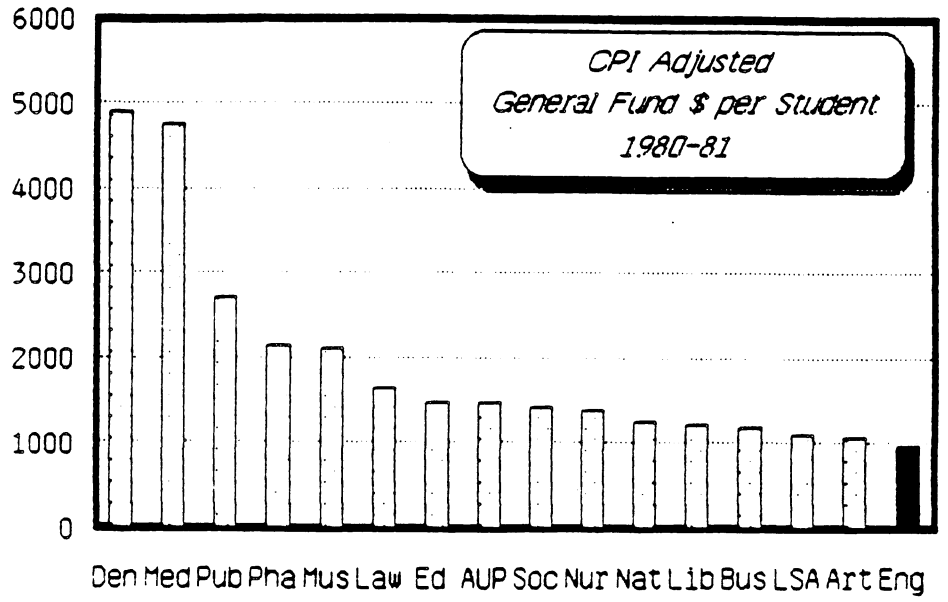


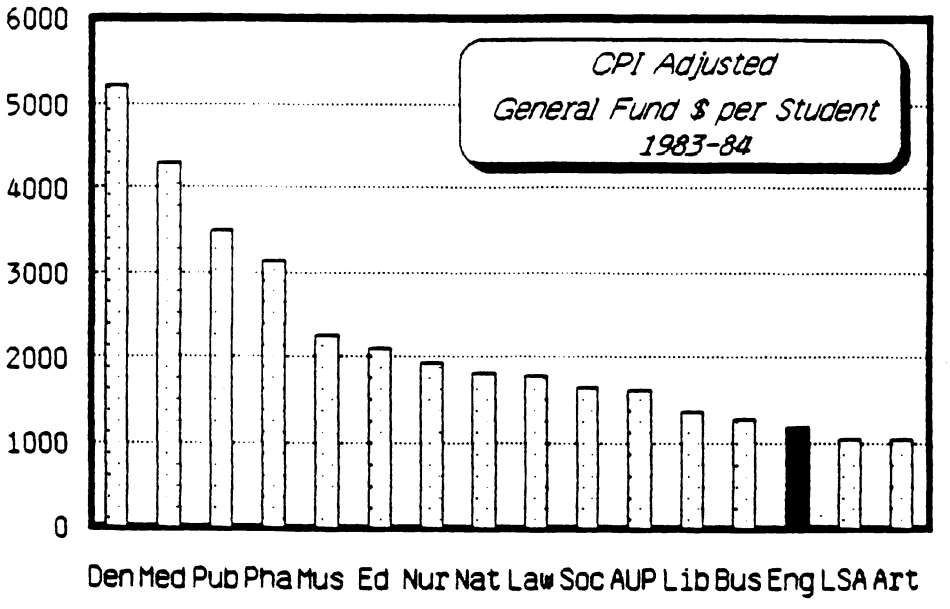

CPI Adjusted
General Fund $ per Student
1970-71
6000
5000
4000
3000
2000
1000
0
Den Med Pub Mus AUP Eng Bus Nat Soc Law LSA Nur Art Pha Ed Lib

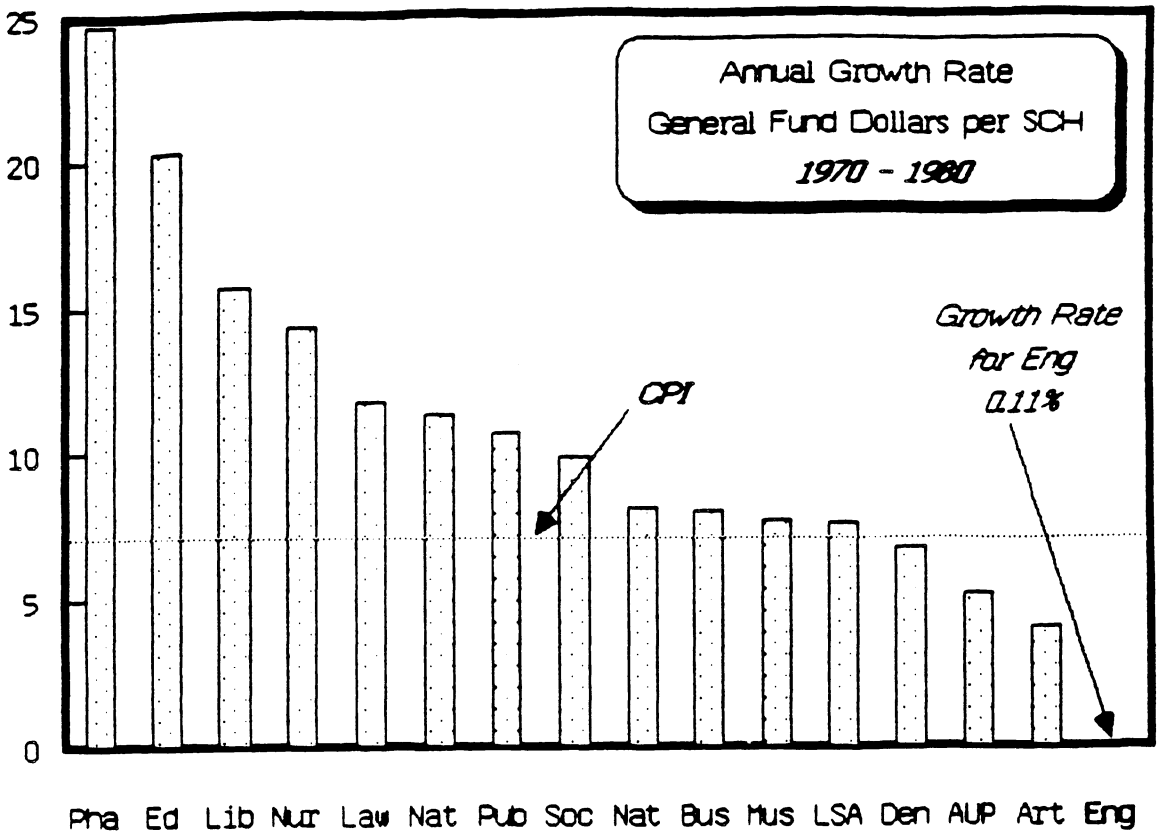

CPI Adjusted
General Fund $ per Student
1980-81
6000
5000
4000
3000
2000
1000
0
Den Med Pub Pha Mus Law Ed AUP Soc Nur Nat Lib Bus LSA Art Eng

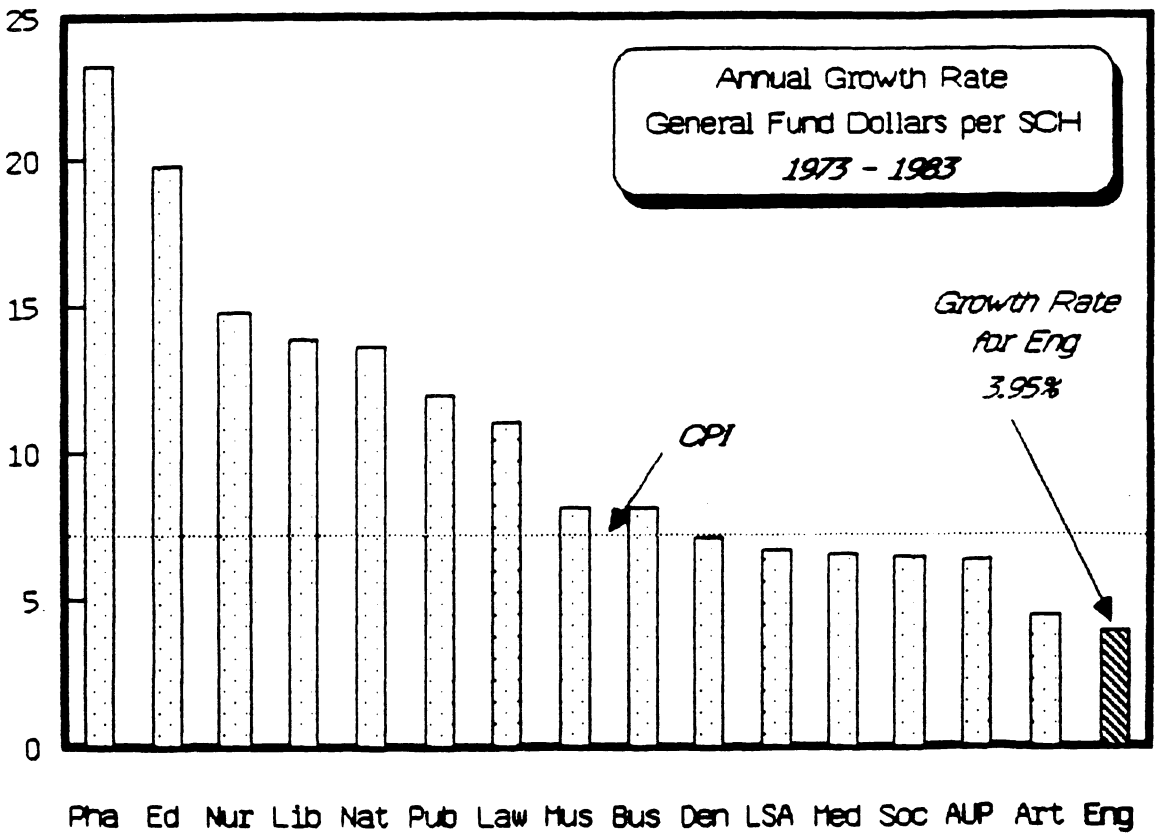

CPI Adjusted
General Fund $ per Student
1983-84
6000
5000
4000
3000
2000
1000
0
Den Med Pub Pha Mus Ed Nur Nat Law Soc AUP Lib Bus Eng LSA Art
School or College

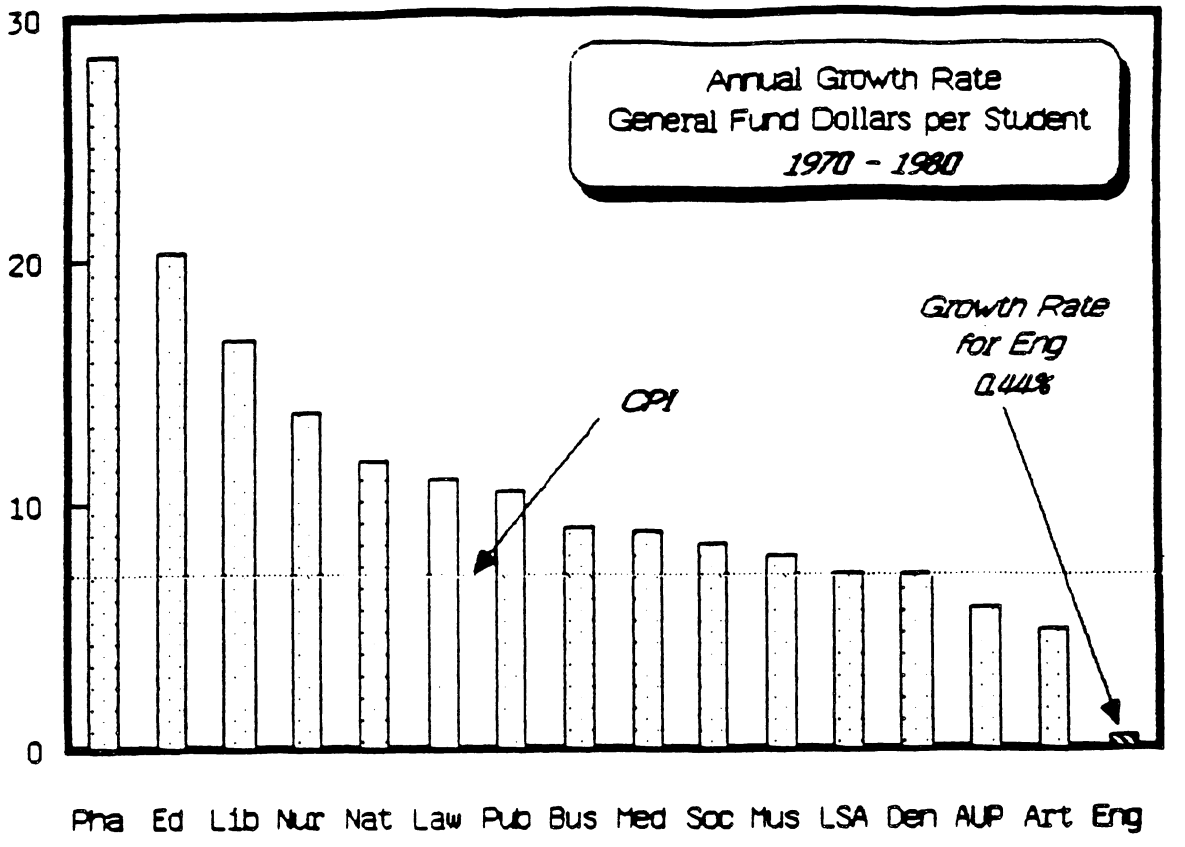

CPI Adjusted
General Fund $ per Student
1970-71
6000
5000
4000
3000
2000
1000
0
Den Med Pub Mus AUP Eng Bus Nat Soc Law LSA Nur Art Pha Ed Lib

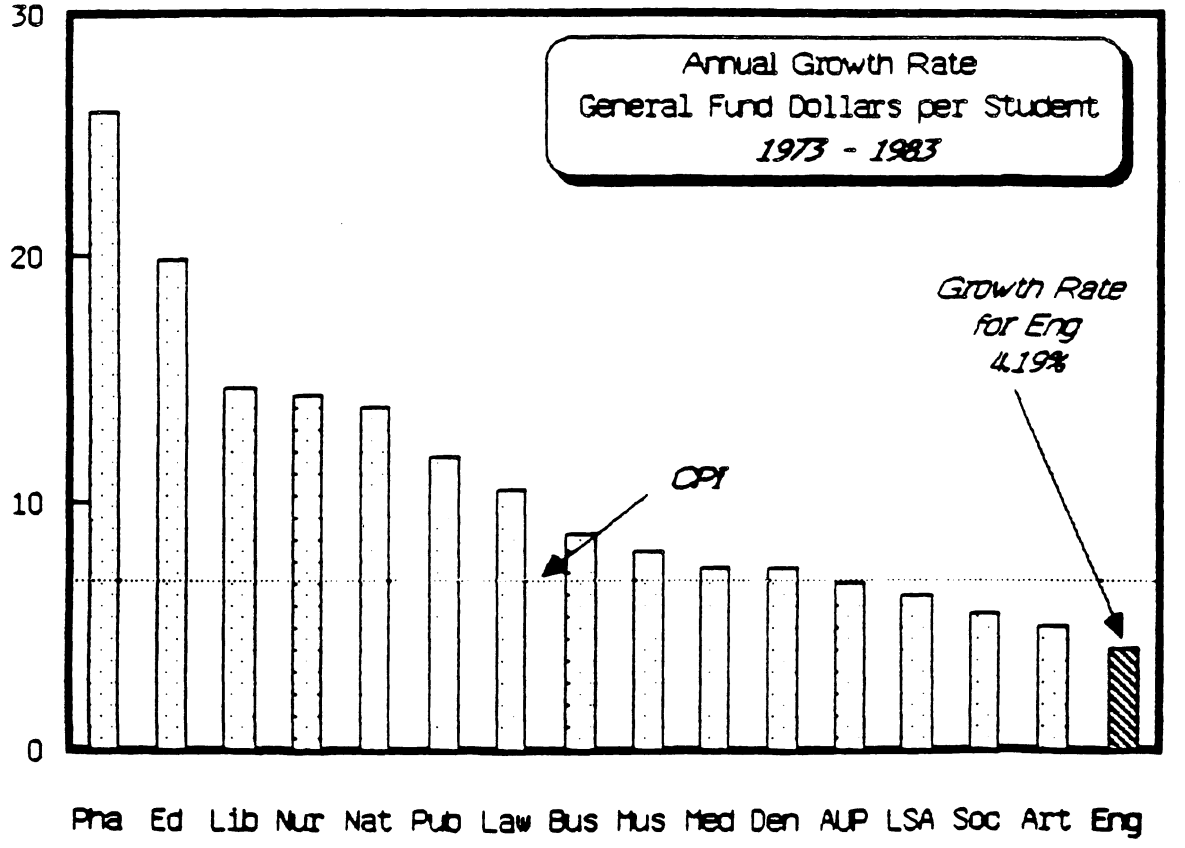

CPI Adjusted
General Fund $ per Student
1980-81
6000
5000
4000
3000
2000
1000
0
Den Med Pub Pha Mus Law Ed AUP Soc Nur Nat Lib Bus LSA Art Eng

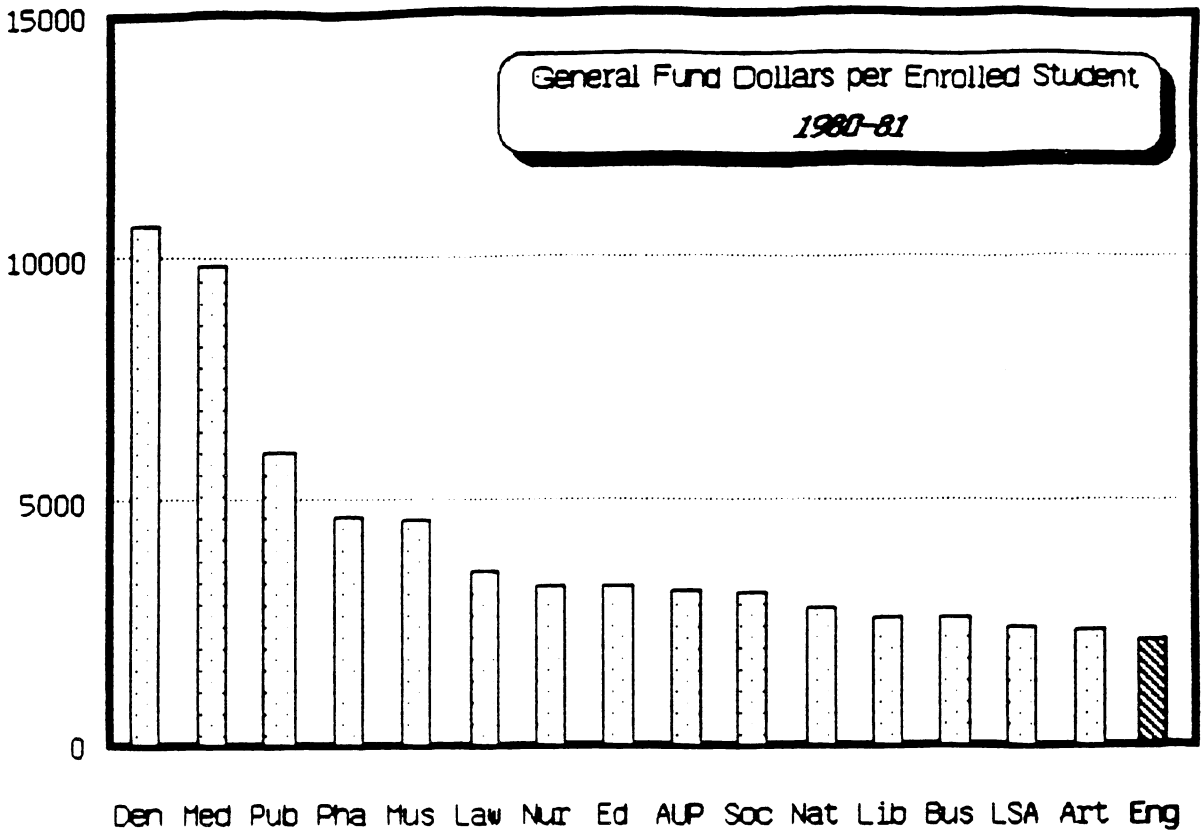

CPI Adjusted
General Fund $ per Student
1983-84
6000
5000
4000
3000
2000
1000
0
Den Med Pub Pha Mus Ed Nur Nat Law Soc AUP Lib Bus Eng LSA Art
School or College

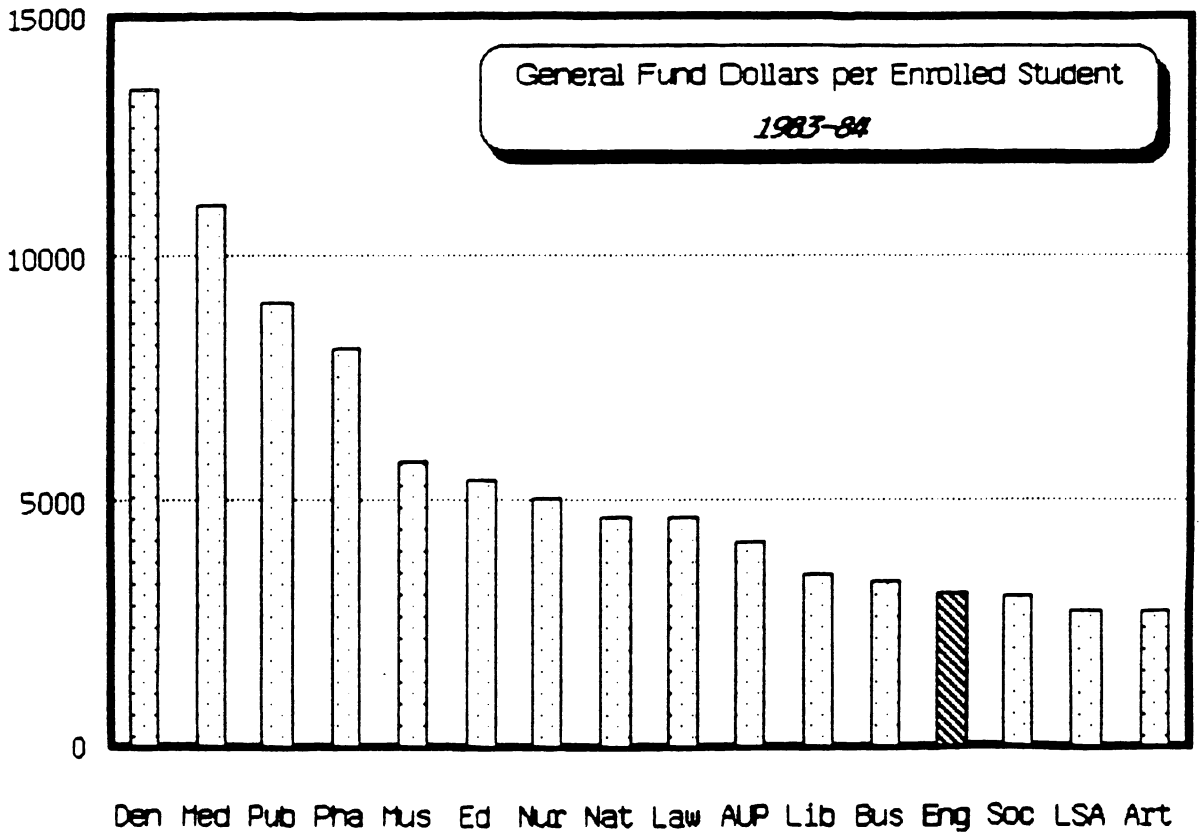

Annual Growth Rate
General Fund Dollars per SCH
1970 - 1980
Growth Rate
for Eng
0.11%
CPI
25
20
15
10
5
0
Pha Ed Lib Nur Law Nat Pub Soc Nat Bus Mus LSA Den AUP Art Eng

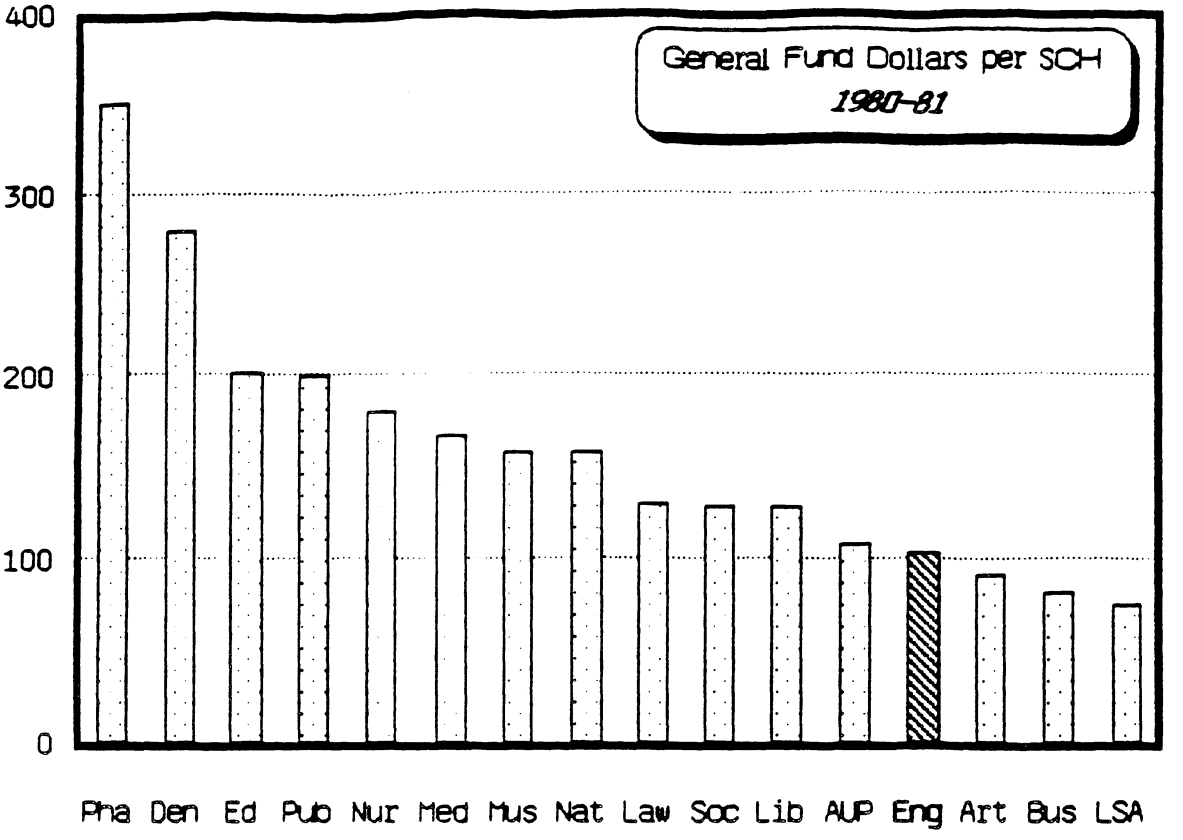

Annual Growth Rate
General Fund Dollars per SCH
1973 - 1983
Growth Rate
for Eng
3.95%
CPI
25
20
15
10
5
0
Pha Ed Nur Lib Nat Pub Law Mus Bus Den LSA Med Soc AUP Art Eng

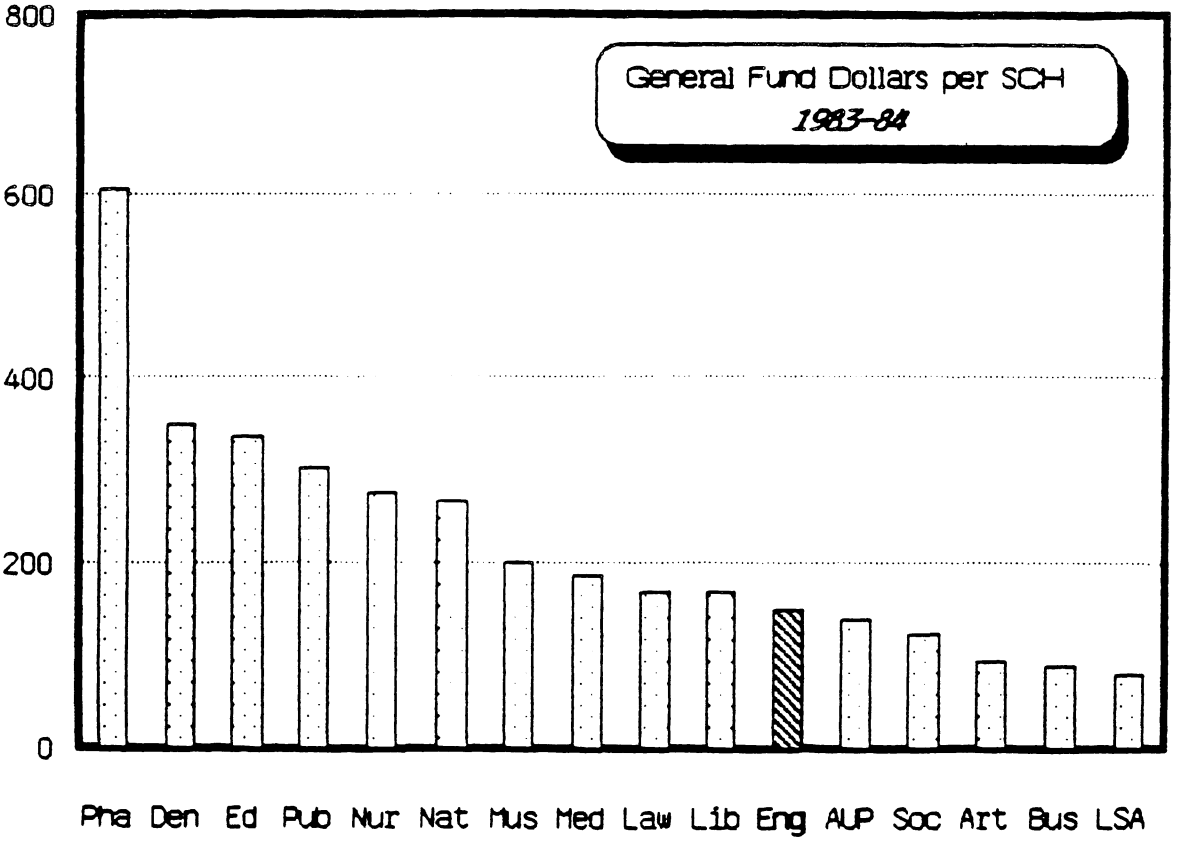

Annual Growth Rate
General Fund Dollars per Student
1970 - 1980
30
20
10
0
CPI
Growth Rate
for Eng
0.44%
Pha Ed Lib Nur Nat Law Pub Bus Med Soc Mus LSA Den AUP Art Eng


Annual Growth Rate
General Fund Dollars per Student
1973 - 1983
30
20
10
0
CPI
Growth Rate
for Eng
4.19%
Pha Ed Lib Nur Nat Pub Law Bus Mus Med Den AUP LSA Soc Art Eng


15000
10000
5000
0
General Fund Dollars per Enrolled Student
1980-81
Den Med Pub Pha Mus Law Nur Ed AUP Soc Nat Lib Bus LSA Art Eng


15000
10000
5000
0
General Fund Dollars per Enrolled Student
1983-84
Den Med Pub Pha Mus Ed Nur Nat Law AUP Lib Bus Eng Soc LSA Art


General Fund Dollars per SCH
1980-81
400
300
200
100
0
Pha Den Ed Pub Nur Med Mus Nat Law Soc Lib AUP Eng Art Bus LSA

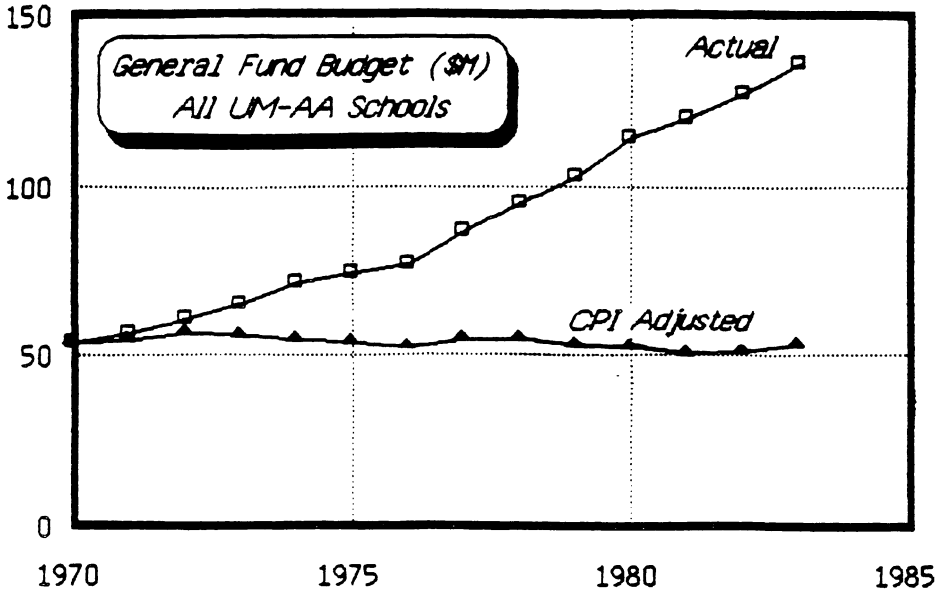

General Fund Dollars per SCH
1983-84
800
600
400
200
0
Pha Den Ed Pub Nur Nat Mus Med Law Lib Eng AUP Soc Art Bus LSA

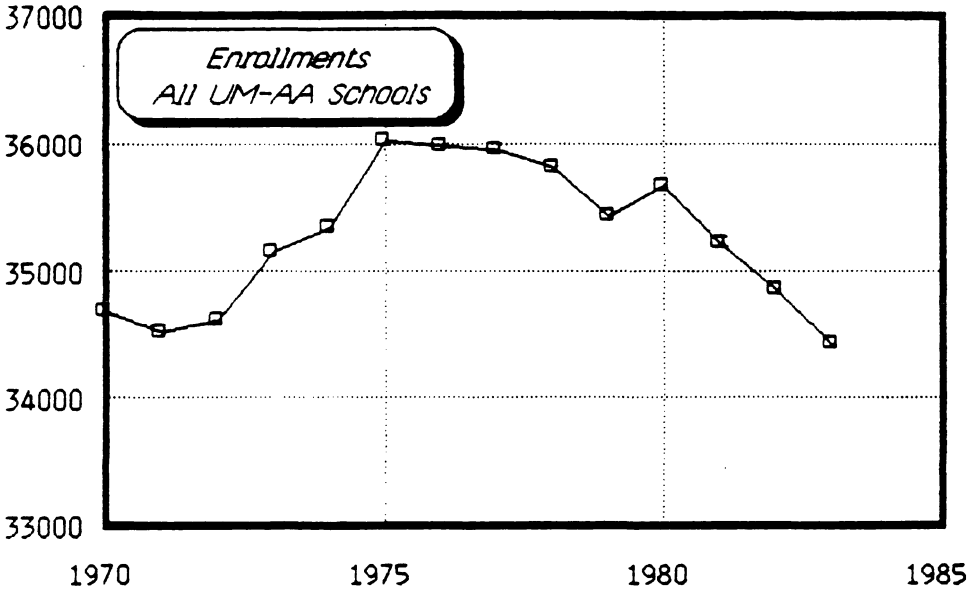
Comparative Trends in General Fund Budget, Enrollments, and General Fund per Student

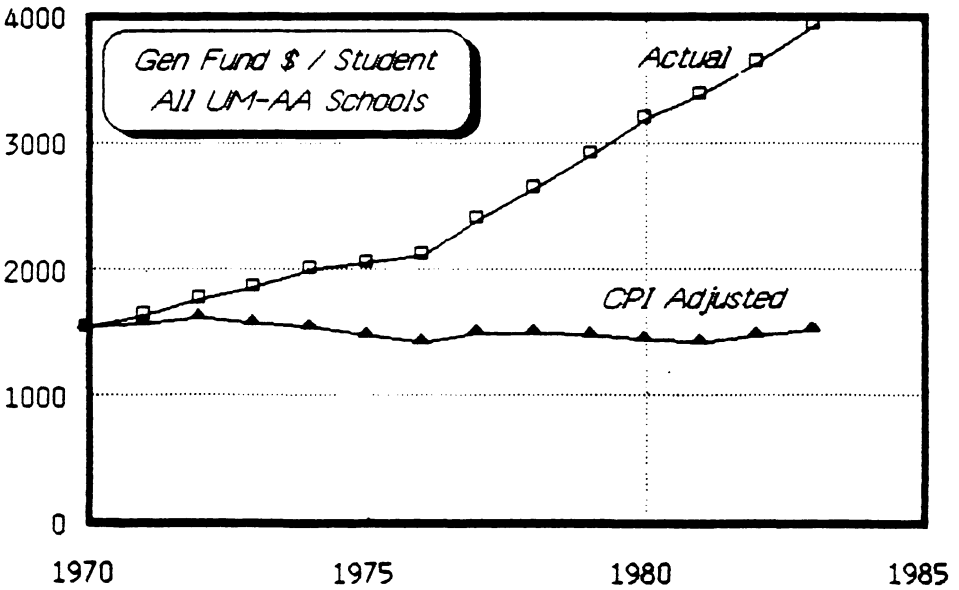
COMPARATIVE TRENDS IN GENERAL FUND BUDGET, ENROLLMENTS, AND GENERAL FUND PER STUDENT

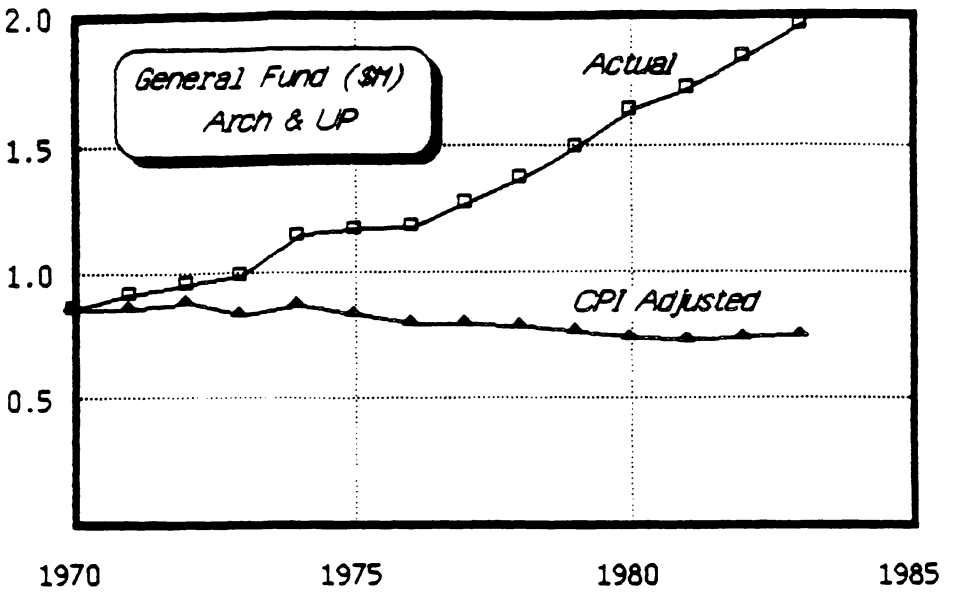
FIGURES:

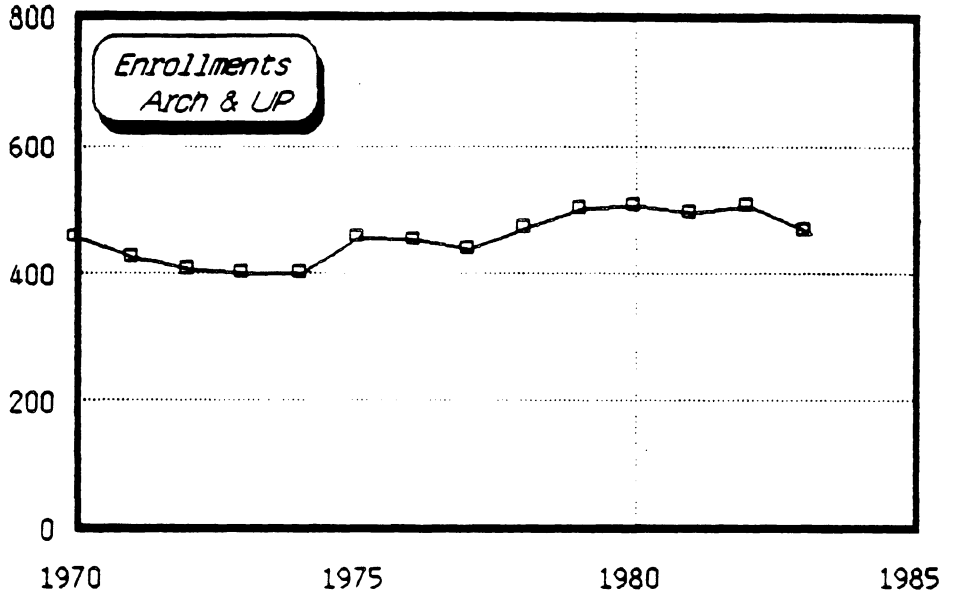
- Comparisons for all academic units

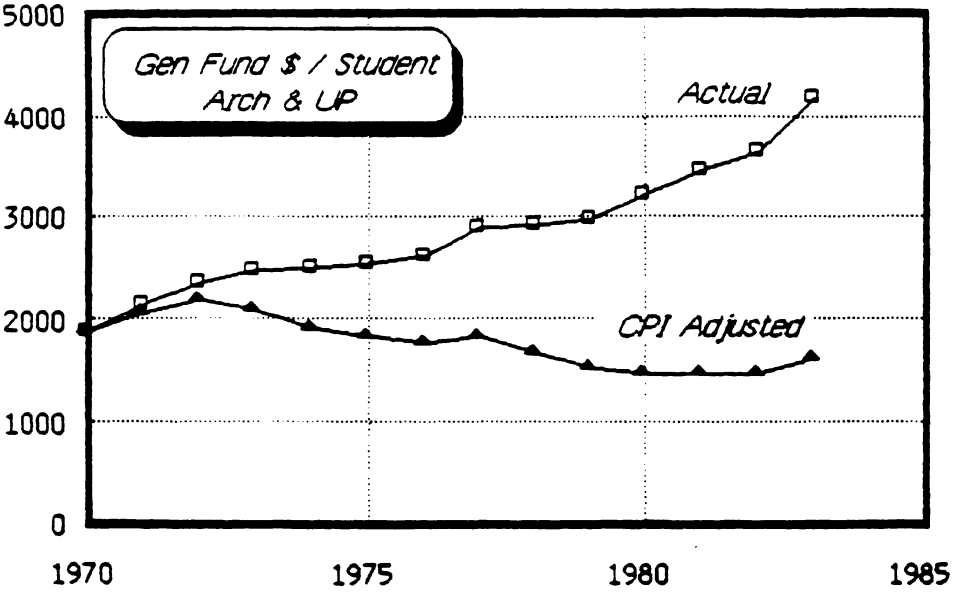

General Fund Budget ($M)
All UM-AA Schools
Actual
CPI Adjusted
150
100
50
0
1970
1975
1980
1985

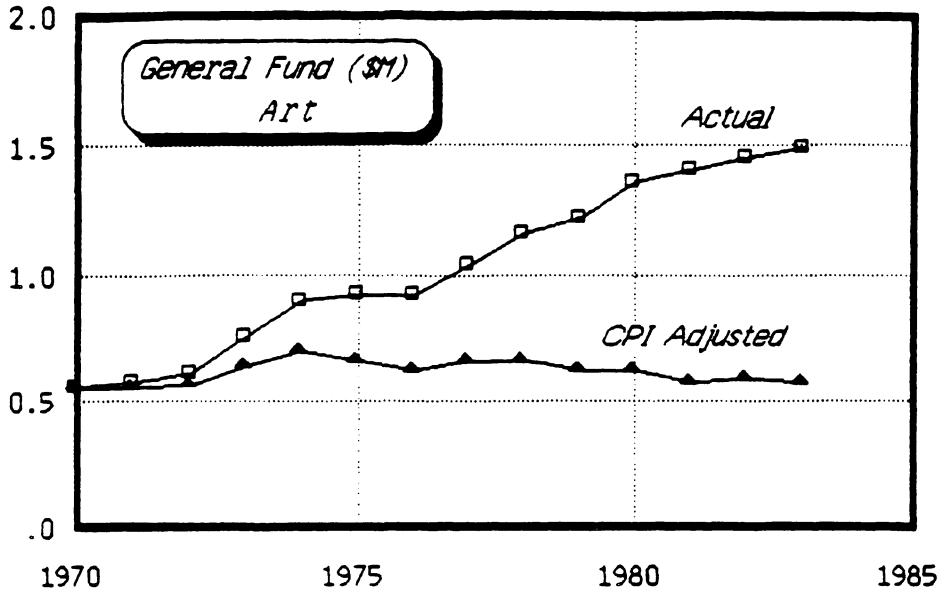

Enrollments
All UM-AA Schools
37000
36000
35000
34000
33000
1970
1975
1980
1985

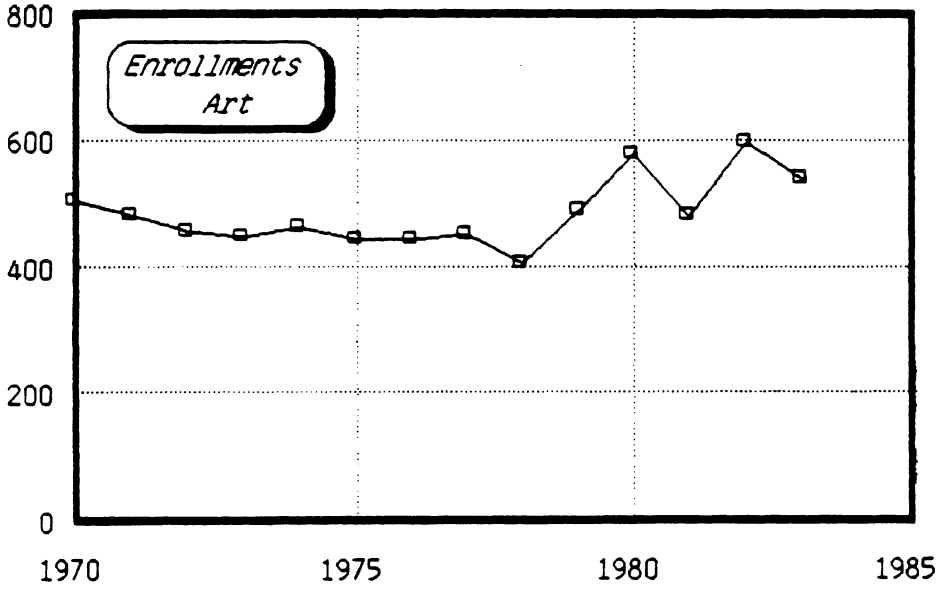

Gen Fund $ / Student
All UM-AA Schools
Actual
CPI Adjusted
4000
3000
2000
1000
0
1970
1975
1980
1985

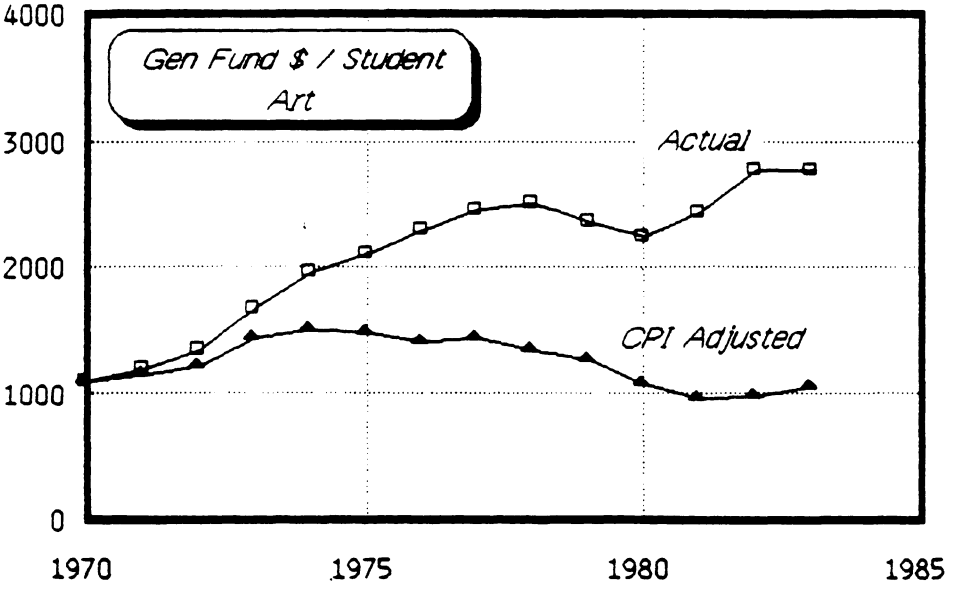

2.0
1.5
1.0
0.5
General Fund ($M)
Arch & UP
Actual
CPI Adjusted
1970
1975
1980
1985

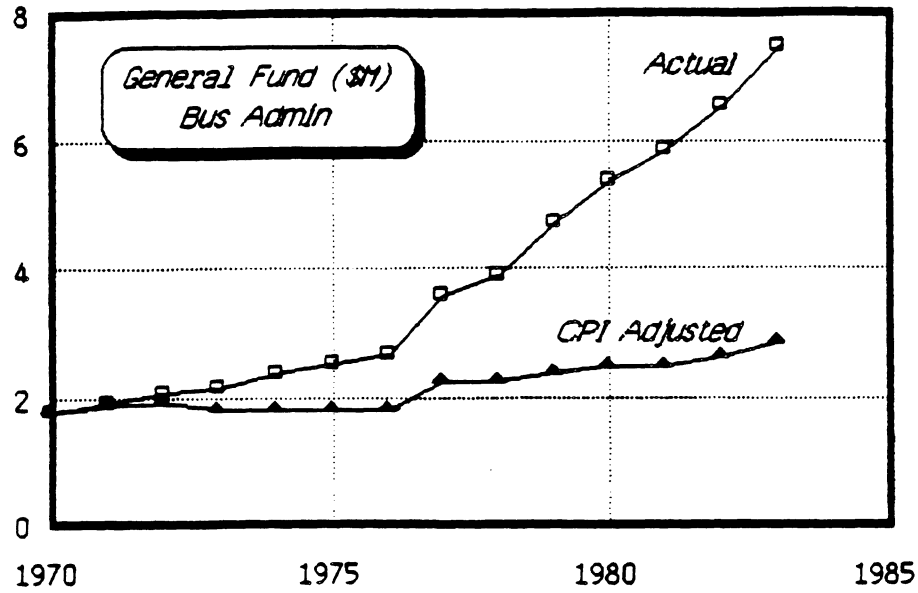

800
600
400
200
0
Enrollments
Arch & UP
1970
1975
1980
1985

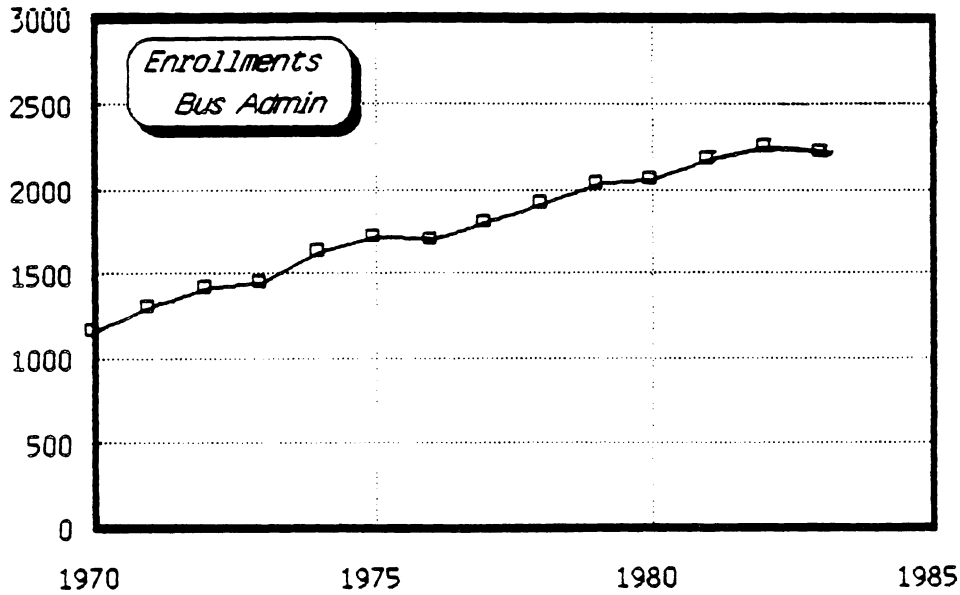

5000
4000
3000
2000
1000
0
Gen Fund $ / Student
Arch & UP
Actual
CPI Adjusted
1970
1975
1980
1985

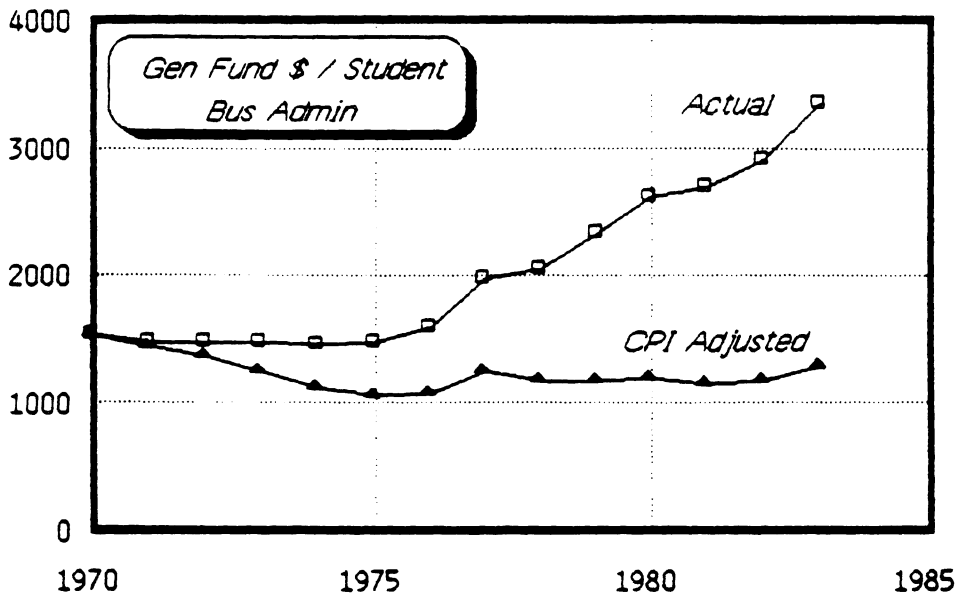

General Fund ($M)
Art
Actual
CPI Adjusted
2.0
1.5
1.0
0.5
.0
1970
1975
1980
1985

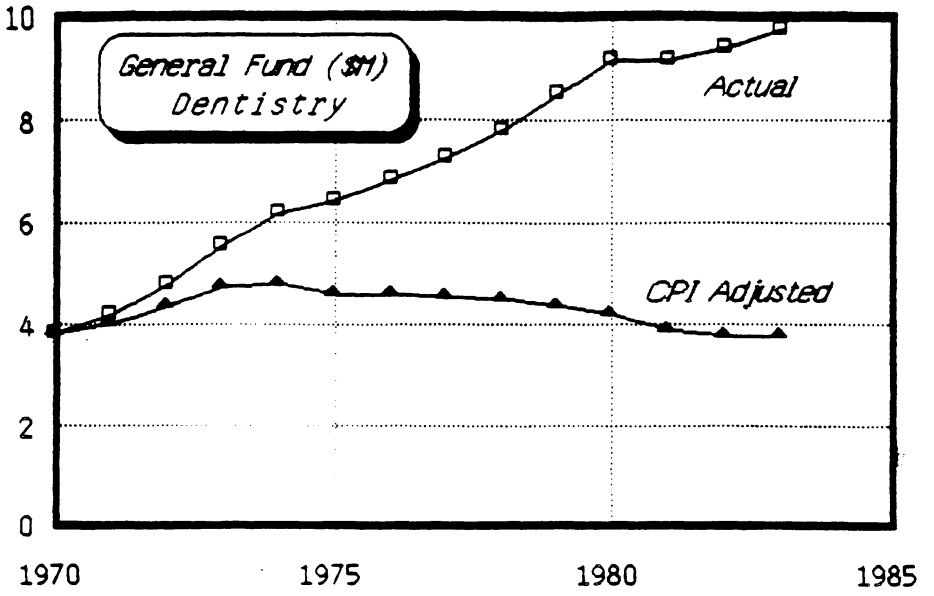

Enrollments
Art
800
600
400
200
0
1970
1975
1980
1985

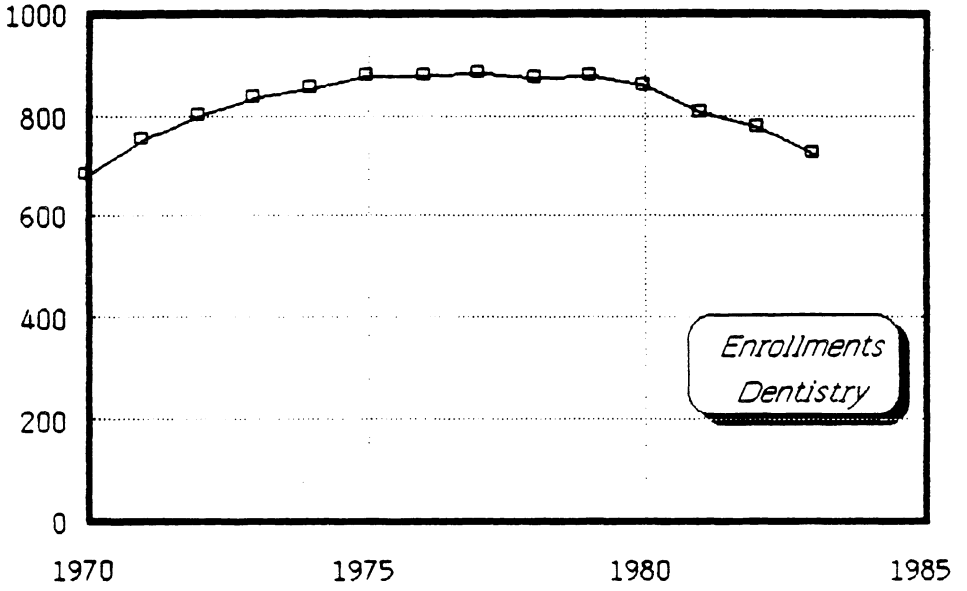

Gen Fund $ / Student
Art
Actual
CPI Adjusted
4000
3000
2000
1000
0
1970
1975
1980
1985

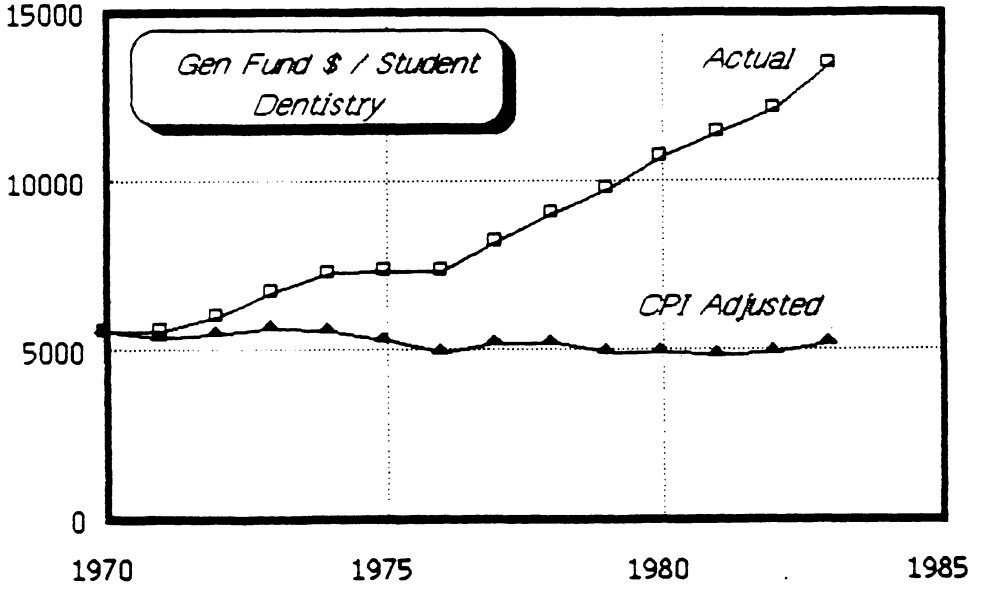

General Fund ($M)
Bus Admin
Actual
CPI Adjusted
8
6
4
2
0
1970
1975
1980
1985

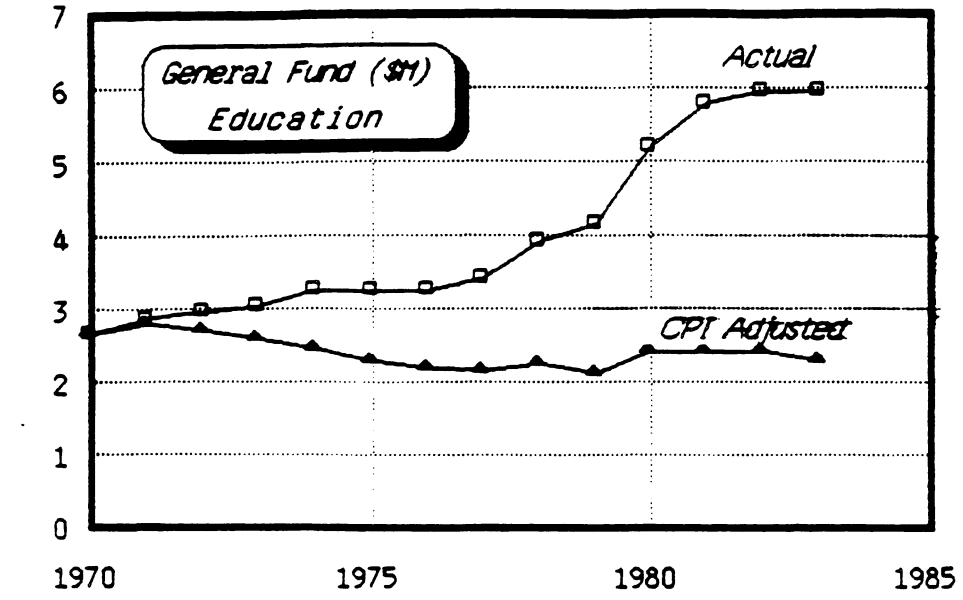

Enrollments
Bus Admin
3000
2500
2000
1500
1000
500
0
1970
1975
1980
1985

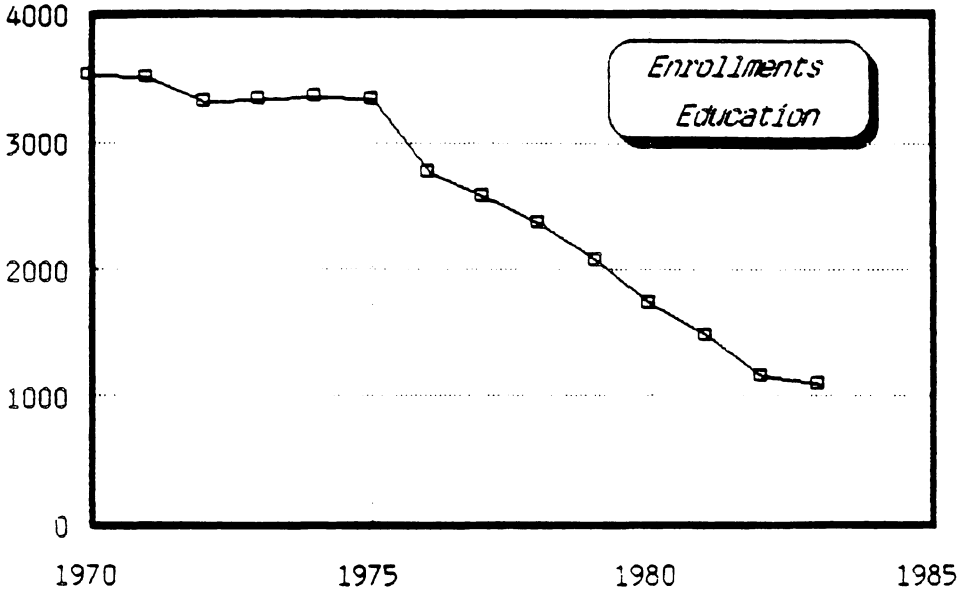

Gen Fund $ / Student
Bus Admin
Actual
CPI Adjusted
4000
3000
2000
1000
0
1970
1975
1980
1985

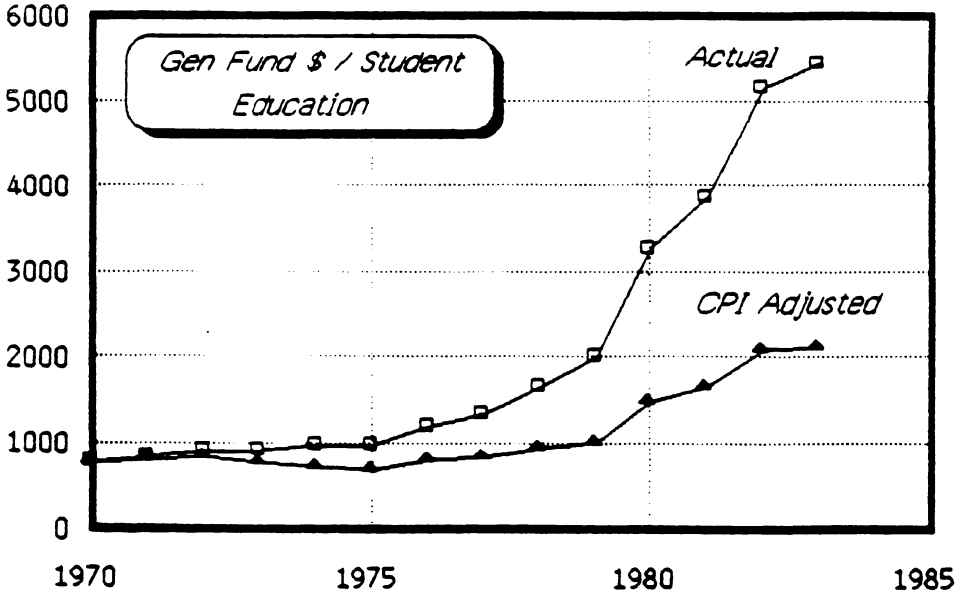

General Fund ($M)
Dentistry
Actual
CPI Adjusted
10
8
6
4
2
0
1970
1975
1980
1985

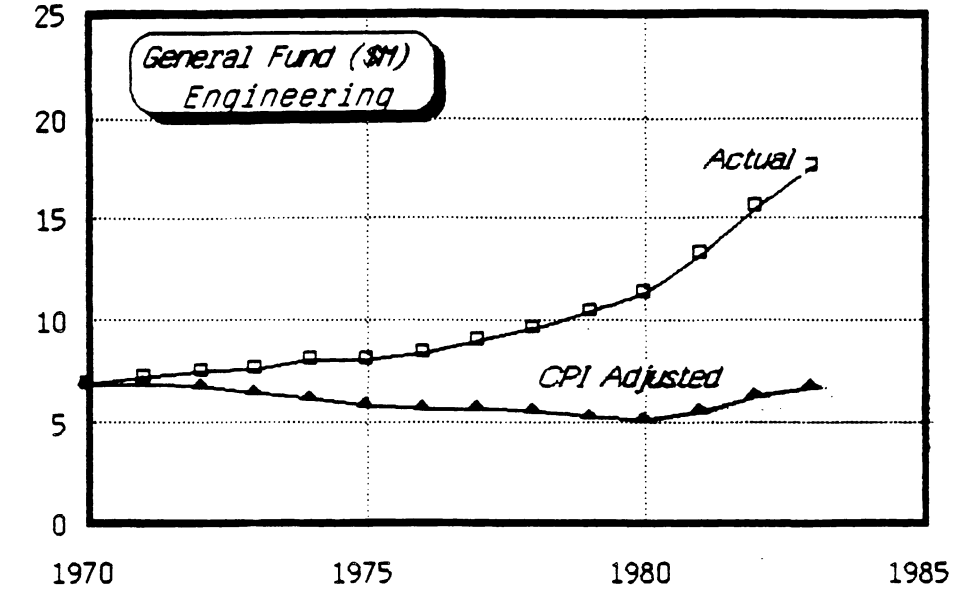

1000
800
600
400
200
0
Enrollments
Dentistry
1970
1975
1980
1985

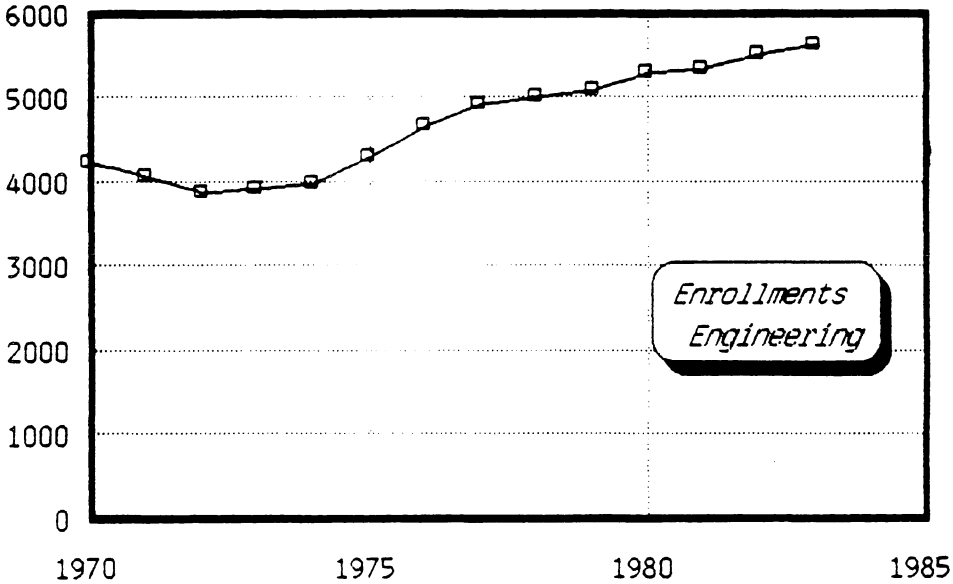

15000
10000
5000
0
Gen Fund $ / Student
Dentistry
Actual
CPI Adjusted
1970
1975
1980
1985

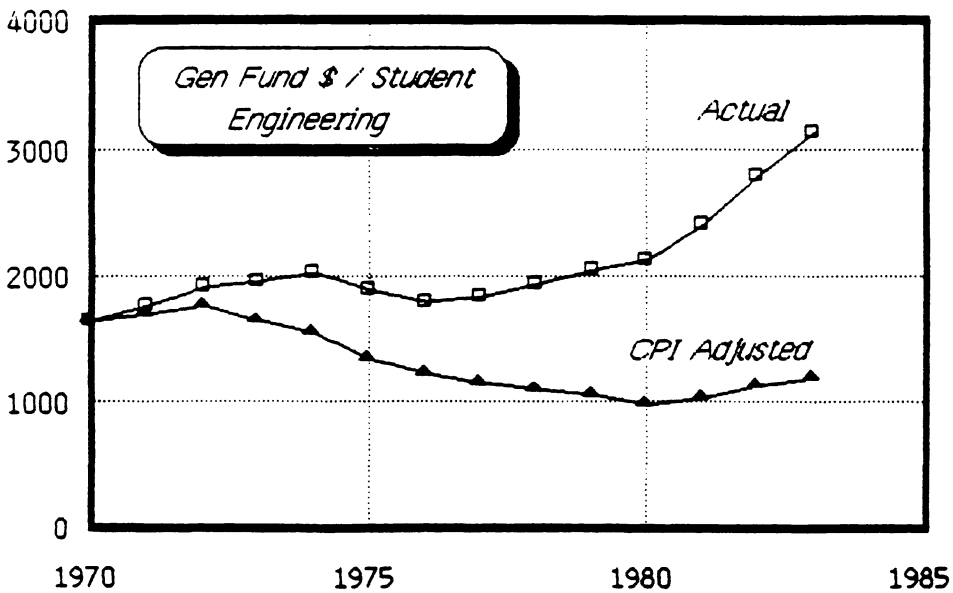

General Fund ($M)
Education
Actual
CPI Adjusted
7
6
5
4
3
2
1
0
1970
1975
1980
1985

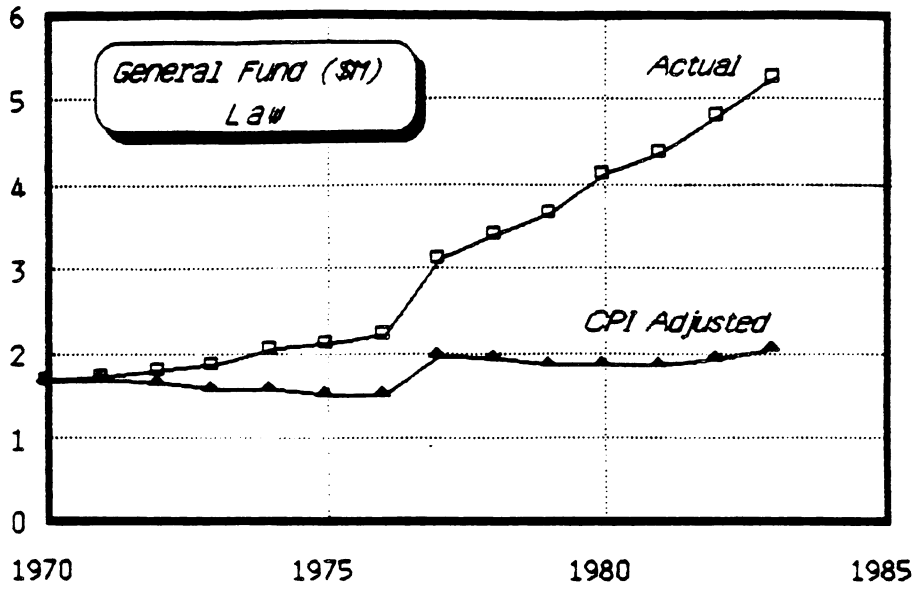

Enrollments
Education
4000
3000
2000
1000
0
1970
1975
1980
1985

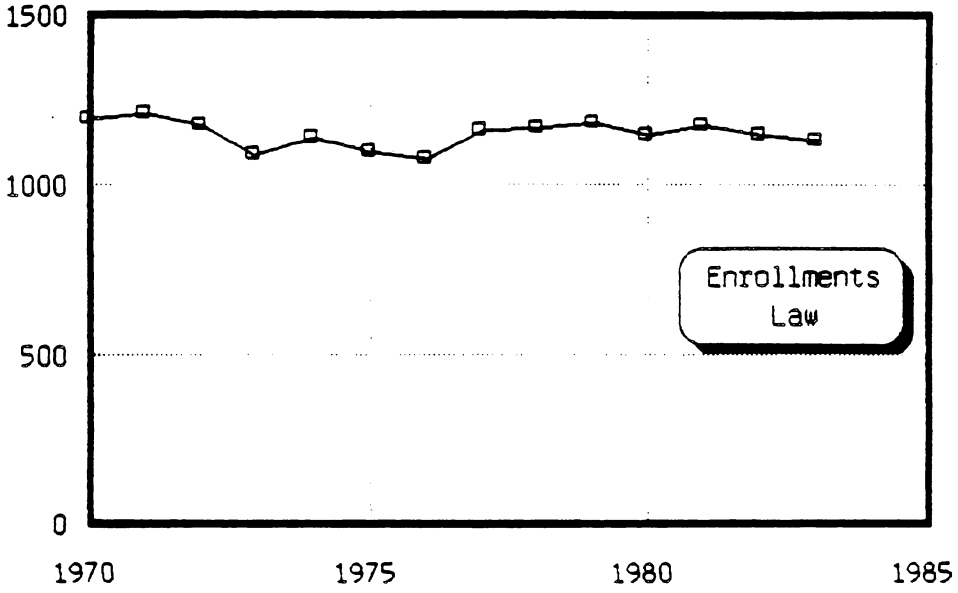

Gen Fund $ / Student
Education
Actual
CPI Adjusted
6000
5000
4000
3000
2000
1000
0
1970
1975
1980
1985

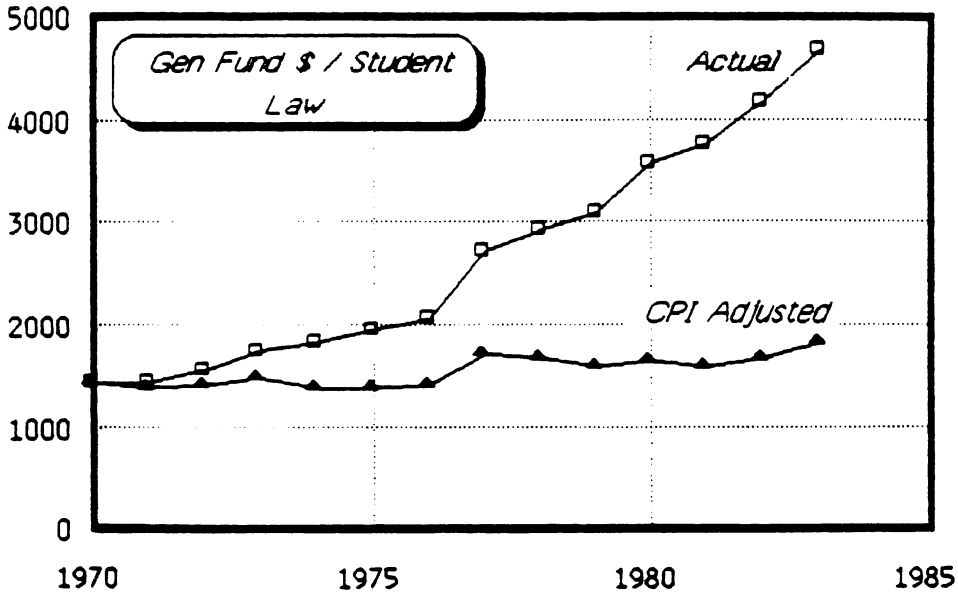

General Fund ($M)
Engineering
Actual
CPI Adjusted
25
20
15
10
5
0
1970
1975
1980
1985

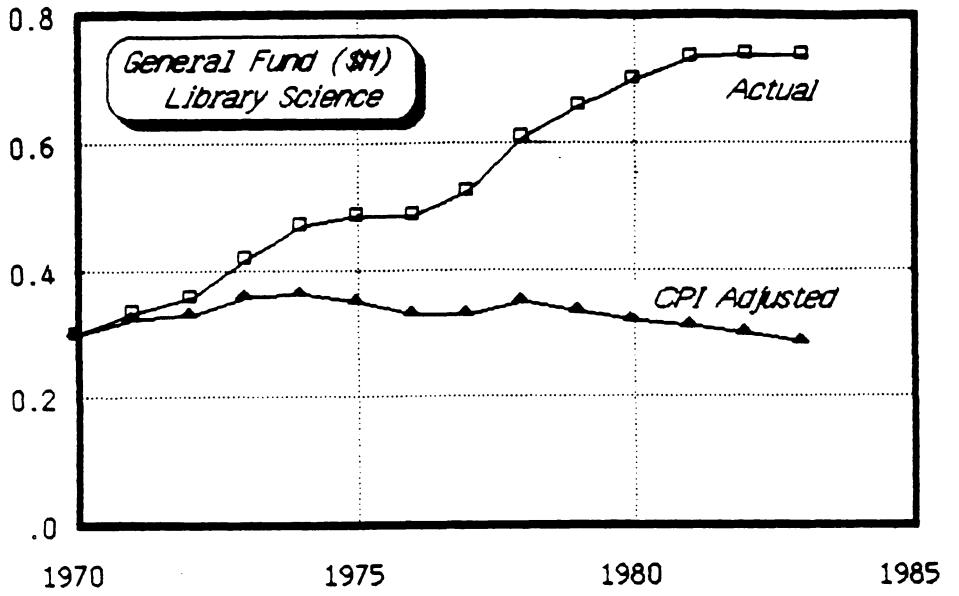

Enrollments
Engineering
6000
5000
4000
3000
2000
1000
0
1970
1975
1980
1985

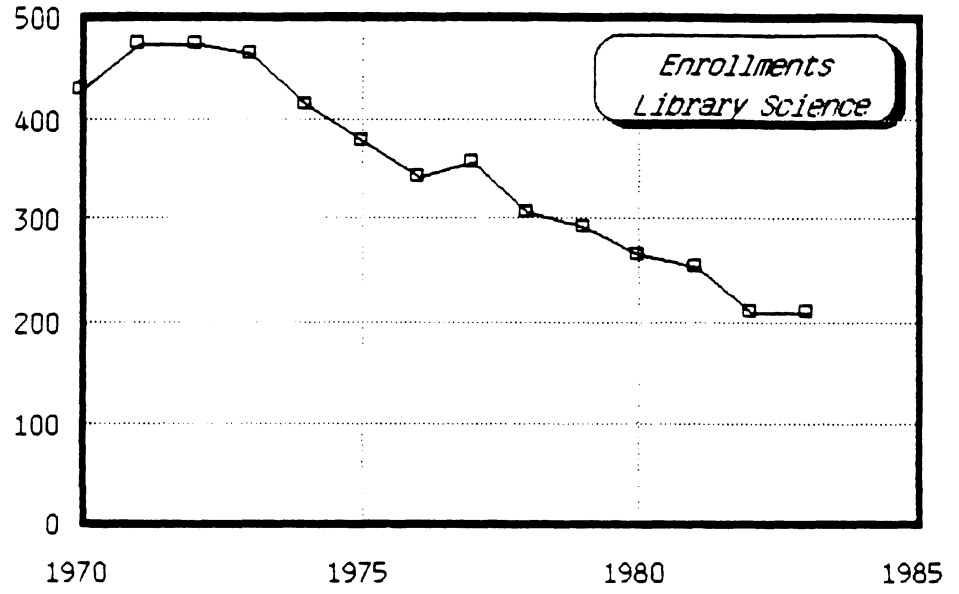

Gen Fund $ / Student
Engineering
Actual
CPI Adjusted
4000
3000
2000
1000
0
1970
1975
1980
1985

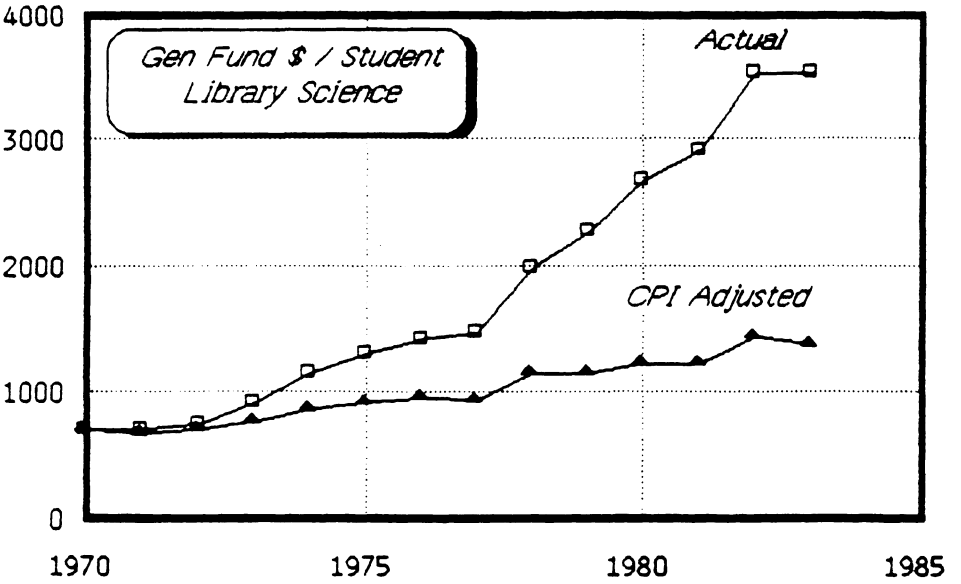

General Fund ($M)
Law
Actual
CPI Adjusted
6
5
4
3
2
1
0
1970
1975
1980
1985

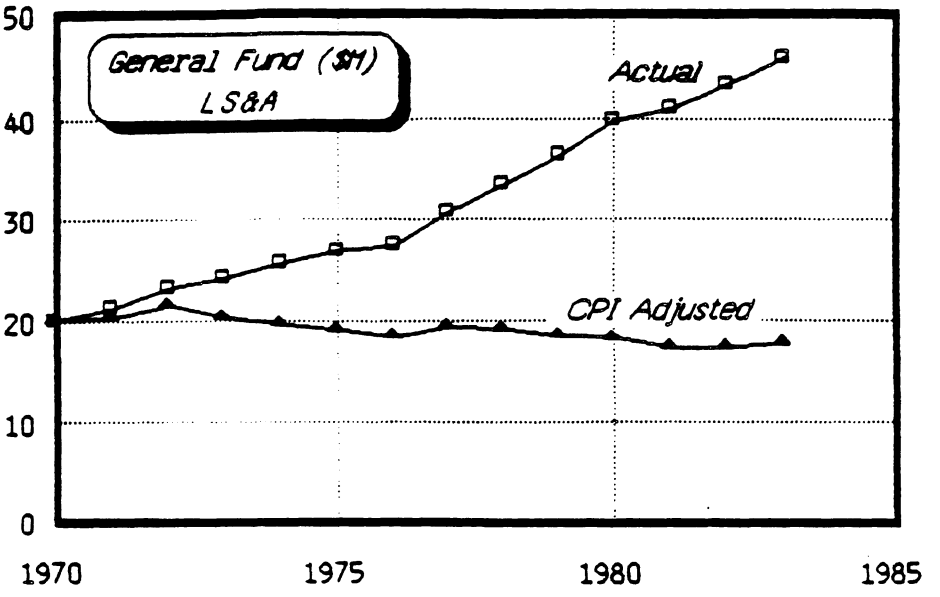

1500
1000
500
0
Enrollments
Law
1970
1975
1980
1985

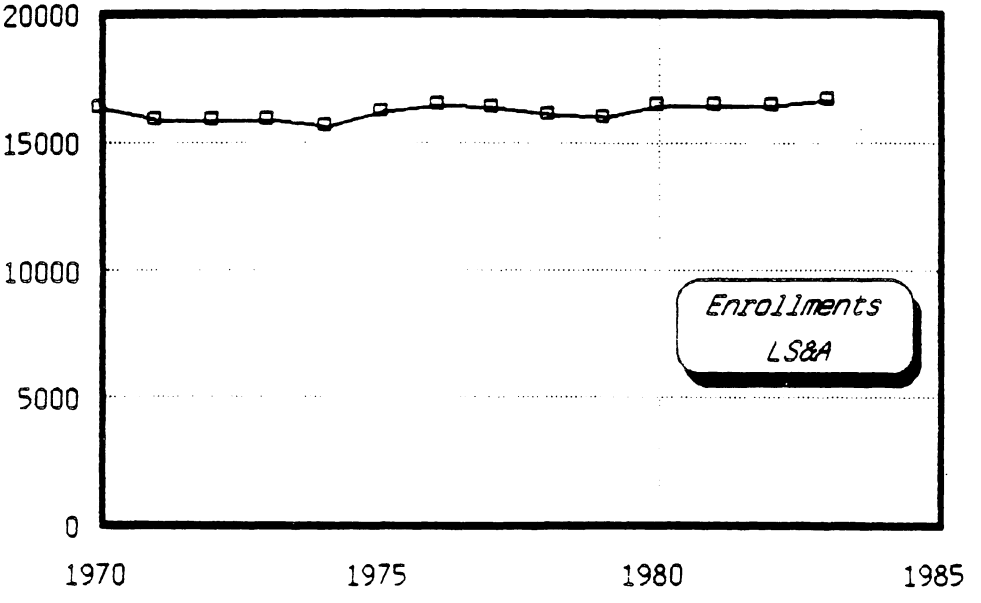

Gen Fund $ / Student
Law
Actual
CPI Adjusted
5000
4000
3000
2000
1000
0
1970
1975
1980
1985

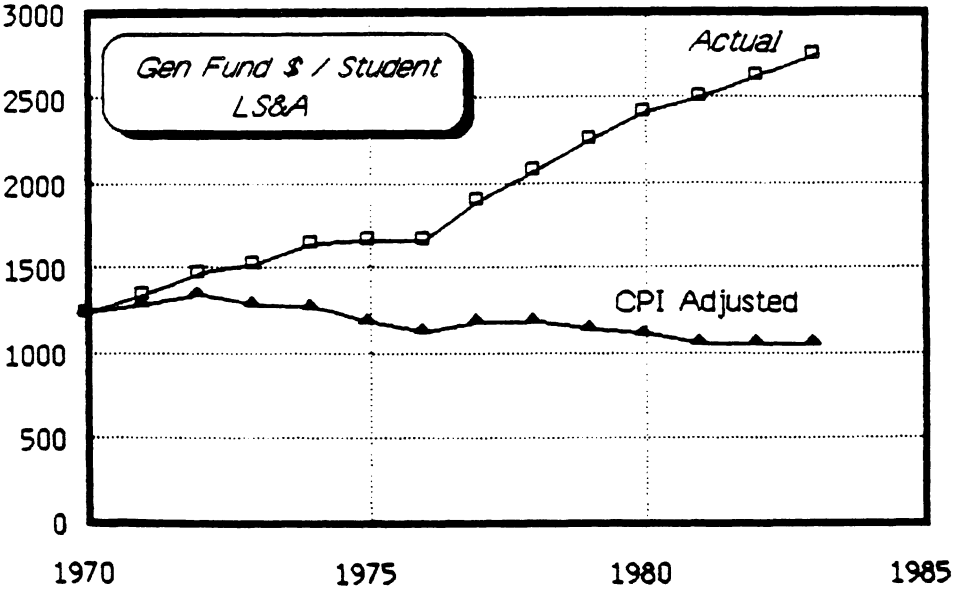

General Fund ($M)
Library Science
Actual
CPI Adjusted
0.8
0.6
0.4
0.2
.0
1970
1975
1980
1985

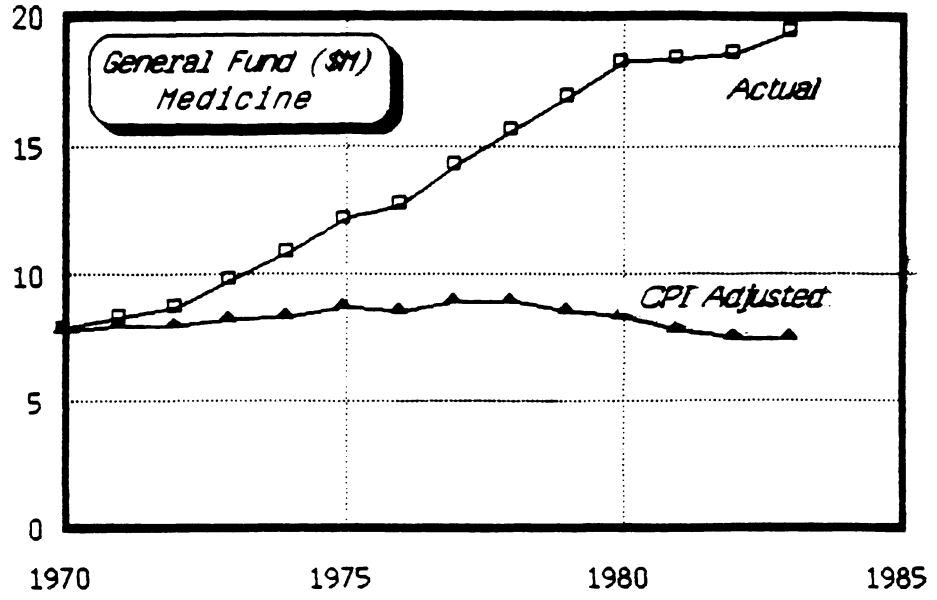

Enrollments
Library Science
500
400
300
200
100
0
1970
1975
1980
1985

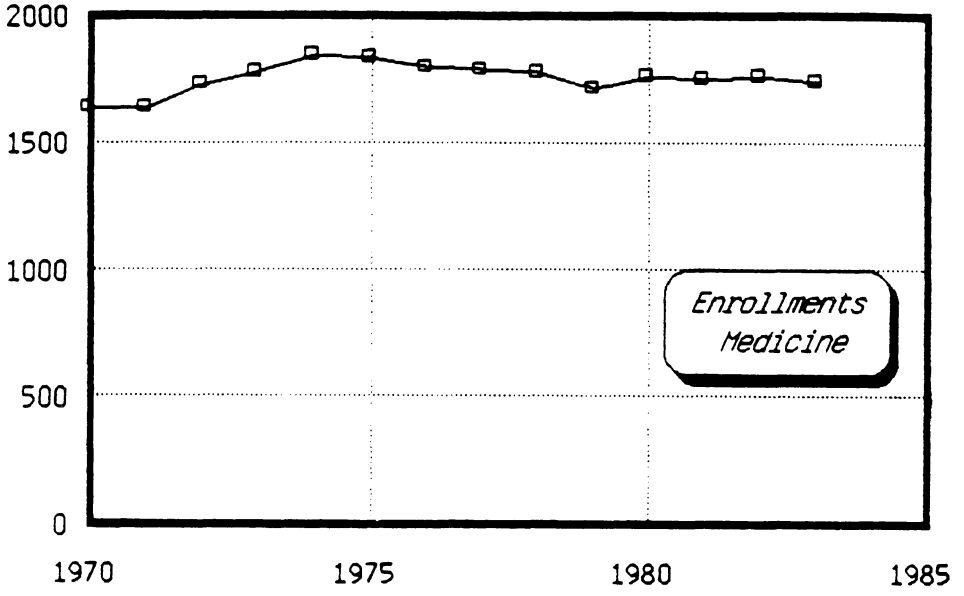

Gen Fund $ / Student
Library Science
Actual
CPI Adjusted
4000
3000
2000
1000
0
1970
1975
1980
1985

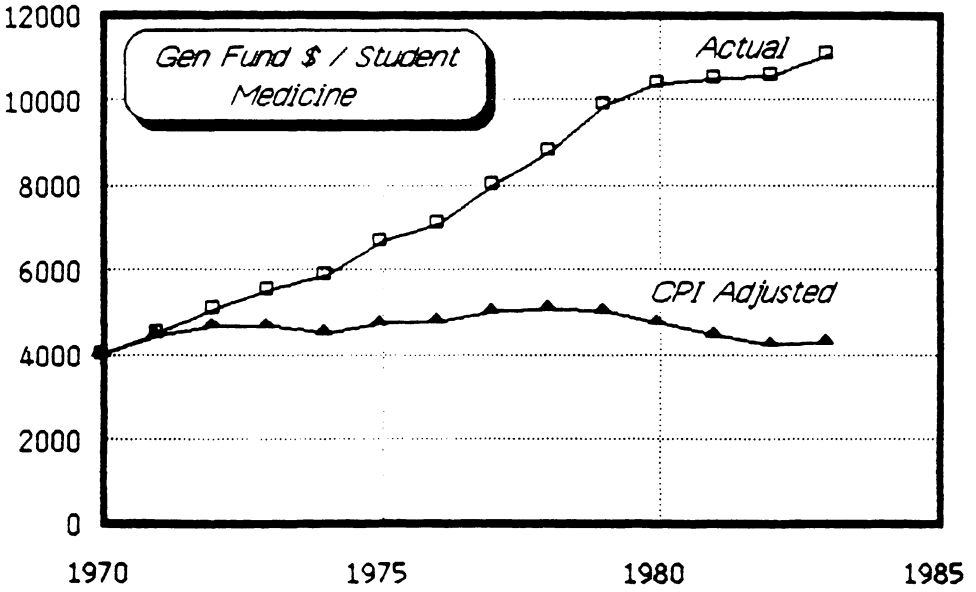

General Fund ($M)
LS&A
Actual
CPI Adjusted
50
40
30
20
10
0
1970
1975
1980
1985

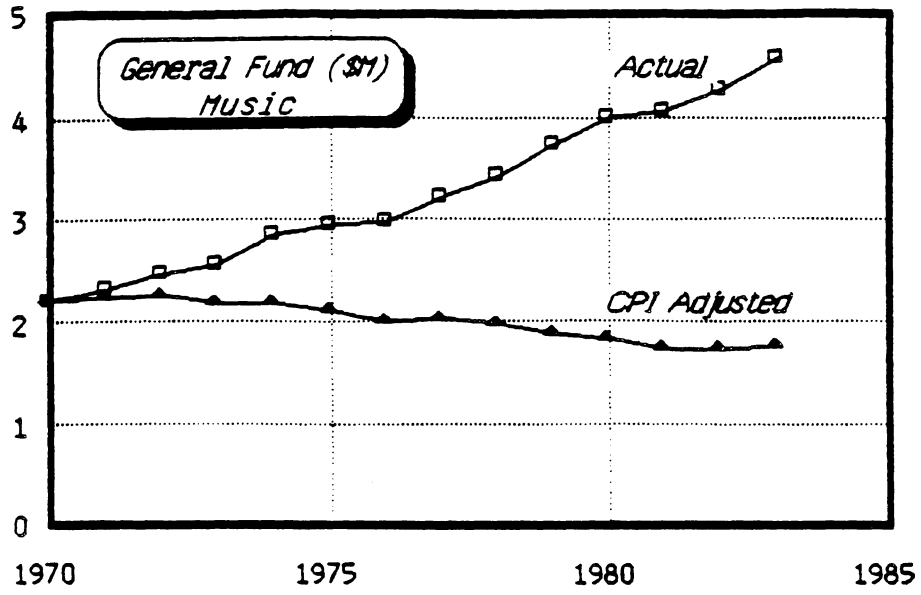

20000
15000
10000
5000
0
Enrollments
LS&A
1970
1975
1980
1985

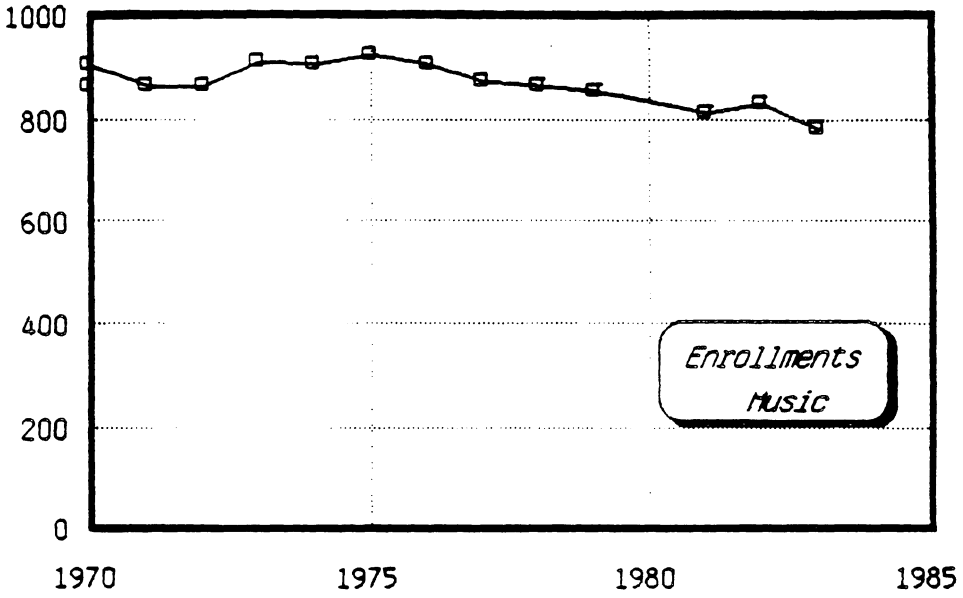

Gen Fund $ / Student
LS&A
Actual
CPI Adjusted
3000
2500
2000
1500
1000
500
0
1970
1975
1980
1985

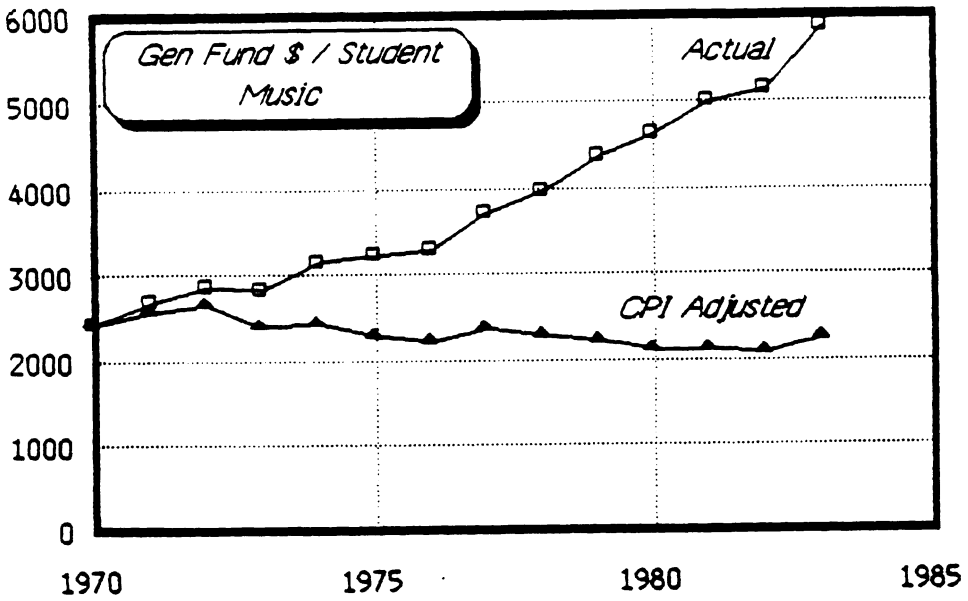

General Fund ($M)
Medicine
Actual
CPI Adjusted
20
15
10
5
0
1970
1975
1980
1985

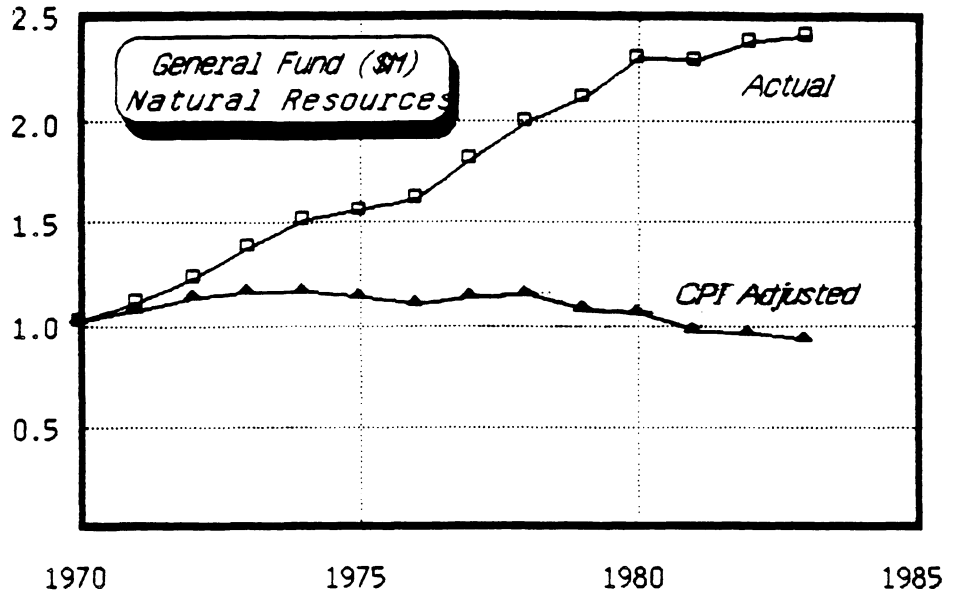

Enrollments
Medicine
2000
1500
1000
500
0
1970
1975
1980
1985

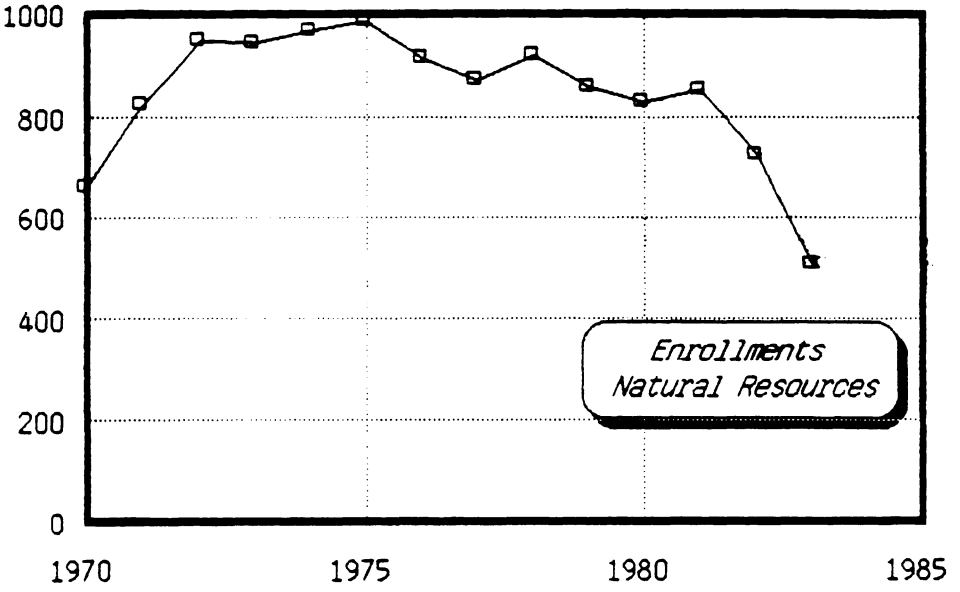

Gen Fund $ / Student
Medicine
Actual
CPI Adjusted
12000
10000
8000
6000
4000
2000
0
1970
1975
1980
1985

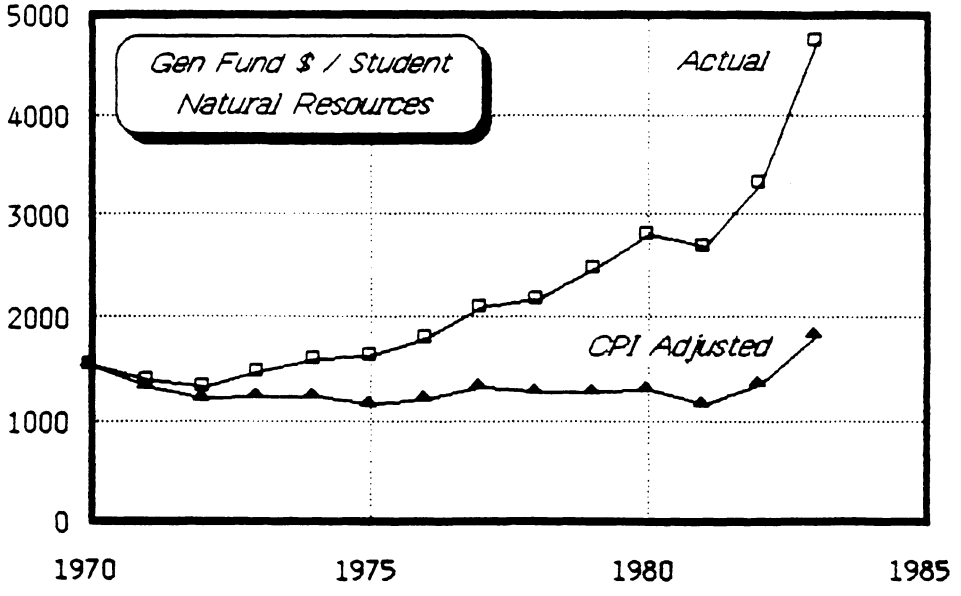

General Fund ($M)
Music
Actual
CPI Adjusted
5
4
3
2
1
0
1970
1975
1980
1985

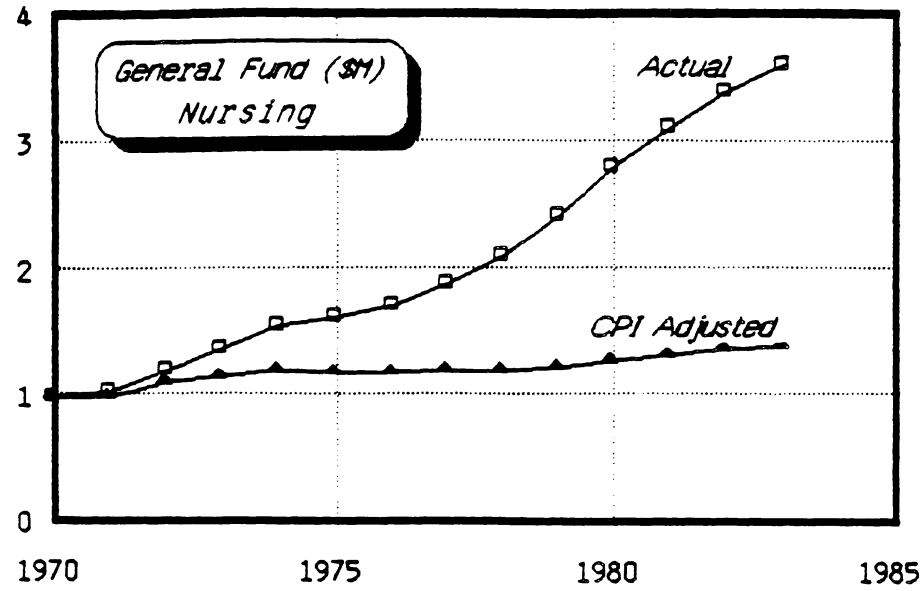

1000
800
600
400
200
0
Enrollments
Music
1970
1975
1980
1985

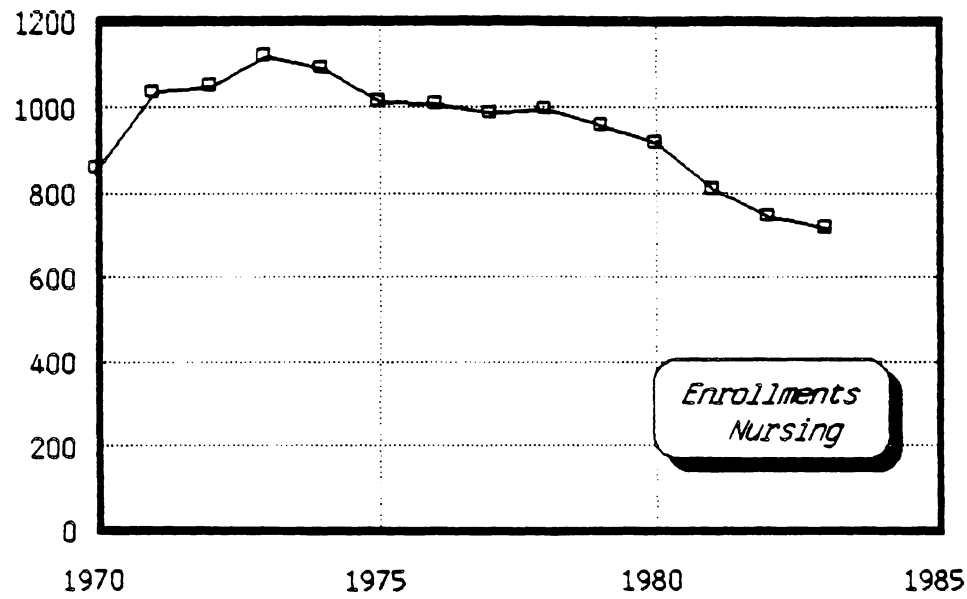

Gen Fund $ / Student
Music
Actual
CPI Adjusted
6000
5000
4000
3000
2000
1000
0
1970
1975
1980
1985

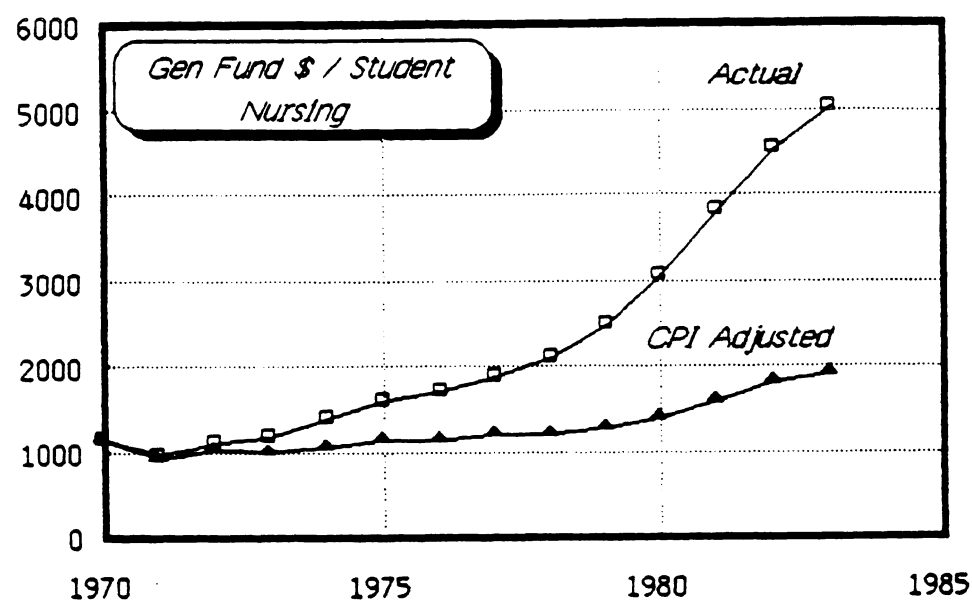

General Fund ($M)
Natural Resources
Actual
CPI Adjusted
2.5
2.0
1.5
1.0
0.5
1970
1975
1980
1985

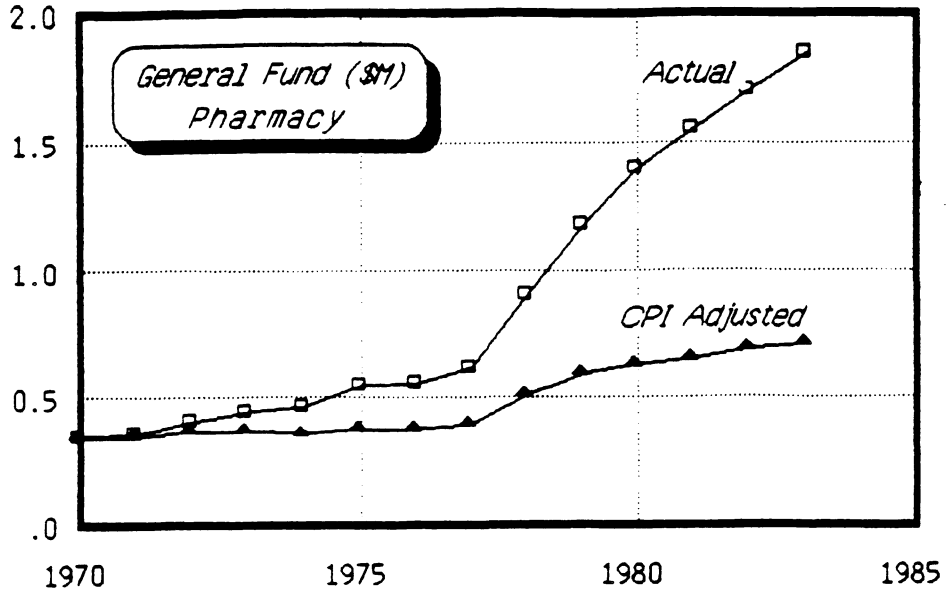

Enrollments
Natural Resources
1000
800
600
400
200
0
1970
1975
1980
1985

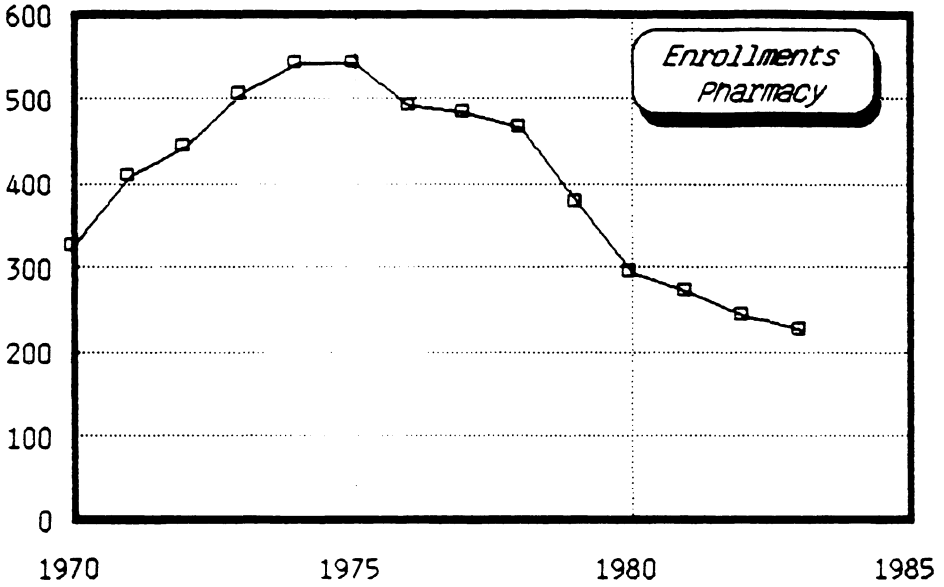

Gen Fund $ / Student
Natural Resources
Actual
CPI Adjusted
5000
4000
3000
2000
1000
0
1970
1975
1980
1985

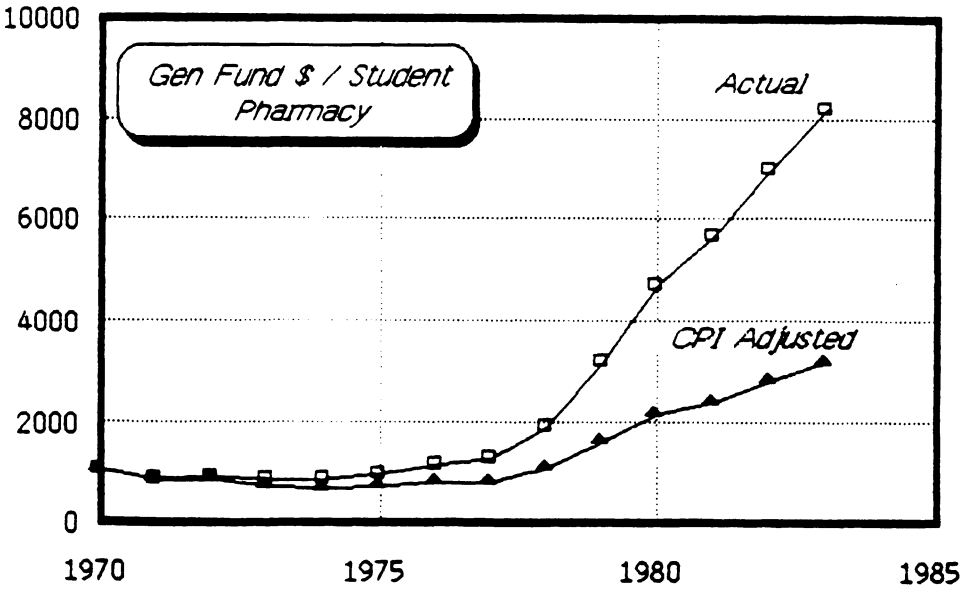

General Fund ($M)
Nursing
Actual
CPI Adjusted
4
3
2
1
0
1970
1975
1980
1985

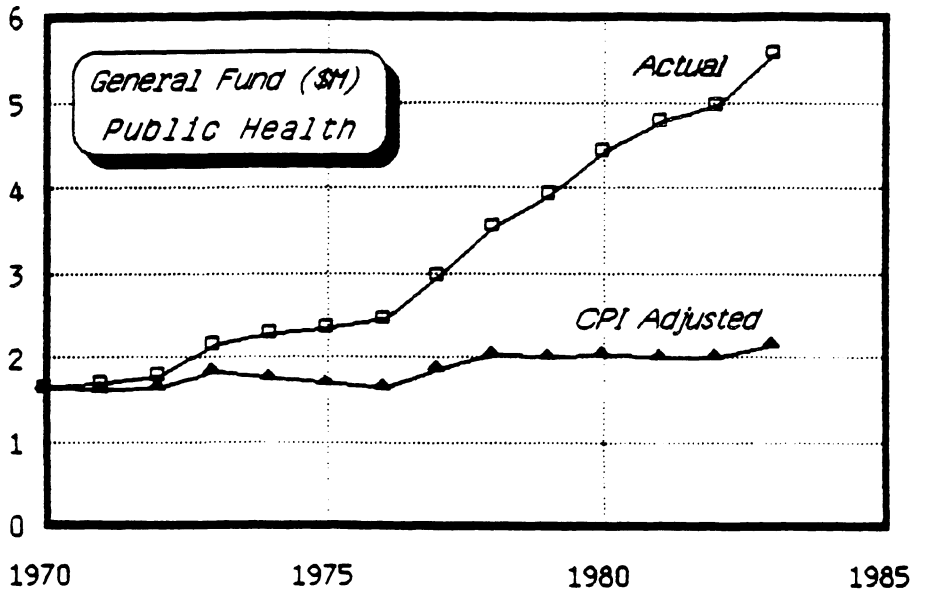

1200
1000
800
600
400
200
0
Enrollments
Nursing
1970
1975
1980
1985

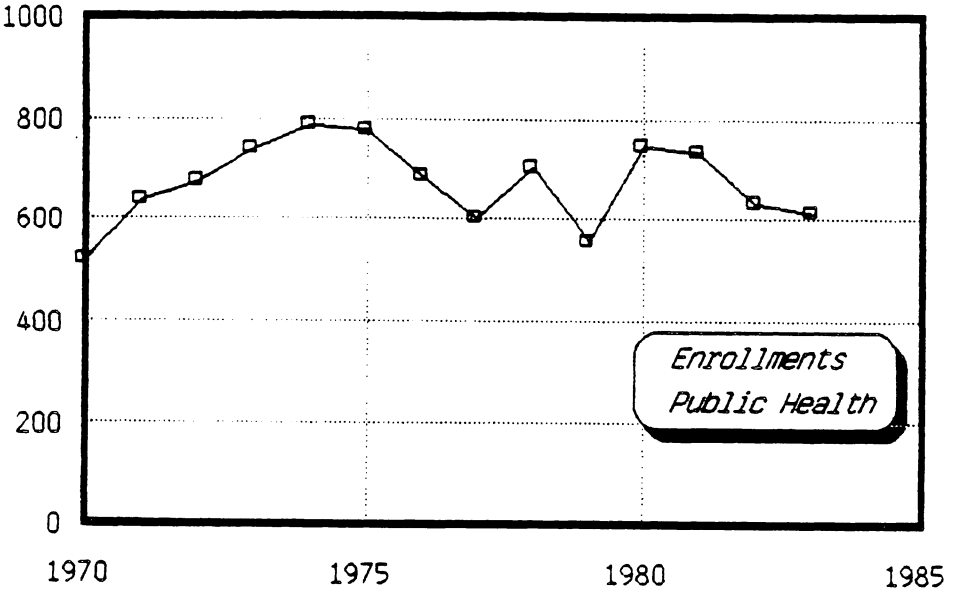

Gen Fund $ / Student
Nursing
Actual
CPI Adjusted
6000
5000
4000
3000
2000
1000
0
1970
1975
1980
1985

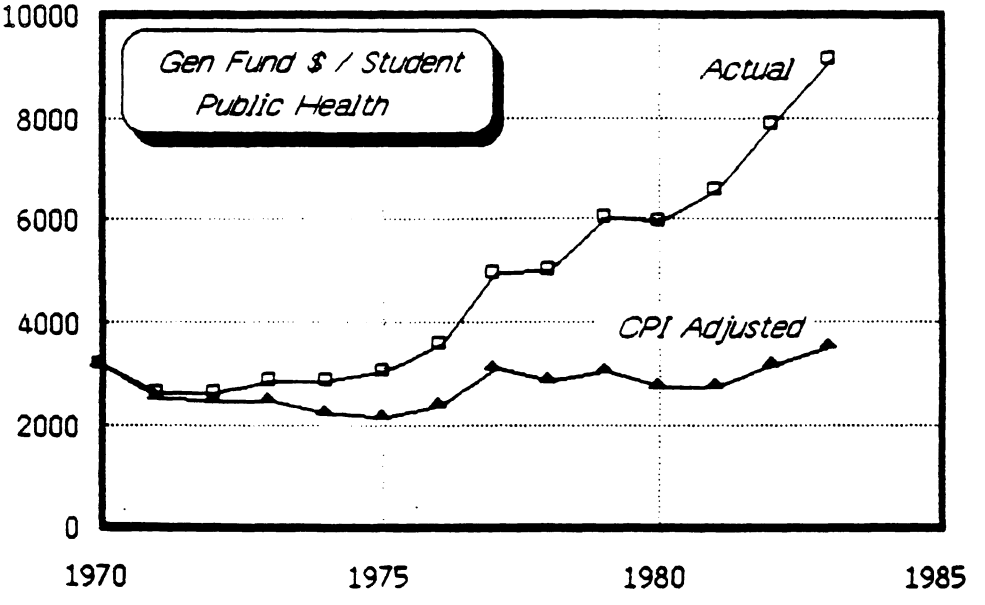

General Fund ($M)
Pharmacy
Actual
CPI Adjusted
2.0
1.5
1.0
0.5
.0
1970
1975
1980
1985

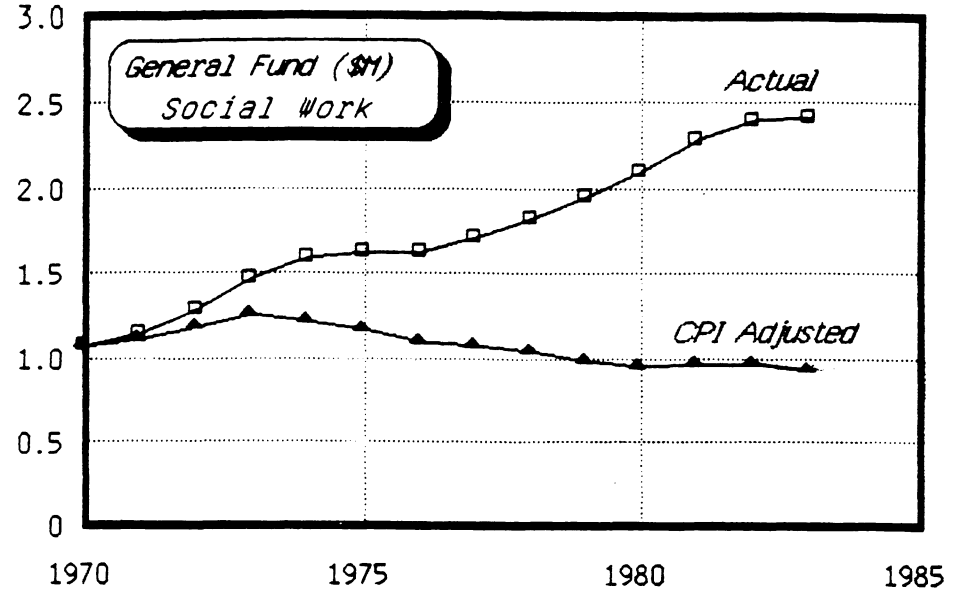

Enrollments
Pharmacy
600
500
400
300
200
100
0
1970
1975
1980
1985

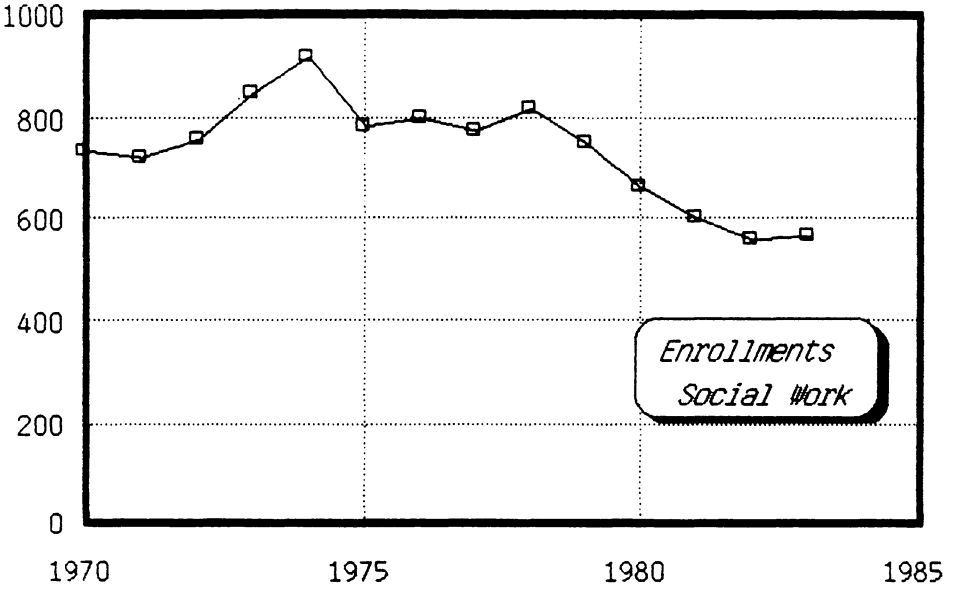

Gen Fund $ / Student
Pharmacy
Actual
CPI Adjusted
10000
8000
6000
4000
2000
0
1970
1975
1980
1985

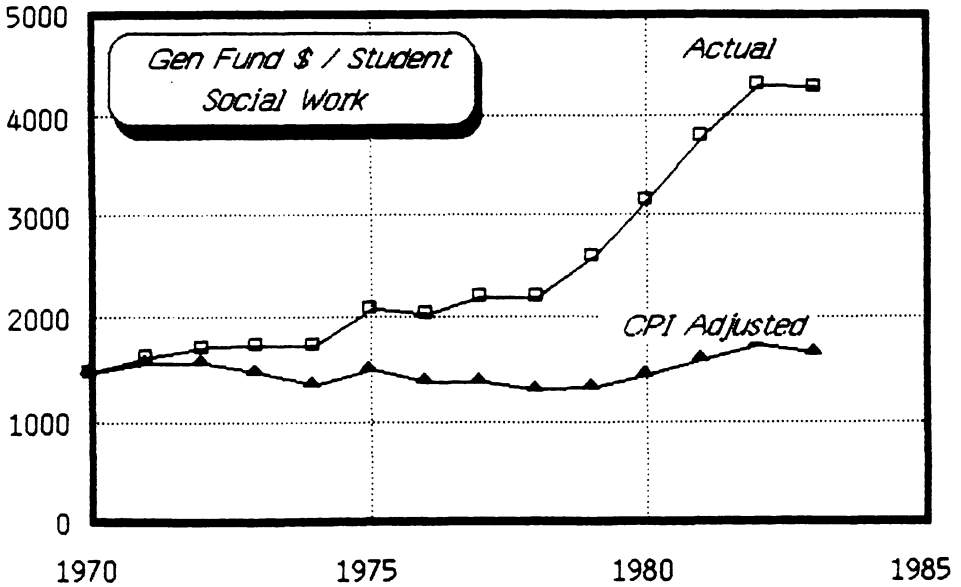

General Fund ($M)
Public Health
Actual
CPI Adjusted
6
5
4
3
2
1
0
1970
1975
1980
1985


1000
800
600
400
200
0
Enrollments
Public Health
1970
1975
1980
1985


10000
8000
6000
4000
2000
0
Gen Fund $ / Student
Public Health
Actual
CPI Adjusted
1970
1975
1980
1985


General Fund ($M)
Social Work
Actual
CPI Adjusted
3.0
2.5
2.0
1.5
1.0
0.5
0
1970
1975
1980
1985


1000
800
600
400
200
0
Enrollments
Social Work
1970
1975
1980
1985


Gen Fund $ / Student
Social Work
Actual
CPI Adjusted
5000
4000
3000
2000
1000
0
1970
1975
1980
1985

GENERAL FUND BUDGET

	69-70	70-71	71-72	72-73	73-74	74-75	75-76	76-77	77-78	78-79	79-80	80-81	81-82	82-83	83-84
ARCH&UP	815,032	855,329	918,948	955,983	985,743	1,141,255	1,160,947	1,180,214	1,269,261	1,374,664	1,494,019	1,630,721	1,712,908	1,841,300	1,959,860
ART	529,464	555,258	572,612	611,542	755,698	901,803	916,464	924,880	1,039,798	1,152,833	1,222,322	1,355,934	1,384,658	1,453,993	1,485,538
BUS AD	1,732,038	1,791,845	1,937,038	2,079,504	2,162,559	2,391,711	2,546,533	2,704,201	3,561,134	3,927,749	4,726,111	5,402,975	5,863,621	6,574,129	7,459,851
DENTISTRY	3,193,855	3,797,388	4,171,748	4,758,309	5,551,008	6,191,188	6,435,921	6,382,933	7,225,212	7,814,990	8,508,224	9,176,927	9,183,811	9,396,535	9,742,143
EDUCATION	2,469,245	2,673,487	2,877,729	2,967,181	3,056,633	3,243,185	3,241,889	3,272,272	3,434,125	3,913,164	4,180,222	5,698,990	5,780,688	5,971,268	5,947,935
ENGIN	6,517,923	6,922,139	7,133,671	7,413,672	7,595,213	8,807,136	8,106,210	8,381,142	8,954,405	9,603,693	10,392,239	11,303,805	13,291,731	15,494,443	17,556,892
LAW	1,598,078	1,705,647	1,737,388	1,809,532	1,875,678	2,051,331	2,114,705	2,223,173	3,129,775	3,488,531	3,651,328	4,183,243	4,378,869	4,783,458	5,258,789
LIB SCI	252,483	301,483	336,887	357,453	428,806	472,530	485,903	485,793	526,333	618,648	656,699	702,866	735,752	748,753	738,486
LS&A	18,758,355	20,143,874	21,252,876	23,228,758	24,179,996	25,706,763	26,839,356	27,365,718	30,843,982	33,335,855	36,193,893	39,674,545	40,926,927	43,170,376	45,798,881
MEDICINE	6,962,388	7,833,469	8,306,886	8,763,546	9,792,882	10,878,561	12,127,498	12,765,785	14,272,322	15,579,868	16,878,721	18,254,976	18,364,134	18,591,713	19,359,125
MUSIC	2,077,611	2,215,481	2,315,185	2,472,648	2,573,862	2,854,317	2,957,683	2,976,662	3,233,896	3,429,139	3,722,151	3,994,762	4,053,177	4,253,476	4,546,289
NAT RES	939,178	1,006,815	1,123,548	1,245,648	1,381,816	1,522,517	1,575,954	1,626,346	1,811,817	1,992,828	2,123,828	2,312,187	2,295,878	2,377,812	2,402,458
NURSING	873,163	974,827	1,028,212	1,191,395	1,353,783	1,549,739	1,635,985	1,723,783	1,895,919	2,102,484	2,417,828	2,797,416	3,086,426	3,376,917	3,593,987
PHARMACY	326,784	346,807	358,360	408,562	448,454	469,358	546,889	564,586	626,488	987,117	1,179,773	1,393,895	1,546,811	1,788,632	1,851,863
PUB HLTH	1,589,316	1,652,861	1,682,861	1,791,531	2,147,258	2,285,884	2,355,488	2,467,145	2,960,738	3,526,448	3,949,252	4,448,646	4,792,889	4,974,184	5,576,653
SOC WK	928,723	1,072,859	1,156,874	1,286,029	1,473,954	1,589,871	1,622,294	1,628,984	1,712,831	1,816,385	1,951,426	2,088,783	2,282,127	2,402,868	2,412,263
TOTAL	49,554,676	53,847,889	56,988,167	61,333,277	65,745,735	71,255,469	74,676,839	76,665,529	86,496,348	94,486,772	103,248,828	114,330,991	119600883	127110169	135601533

GENERAL FUND (Adjusted by CPI)

ARCH&UP	855,329	885,306	879,469	833,962	877,888	837,355	796,983	800,291	798,946	761,898	746,325	724,887	743,960	757,857
ART	555,258	551,649	562,596	639,338	693,879	656,493	624,497	655,618	663,318	622,681	620,565	552,119	587,472	574,676
BUS AD	1,791,845	1,866,118	1,913,067	1,829,576	1,839,778	1,824,164	1,825,929	2,245,356	2,259,925	2,407,596	2,472,757	2,481,431	2,656,214	2,885,022
DENTISTRY	3,797,388	4,019,025	4,377,469	4,696,284	4,762,452	4,618,259	4,389,888	4,555,619	4,496,542	4,334,296	4,199,967	3,886,167	3,796,588	3,768,798
EDUCATION	2,673,487	2,772,379	2,729,697	2,585,984	2,494,696	2,322,278	2,209,502	2,165,274	2,251,533	2,129,587	2,688,233	2,446,334	2,412,634	2,388,942
ENGIN	6,922,139	6,872,515	6,828,385	6,425,738	6,159,335	5,806,741	5,659,118	5,645,985	5,525,715	5,294,868	5,173,366	5,625,786	6,268,381	6,791,525
LAW	1,705,647	1,673,776	1,664,783	1,586,868	1,577,947	1,514,832	1,501,138	1,973,376	1,956,577	1,868,871	1,877,914	1,853,897	1,932,718	2,031,253
LIB SCI	301,483	323,706	328,844	356,812	363,485	348,868	328,817	331,862	351,346	334,538	321,312	311,364	299,294	285,681
LS&A	20,143,874	20,474,832	21,362,243	20,456,849	19,774,433	19,225,988	18,477,868	19,447,656	19,188,124	18,438,858	18,157,686	17,319,981	17,442,576	17,717,169
MEDICINE	7,833,469	8,001,933	8,862,148	8,284,333	8,368,124	8,687,319	8,619,786	8,998,942	8,964,251	8,598,431	8,354,688	7,771,534	7,511,883	7,488,023
MUSIC	2,215,481	2,230,352	2,274,738	2,177,548	2,195,628	2,118,684	2,089,988	2,038,522	1,973,037	1,896,154	1,828,266	1,715,267	1,718,576	1,758,719
NAT RES	1,006,815	1,002,416	1,145,943	1,168,372	1,171,167	1,128,987	1,098,148	1,142,381	1,146,157	1,081,926	1,058,289	971,591	968,489	929,384
NURSING	974,827	998,578	1,096,848	1,145,332	1,192,187	1,171,989	1,163,932	1,195,489	1,209,715	1,231,788	1,288,282	1,386,147	1,364,411	1,398,293
PHARMACY	346,807	345,241	375,862	372,635	361,845	391,181	381,165	394,956	521,932	601,885	637,572	654,258	698,356	716,188
PUB HLTH	1,652,861	1,621,253	1,648,143	1,816,624	1,757,757	1,687,255	1,665,864	1,866,796	2,029,822	2,011,845	2,032,332	2,028,387	2,089,739	2,157,313
SOC WK	1,072,859	1,113,751	1,183,899	1,247,888	1,222,978	1,162,182	1,094,528	1,079,465	1,045,181	994,184	955,928	965,775	978,529	933,177
TOTAL	53,847,889	54,824,824	56,424,358	55,622,449	54,811,899	53,493,438	51,766,856	54,537,428	54,365,231	52,597,856	52,325,396	50,613,967	51,357,644	52,488,021

ENROLLMENT

ARCH&UP	457	427	485	488	481	459	451	441	471	503	507	494	505	469
ART	507	488	460	449	462	446	442	453	488	489	577	581	597	539
BUS AD	1163	1302	1411	1456	1629	1719	1691	1799	1988	2038	2052	2173	2258	2225
DENTISTRY	679	748	798	831	854	874	874	882	867	874	858	805	774	723
EDUCATION	3527	3491	3322	3340	3359	3327	2758	2577	2362	2066	1753	1494	1164	1094
ENGIN	4221	4042	3861	3982	3956	4299	4654	4898	4995	5065	5311	5495	5538	5642
LAW	1185	1207	1178	1082	1133	1093	1075	1153	1161	1176	1146	1171	1145	1122
LIB SCI	438	474	474	465	415	379	342	358	387	291	264	254	218	218
LS&A	16299	15826	15825	15874	15555	16167	16392	16337	16084	16019	16418	16377	16411	16628
MEDICINE	1934	1631	1726	1771	1844	1838	1799	1783	1771	1711	1757	1748	1761	1743
MUSIC	905	864	861	909	903	923	905	867	864	851	864	889	827	778
NAT RES	662	819	944	939	962	988	912	868	917	858	829	853	718	589
NURSING	856	1035	1052	1125	1096	1017	1005	987	991	959	912	887	744	712
PHARMACY	326	489	443	504	544	543	498	483	464	375	296	272	245	227
PUB HLTH	517	638	674	748	789	777	686	681	704	656	742	734	633	613
SOC WK	731	721	758	847	915	788	808	776	817	758	663	684	568	567
RACKHAM	318	423	436	515	529	722	714	699	733	758	755	731	768	689
TOTALS	34789	34537	34628	35149	35346	36335	35998	35954	35824	35423	35696	35482	34858	34482

GENERAL FUND $ PER ENROLLED STUDENT

ARCH&UP	1,872	2,152	2,360	2464	2846	2547	2617	2878	2919	2978	3216	3467	3646	4177
ART	1,095	1,193	1,329	1683	1958	2055	2092	2295	2826	2508	2358	2246	2435	2756
BUS AD	1,541	1,488	1,474	1485	1468	1481	1599	1988	2859	2328	2633	2698	2911	3353
DENTISTRY	5,593	5,577	5,963	6688	7250	7364	7303	8192	9014	9735	10696	11487	12140	13475
EDUCATION	758	824	893	915	965	974	1186	1333	1657	2023	3251	3869	5130	5437
ENGIN	1,640	1,765	1,920	1946	2024	1886	1801	1831	1923	2052	2128	2419	2798	3112
LAW	1,439	1,439	1,547	1734	1811	1935	2068	2714	2929	3185	3588	3719	4178	4680
LIB SCI	701	709	754	905	1139	1282	1420	1478	1989	2257	2659	2897	3527	3517
LSA	1,236	1,343	1,467	1523	1553	1660	1669	1888	2073	2259	2418	2499	2631	2756
MEDICINE	4,058	5,093	5,077	5529	5899	6627	7096	8005	8797	9865	10390	10506	10557	11107
MUSIC	2,448	2,688	2,872	2832	3161	3284	3289	3729	3969	4374	4624	5018	5143	5844
NAT RES	1,520	1,372	1,320	1471	1583	1688	1783	2087	2172	2475	2789	2692	3311	4728
NURSING	1,138	993	1,133	1283	1414	1689	1715	1921	2122	2521	3067	3825	4539	5048
PHARMACY	1,064	876	922	874	863	1086	1152	1297	1955	3146	4706	5684	6974	8158
PUB HLTH	3,197	2,638	2,658	2902	2896	3831	3596	4926	5809	6020	5985	6530	7858	9097
SOC WK	1,467	1,603	1,697	1740	1738	2088	2026	2206	2223	2602	3150	3778	4289	4254
	1,551	1,648	1,772	1,878	2,016	2,055	2,130	2,406	2,638	2,915	3,203	3,378	3,647	3,935
CPI	1	1.038	1.087	1.182	1.3	1.396	1.481	1.586	1.738	1.963	2.185	2.363	2.475	2.585

GENERAL FUND DOLLARS PER ENROLLED STUDENT (DEFLATED BY CPI)

ARCH&UP	1,872	2,073	2,172	2,085	2,189	1,824	1,767	1,815	1,679	1,513	1,472	1,467	1,473	1,616
ART	1,095	1,149	1,223	1,424	1,508	1,272	1,413	1,447	1,626	1,273	1,076	950	984	1,066
BUS AD	1,541	1,433	1,356	1,257	1,129	1,061	1,088	1,268	1,184	1,186	1,205	1,142	1,176	1,297
DENTISTRY	5,593	5,373	5,486	5,651	5,577	5,275	4,931	5,165	5,186	4,959	4,895	4,828	4,985	5,213
EDUCATION	758	794	822	774	743	698	801	848	953	1,031	1,488	1,637	2,073	2,183
ENGINEERING	1,640	1,708	1,766	1,647	1,557	1,351	1,216	1,155	1,106	1,045	974	1,024	1,130	1,284
LAW	1,439	1,387	1,423	1,467	1,393	1,386	1,396	1,712	1,685	1,582	1,639	1,582	1,688	1,810
LIB SCI	701	683	694	766	876	918	959	927	1,144	1,150	1,217	1,226	1,425	1,360
LBA	1,236	1,294	1,358	1,289	1,271	1,189	1,127	1,190	1,192	1,151	1,107	1,058	1,063	1,066
MEDICINE	4,058	4,906	4,671	4,678	4,538	4,747	4,791	5,047	5,062	5,025	4,755	4,446	4,266	4,297
MUSIC	2,448	2,581	2,642	2,396	2,431	2,295	2,221	2,351	2,284	2,228	2,116	2,120	2,078	2,261
NATRES	1,520	1,322	1,214	1,244	1,217	1,152	1,204	1,316	1,250	1,261	1,276	1,139	1,338	1,826
NURSING	1,138	957	1,042	1,018	1,088	1,152	1,158	1,211	1,221	1,284	1,404	1,619	1,834	1,953
PHARMACY	1,064	844	848	739	664	720	778	818	1,125	1,603	2,154	2,405	2,818	3,156
PUB HEALTH	3,197	2,541	2,485	2,455	2,228	2,171	2,428	3,106	2,882	3,067	2,739	2,763	3,175	3,519
SOC WORK	1,467	1,545	1,561	1,472	1,337	1,498	1,368	1,391	1,279	1,325	1,442	1,599	1,733	1,646
	1.5	1,587	1,630	1,582	1,551	1,472	1,438	1,517	1,518	1,485	1,466	1,430	1,473	1,522

Comparative Enrollment Statistics
of
Schools and Colleges

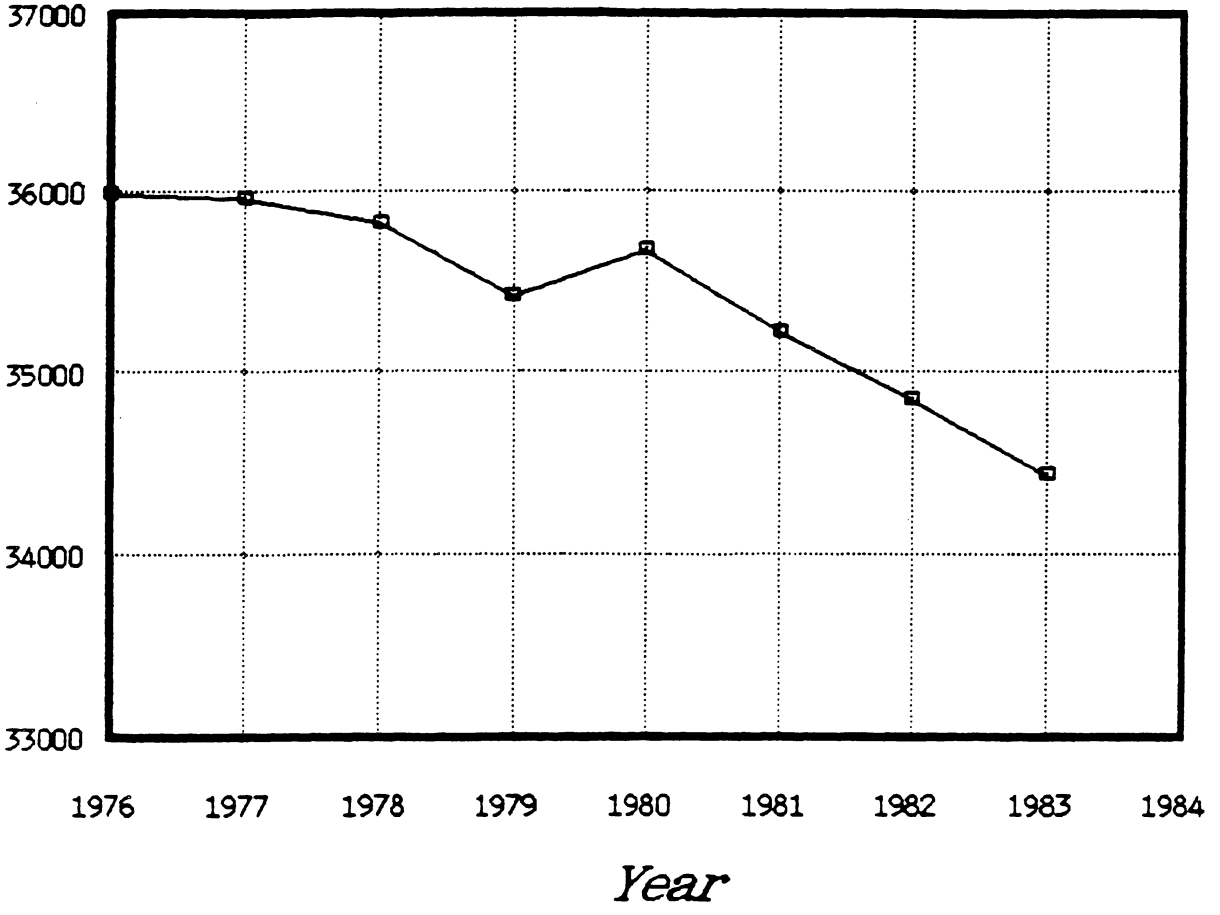
COMPARATIVE UNIVERSITY ENROLLMENT TRENDS

FIGURES:

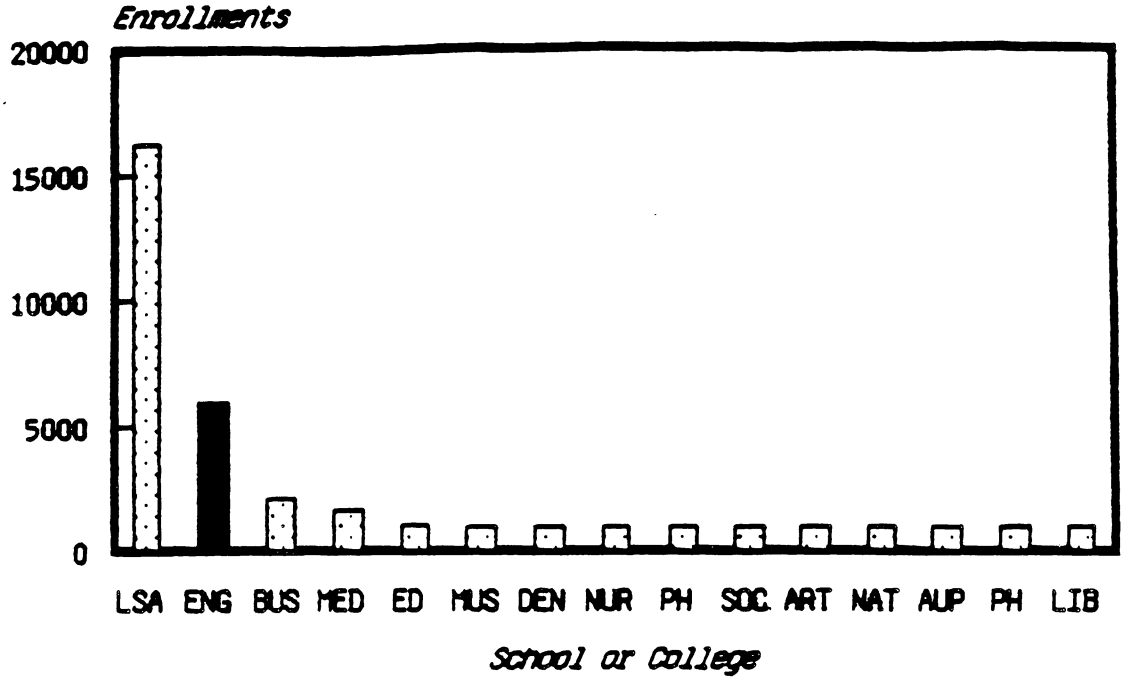
- Enrollment Decline at UM-Ann Arbor
- Comparison of UM Unit Enrollments in Fall-1983
- Some Enrollment Comparisons
- Absolute Enrollment Changes
- Percentage Enrollment Changes
- Enrollment Gains and Losses
- Graduate Enrollment and PhD Distributions
- School and College Enrollment Trends

Enrollments

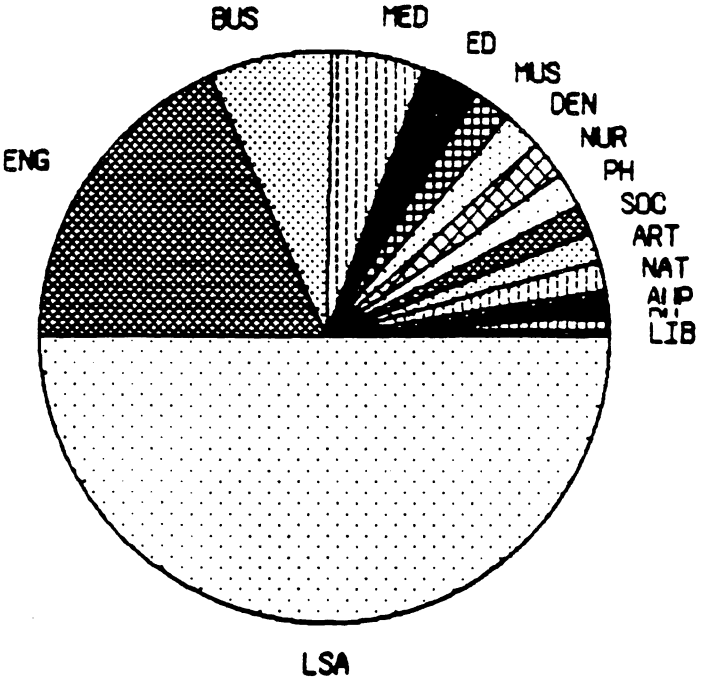
University of Michigan - Ann Arbor



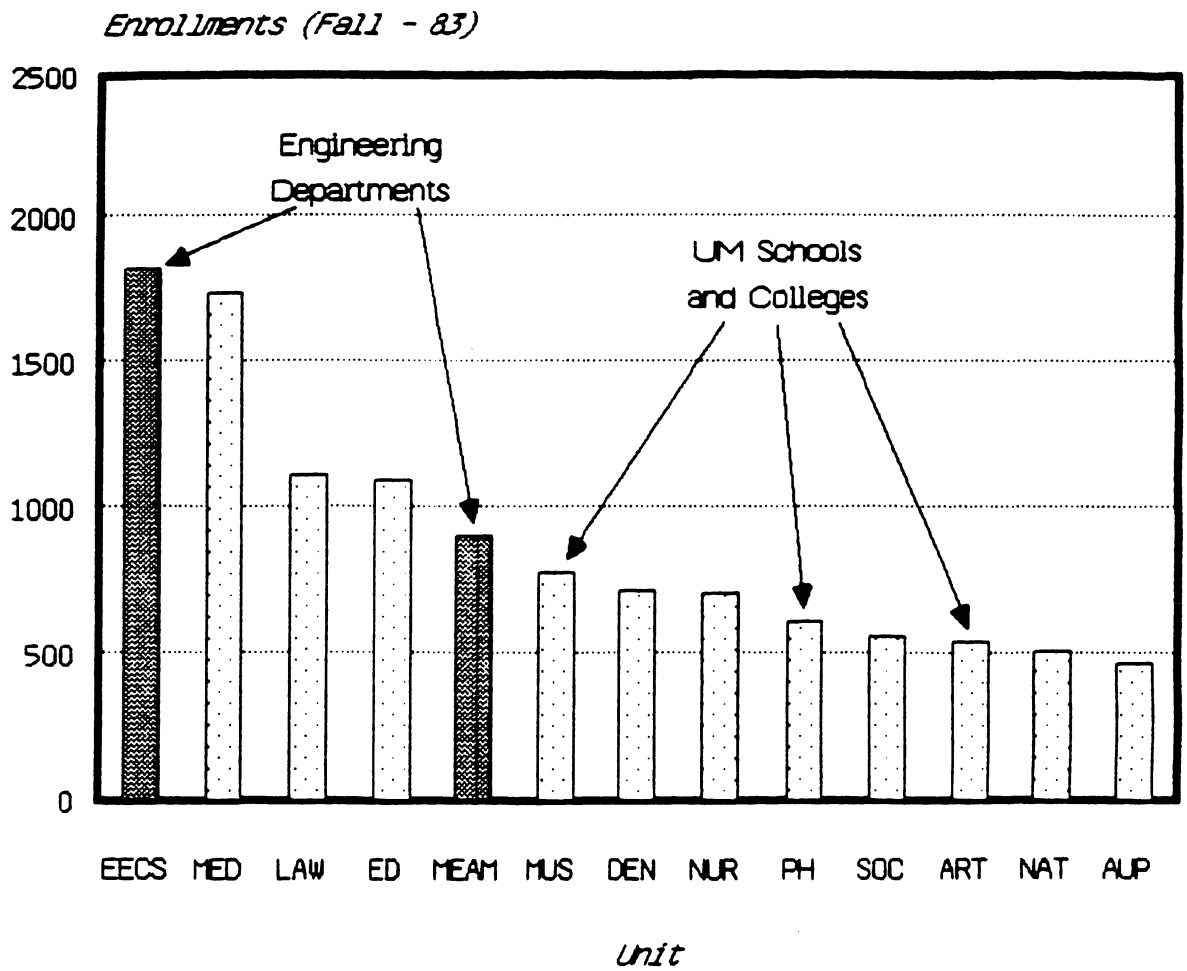
UM Unit Enrollments — Fall 1983



UM Unit Enrollments -- Fall 1983

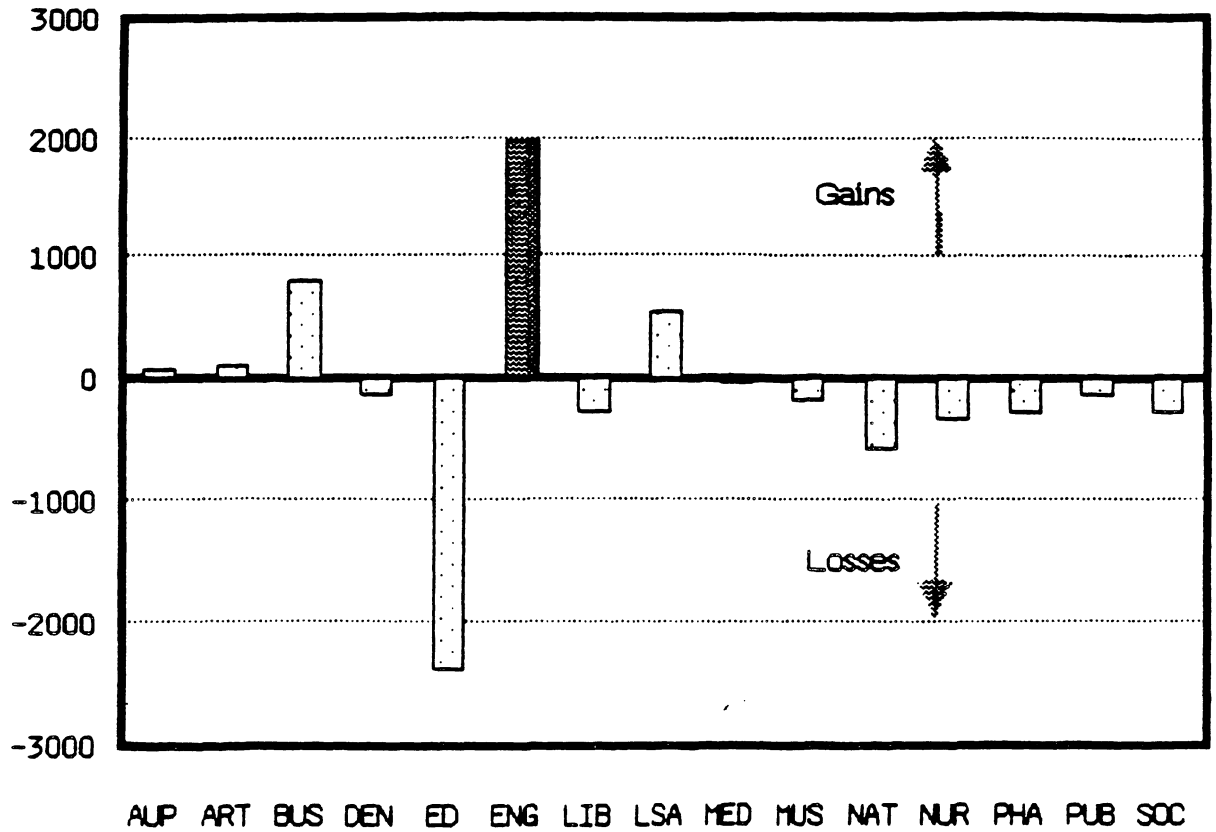


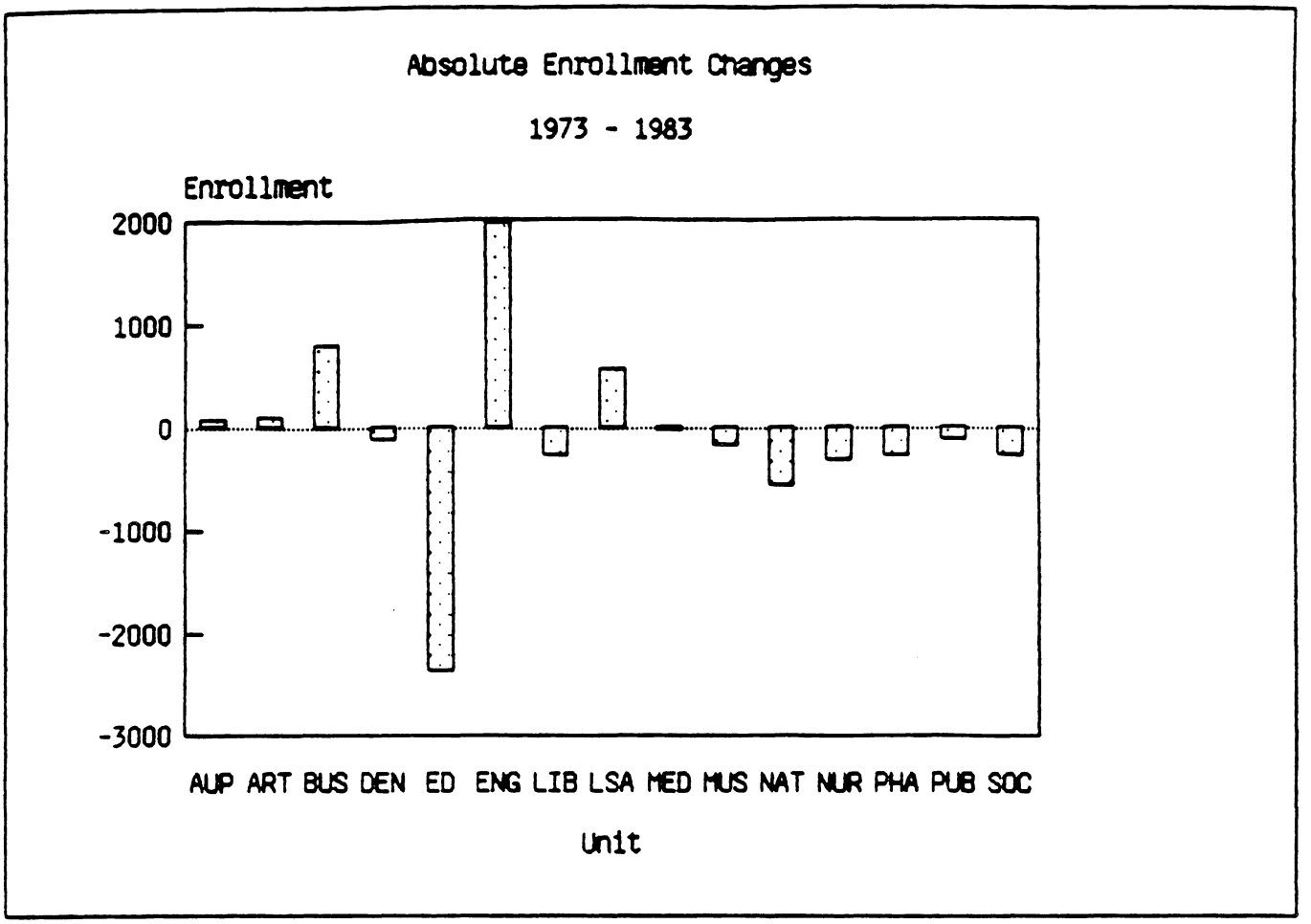
Some Enrollment Comparisons

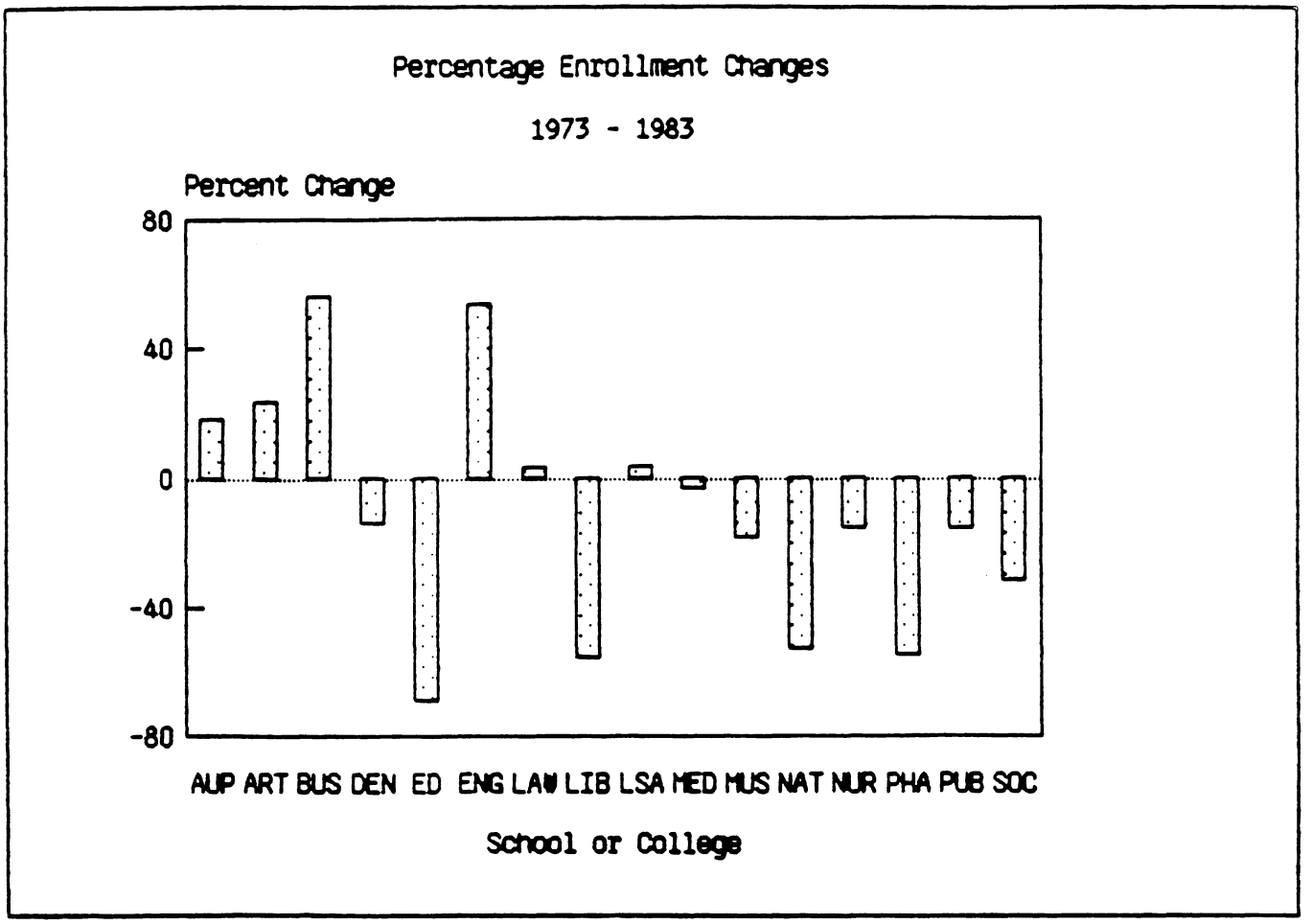


Absolute Enrollment Changes

1973 - 1983

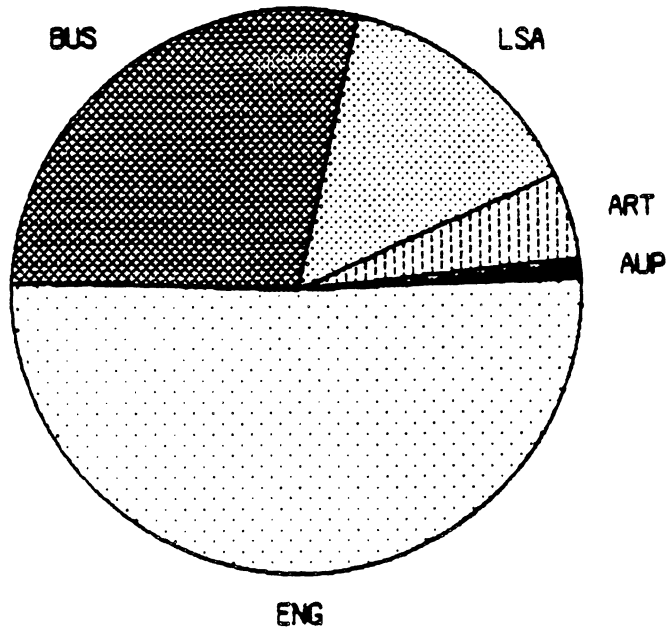



Absolute Enrollment Changes
1973 - 1983
Enrollment
2000
1000
0
-1000
-2000
-3000
AUP ART BUS DEN ED ENG LIB LSA MED MUS NAT NUR PHA PUB SOC
Unit


Percentage Enrollment Changes
1973 - 1983
Percent Change
80
40
0
-40
-80
AUP ART BUS DEN ED ENG LAW LIB LSA MED MUS NAT NUR PHA PUB SOC
School or College

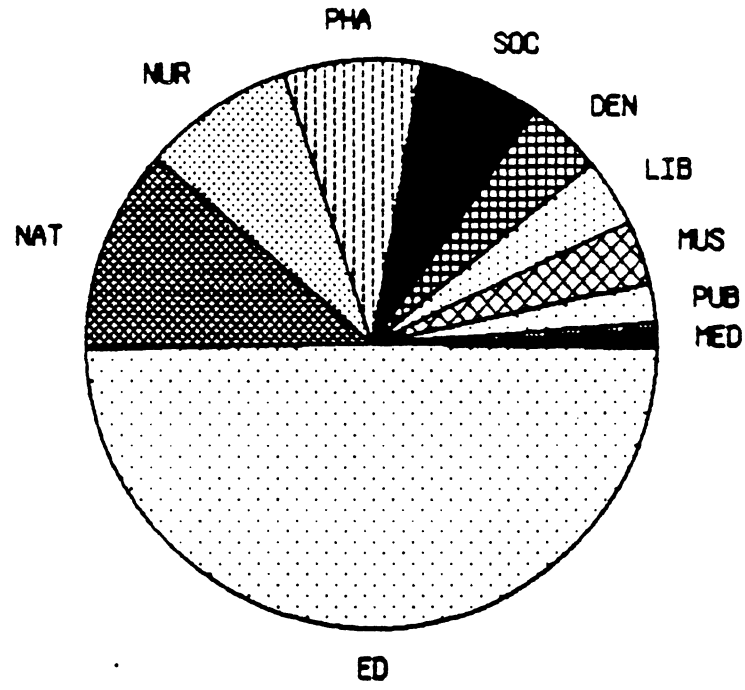
Enrollment Gains

1976 - 1983

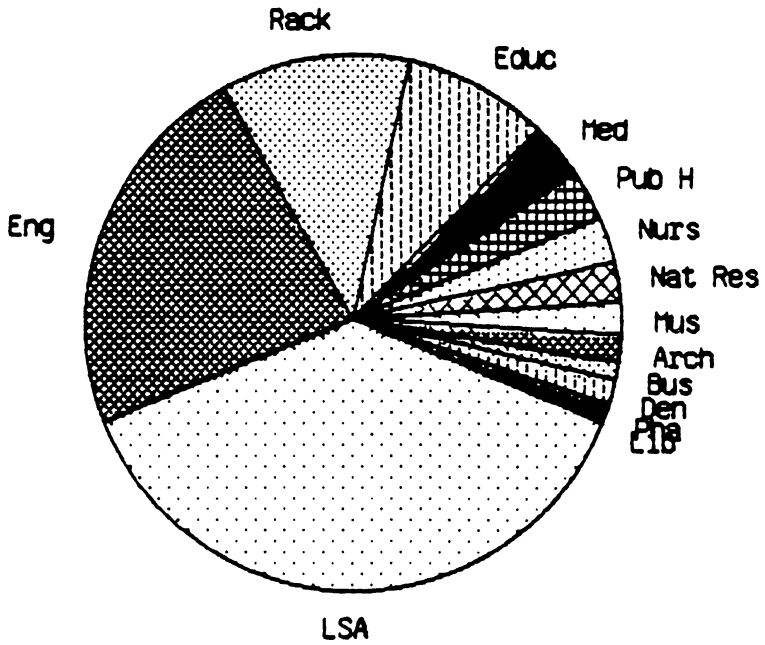


Enrollment Losses (Absolute)

1976 - 1983

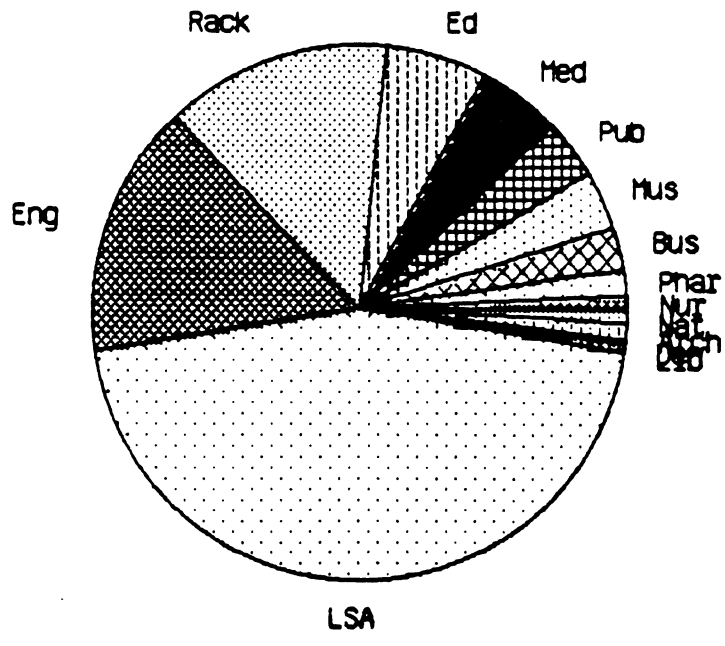


Graduate Enrollments



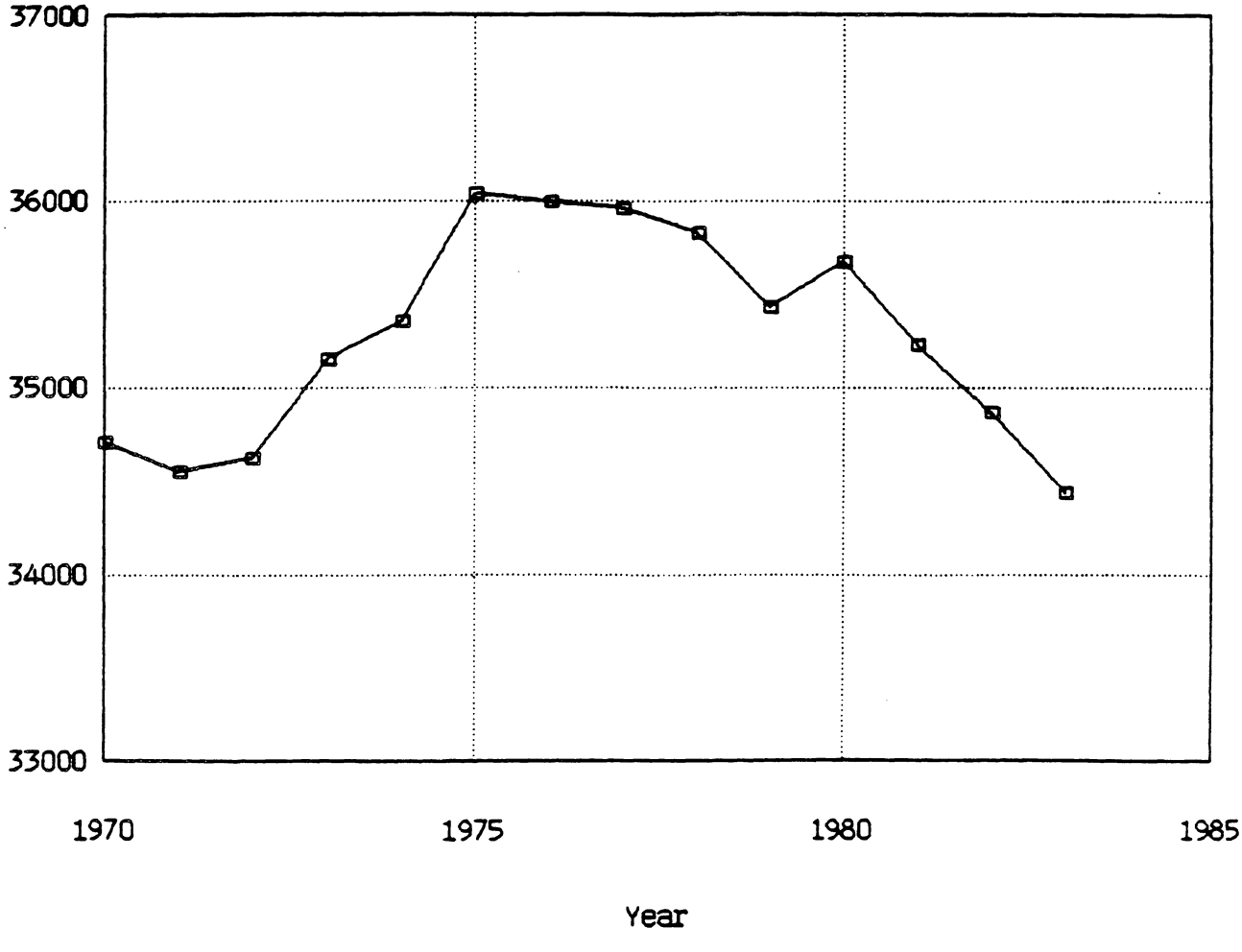
(Total: 6061)

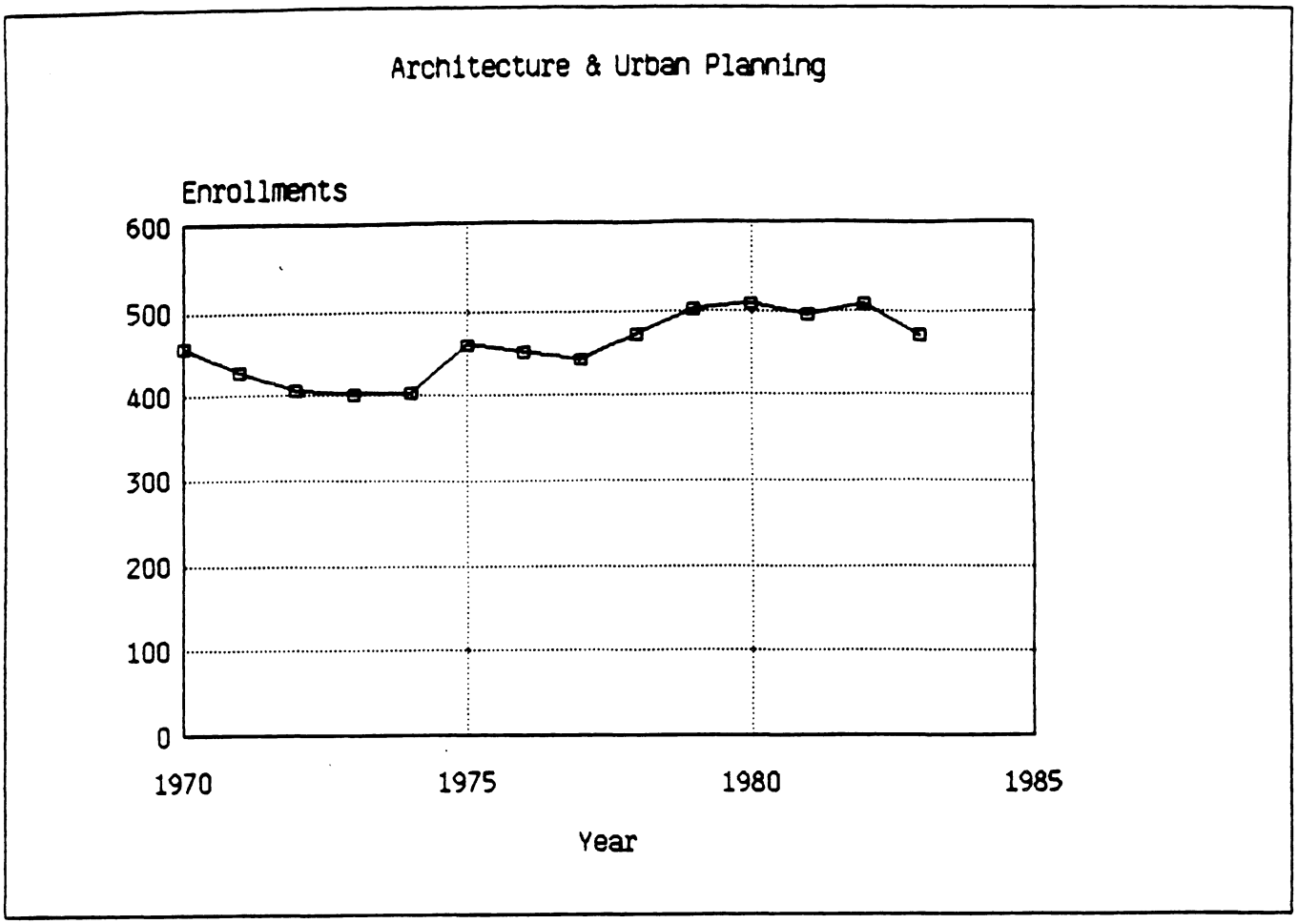
PhD Distribution

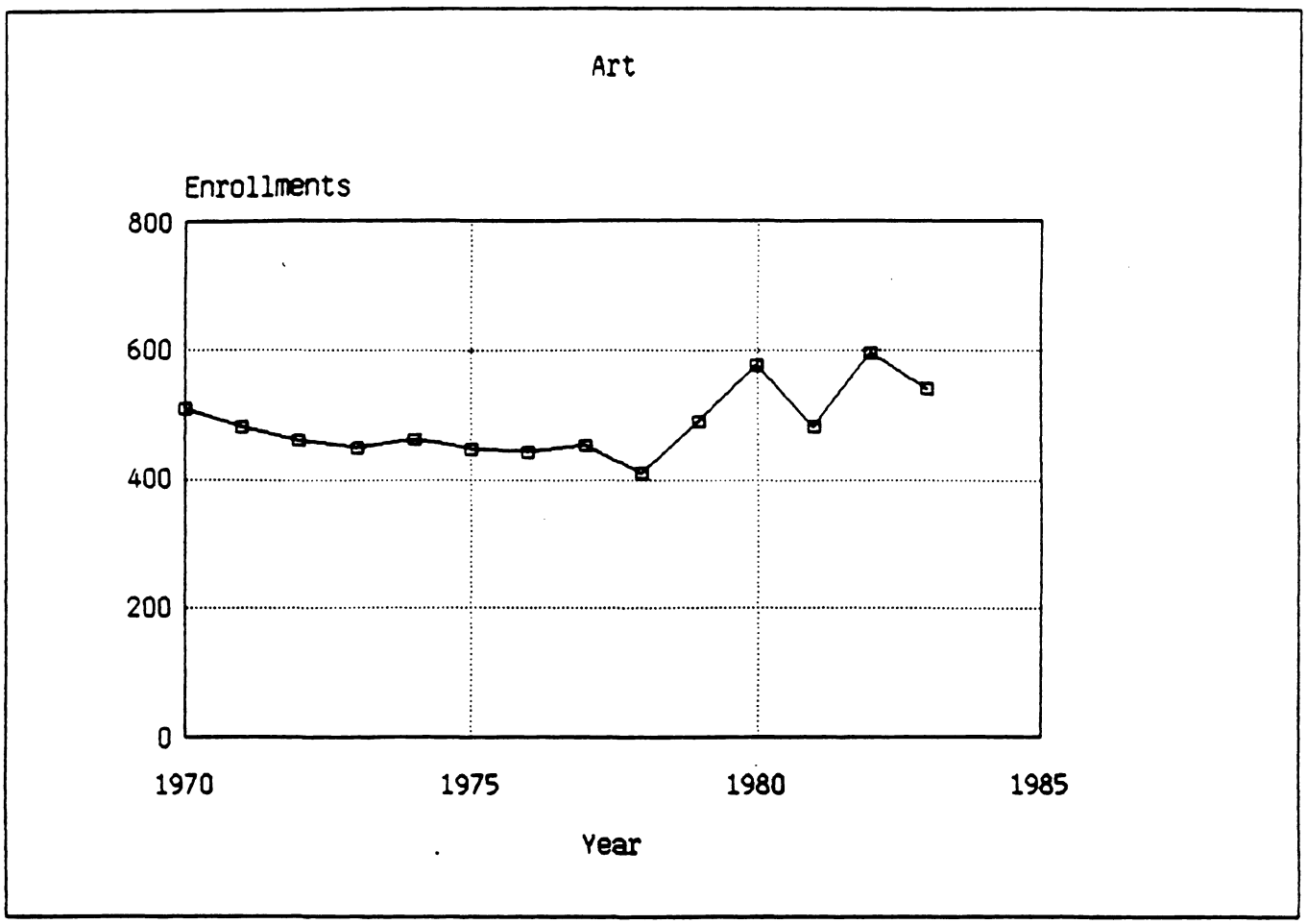


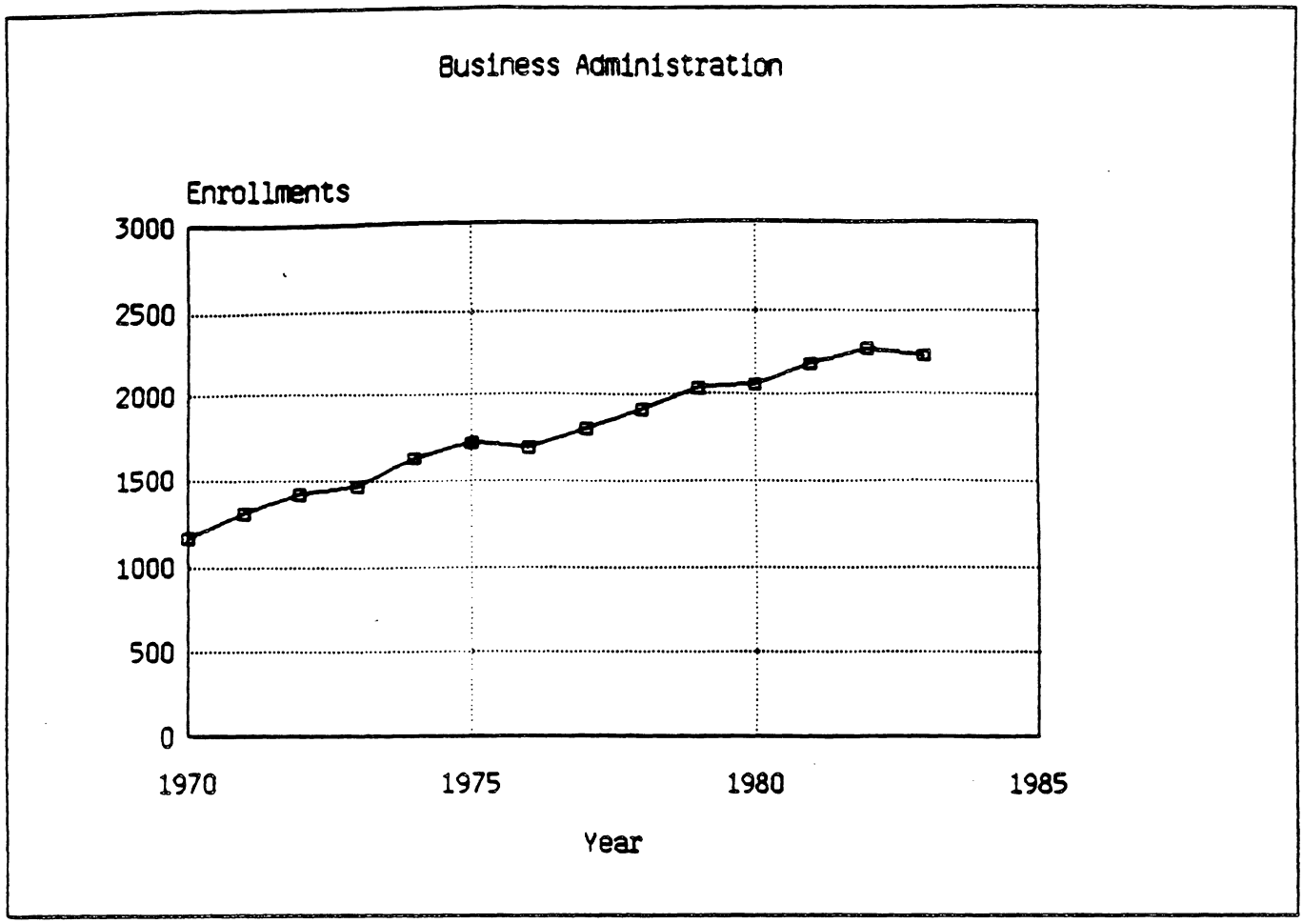
(Total: 3247)

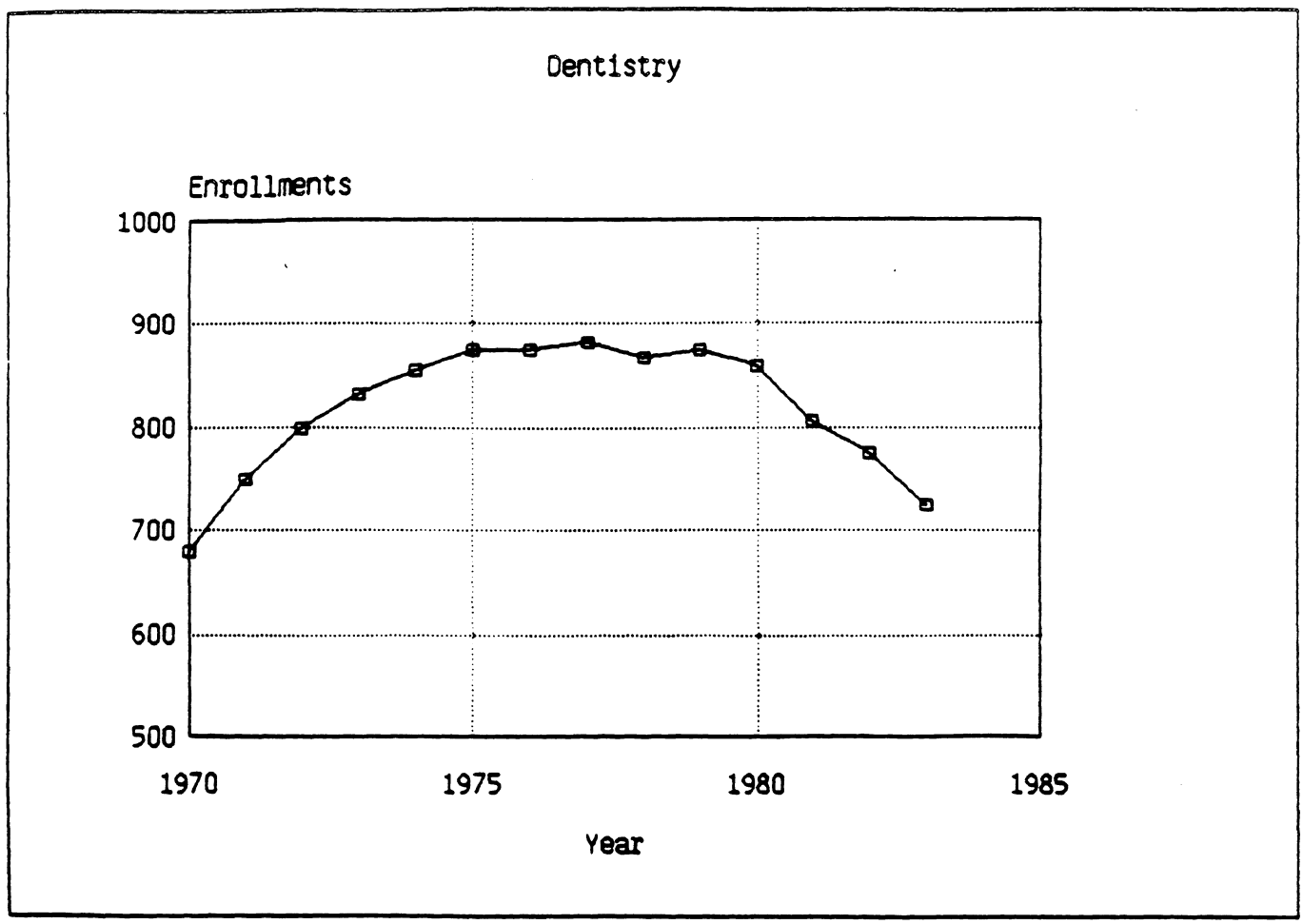
University of Michigan - Ann Arbor

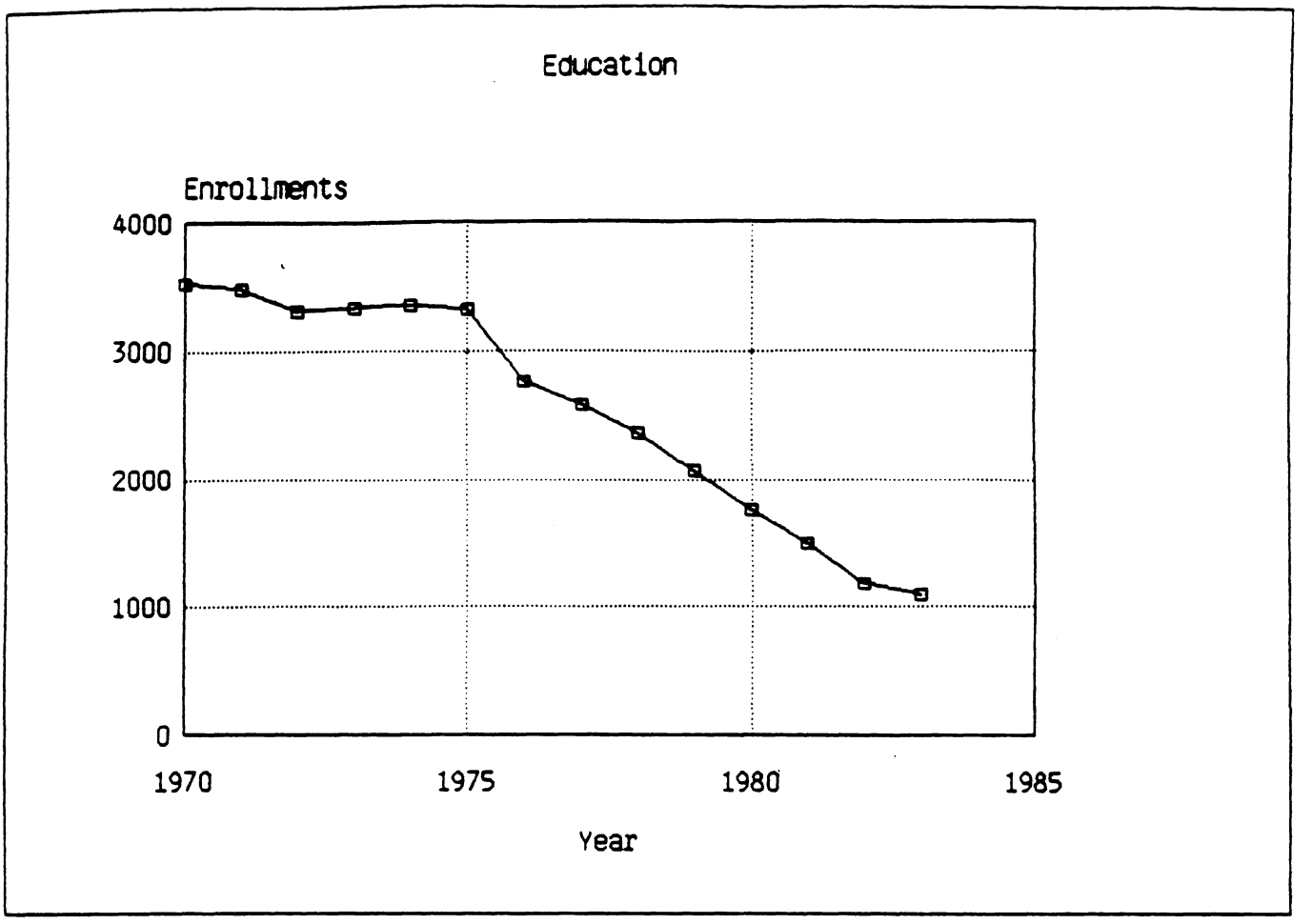


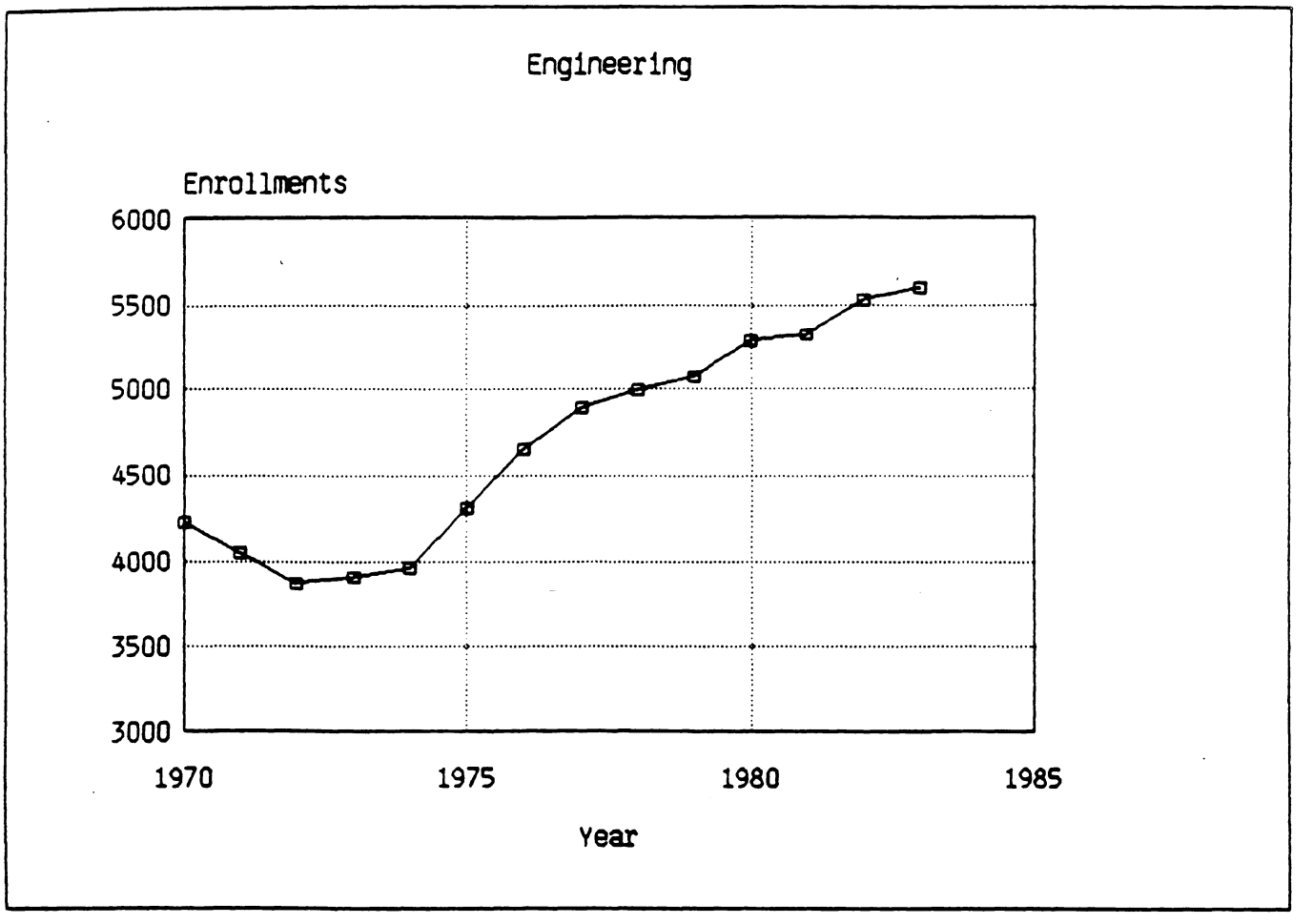

Architecture & Urban Planning
Enrollments
600
500
400
300
200
100
0
1970
1975
1980
1985
Year

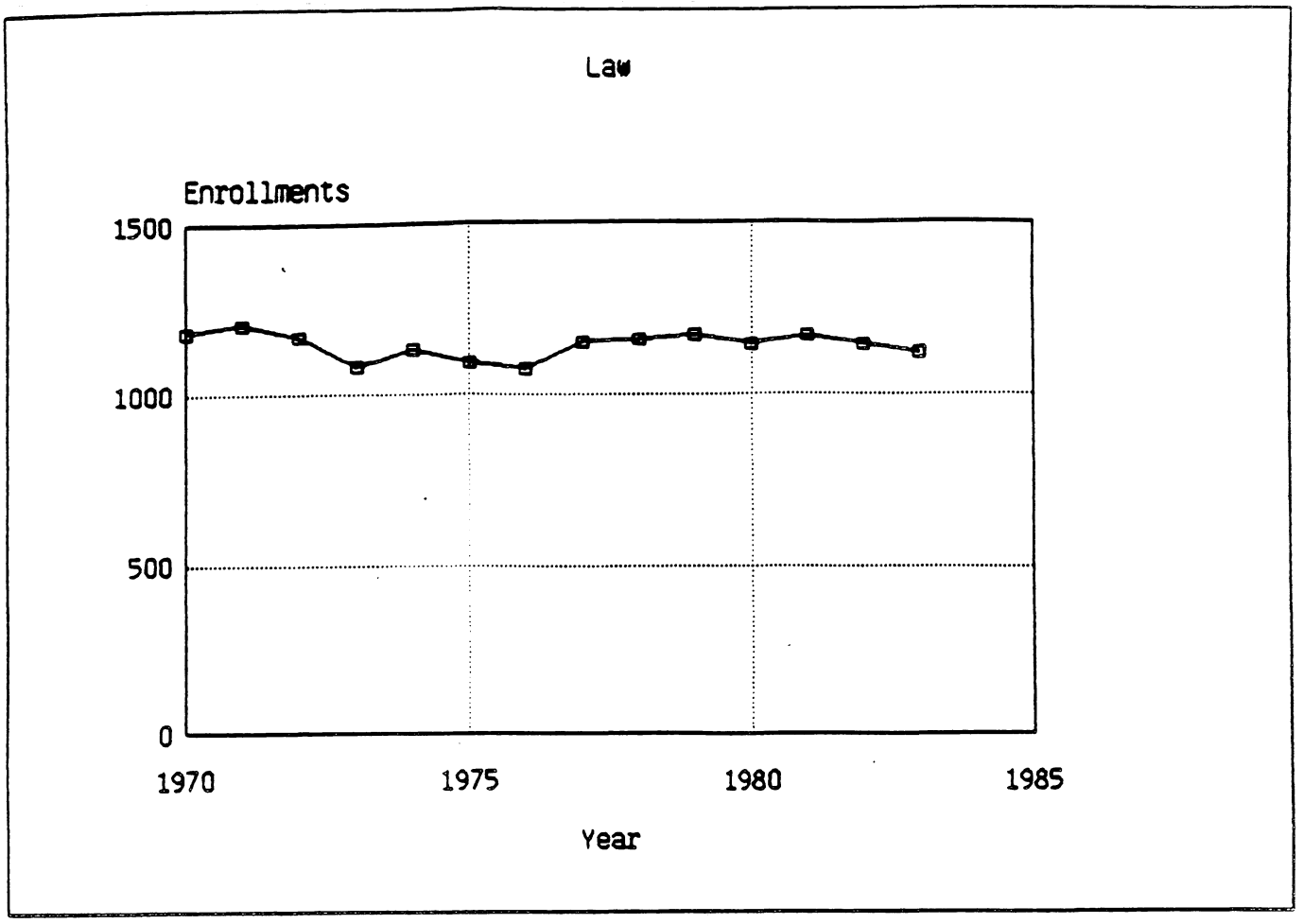

Art
Enrollments
800
600
400
200
0
1970
1975
1980
1985
Year

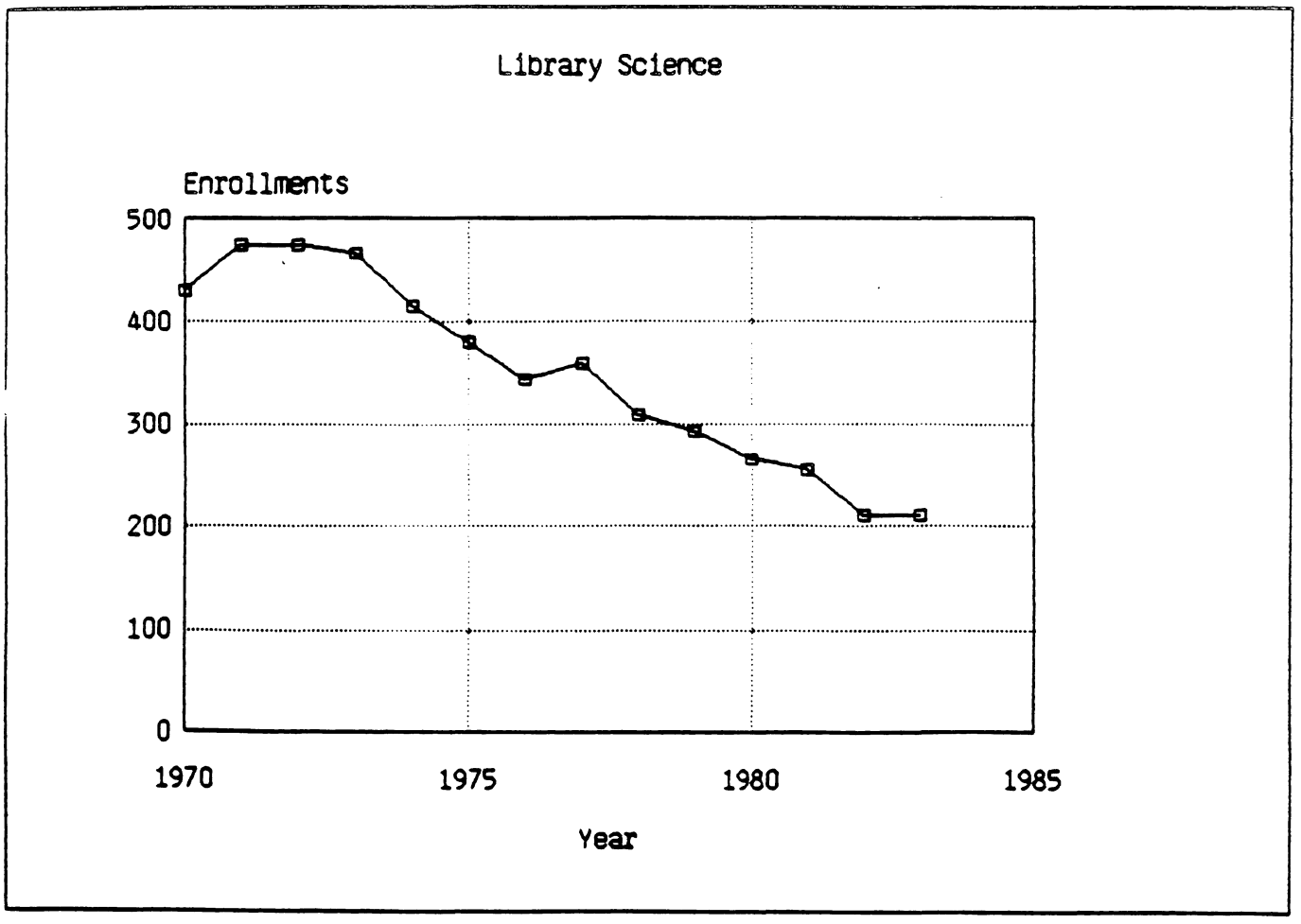

Business Administration
Enrollments
3000
2500
2000
1500
1000
500
0
1970
1975
1980
1985
Year

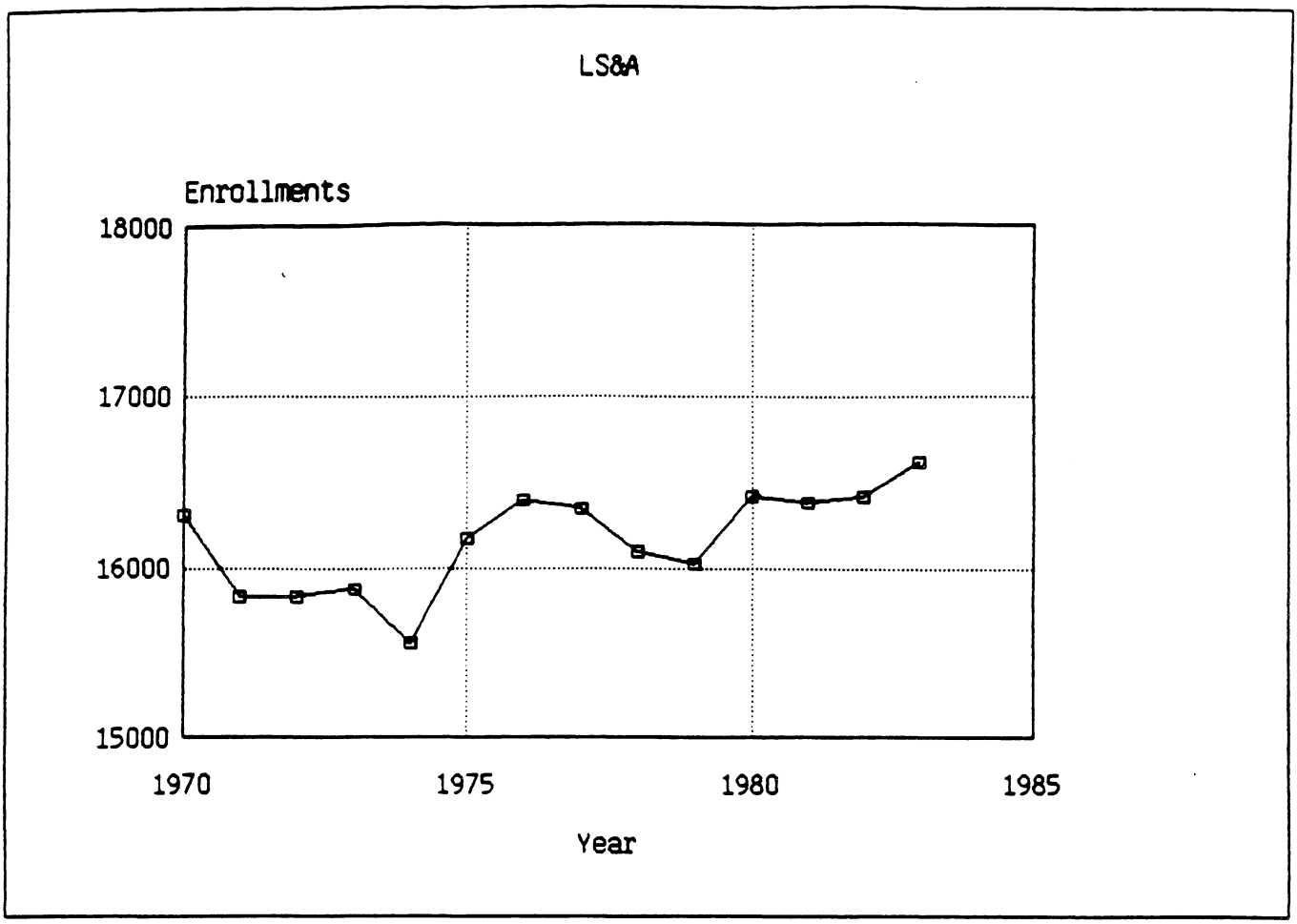

Dentistry
Enrollments
1000
900
800
700
600
500
1970
1975
1980
1985
Year

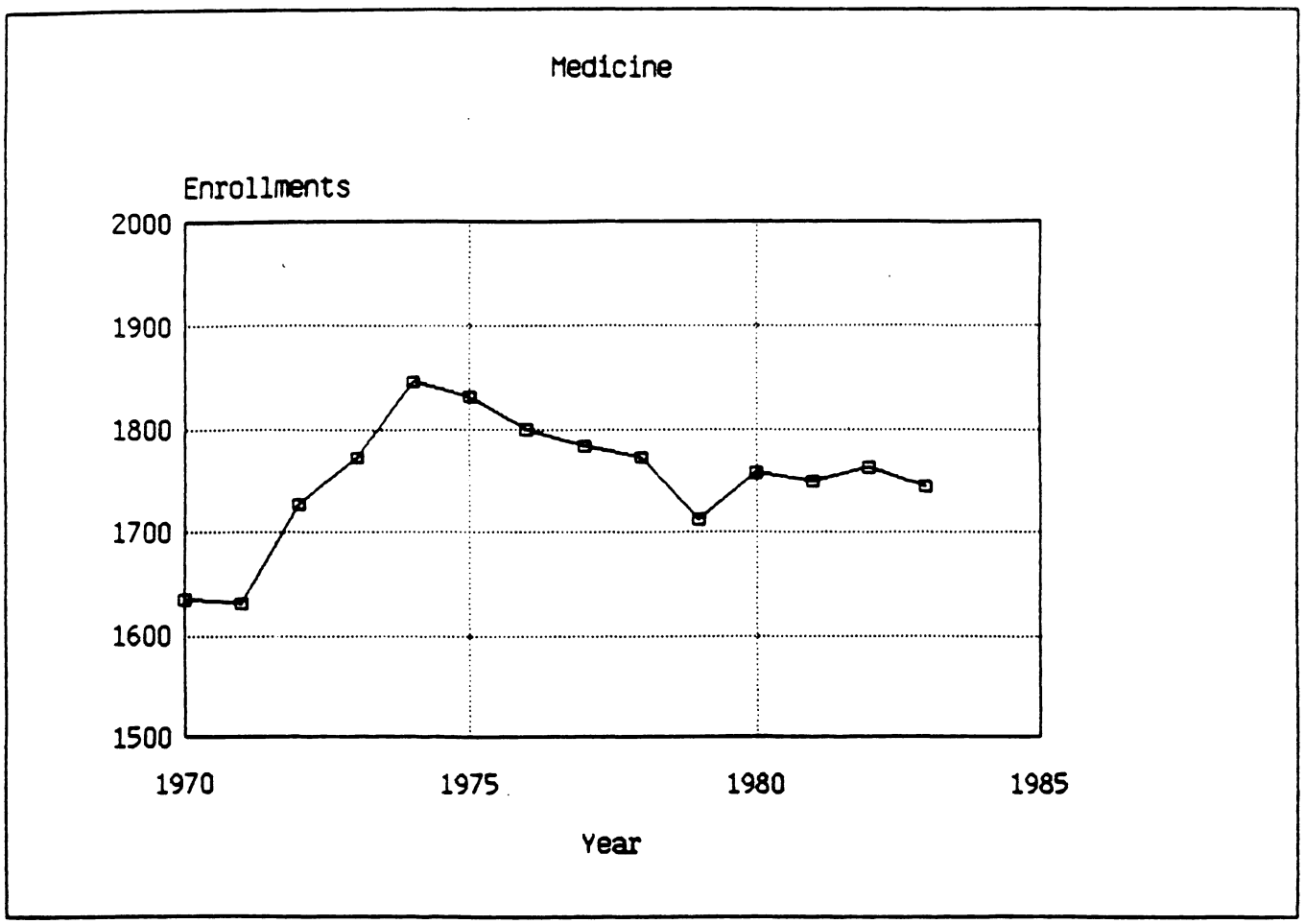

Education
Enrollments
4000
3000
2000
1000
0
1970
1975
1980
1985
Year

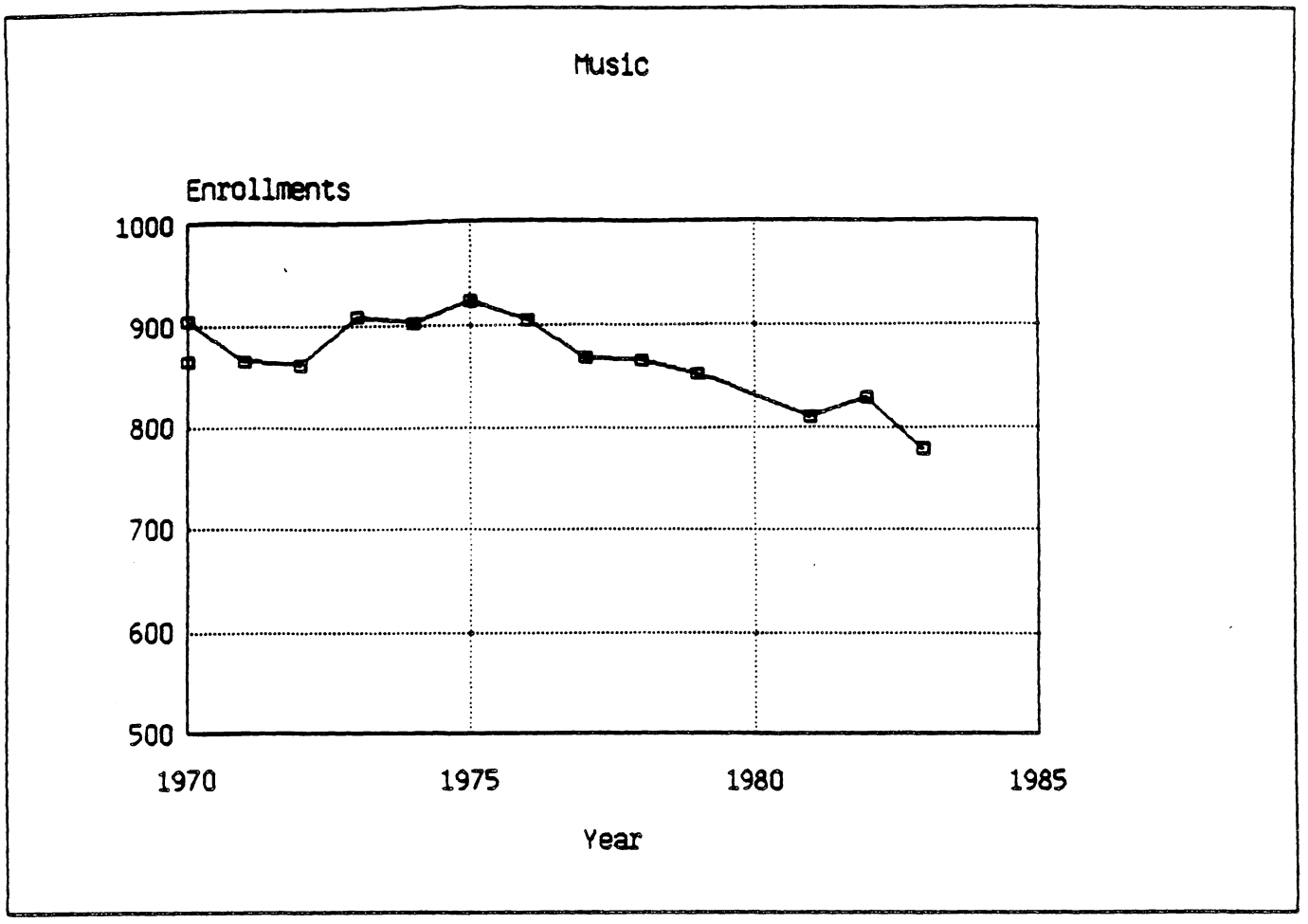

Engineering
Enrollments
6000
5500
5000
4500
4000
3500
3000
1970
1975
1980
1985
Year

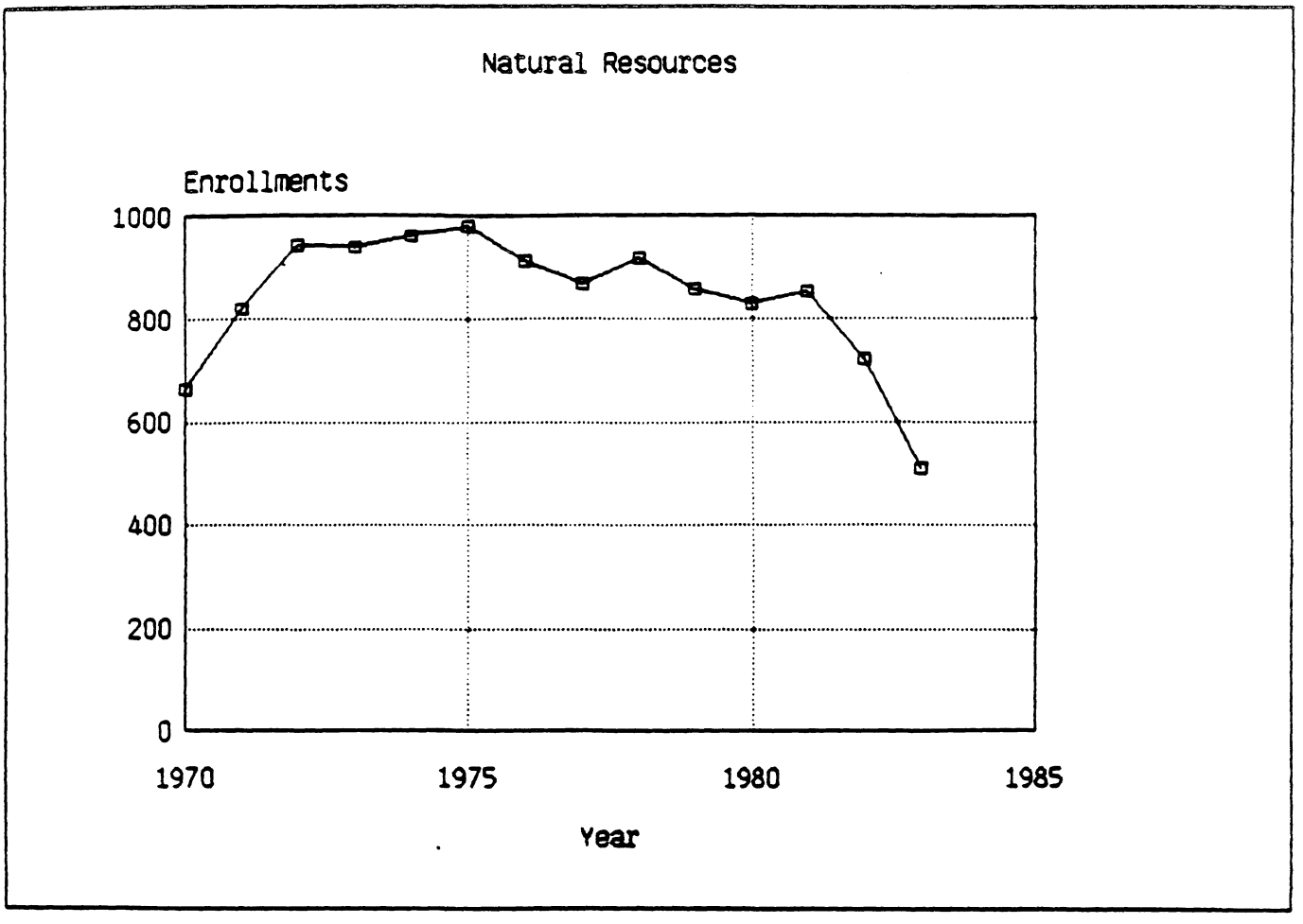

Law
Enrollments
1500
1000
500
0
1970
1975
1980
1985
Year

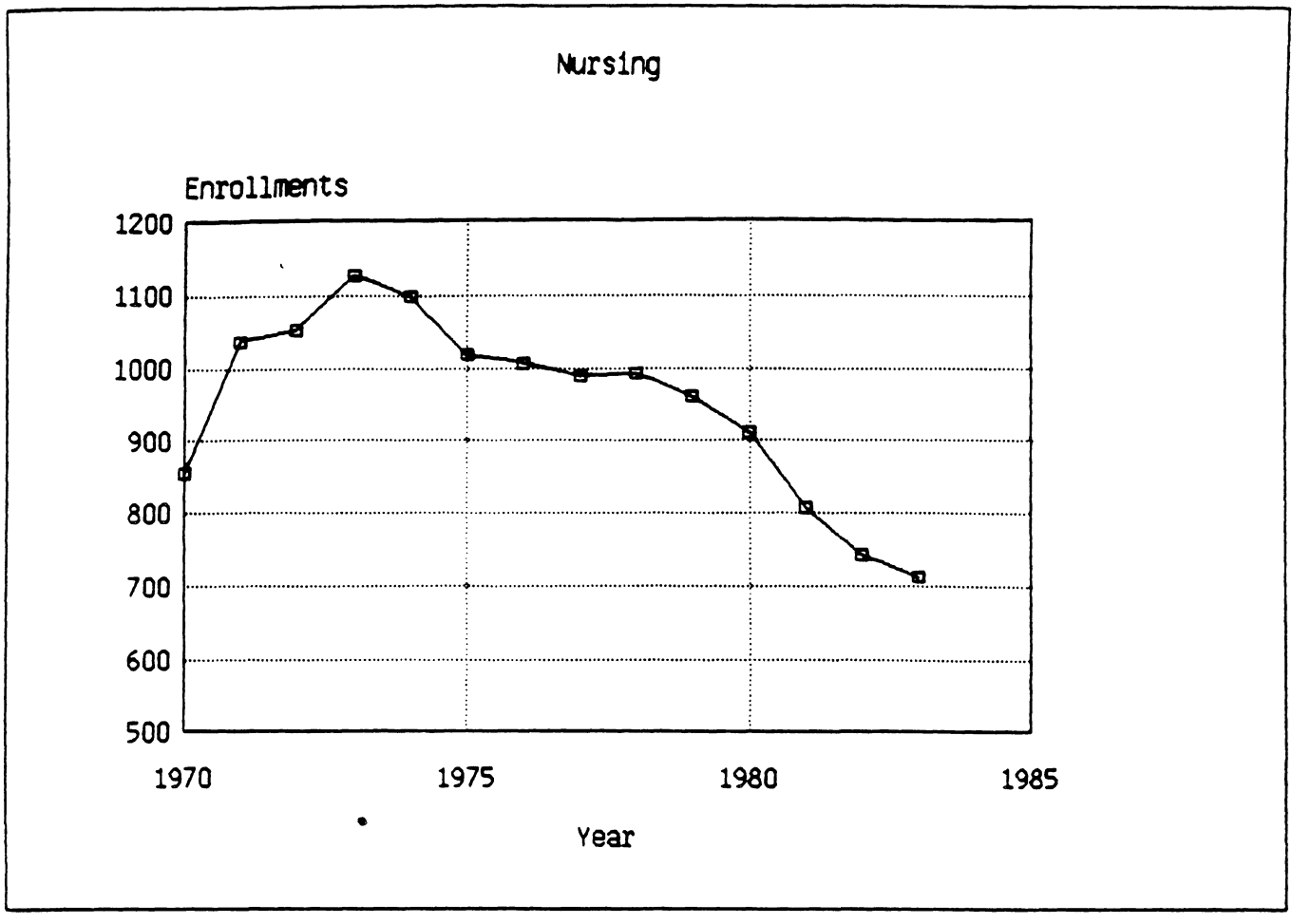

Library Science
Enrollments
500
400
300
200
100
0
1970
1975
1980
1985
Year

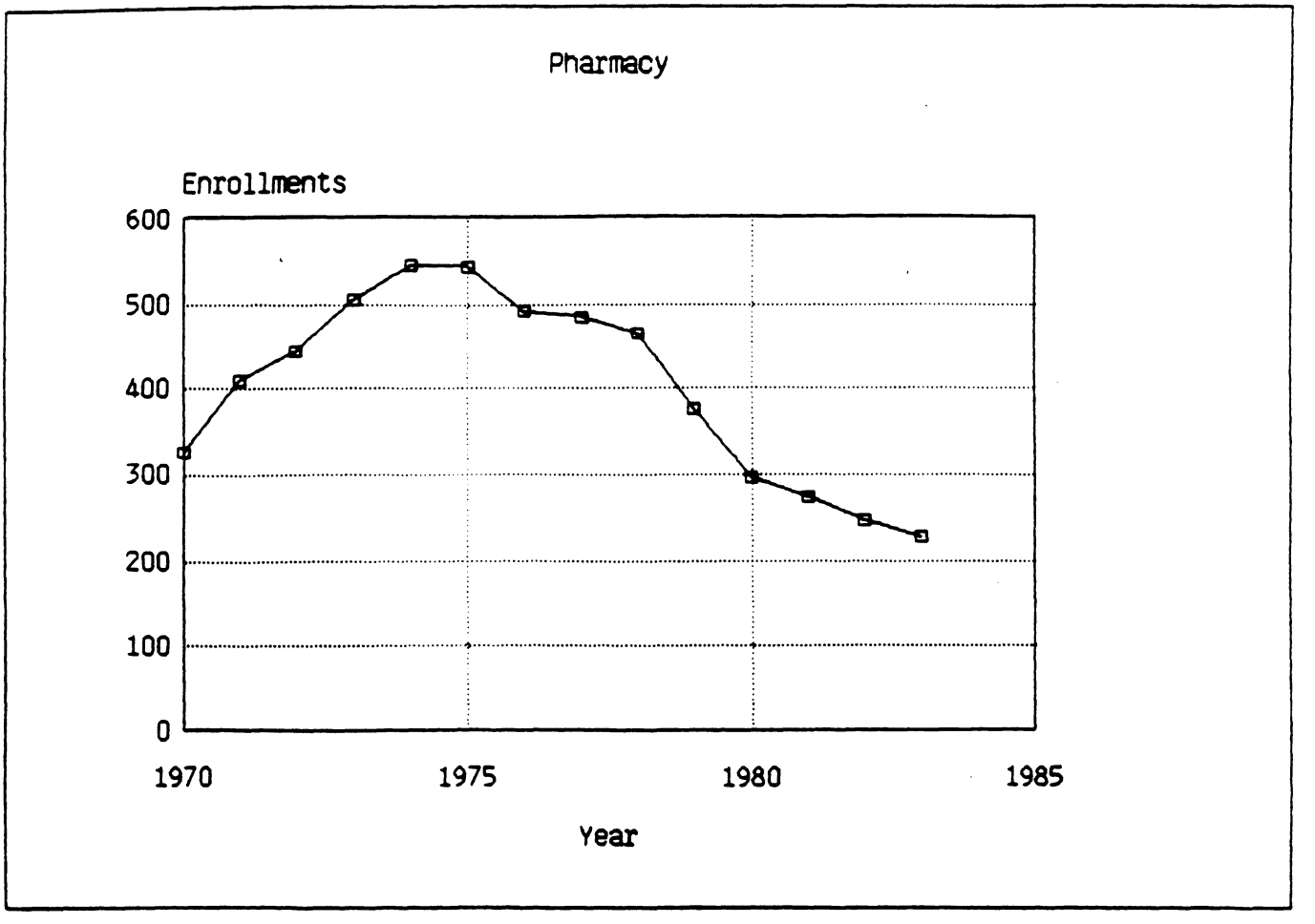

LS&A
Enrollments
18000
17000
16000
15000
1970
1975
1980
1985
Year

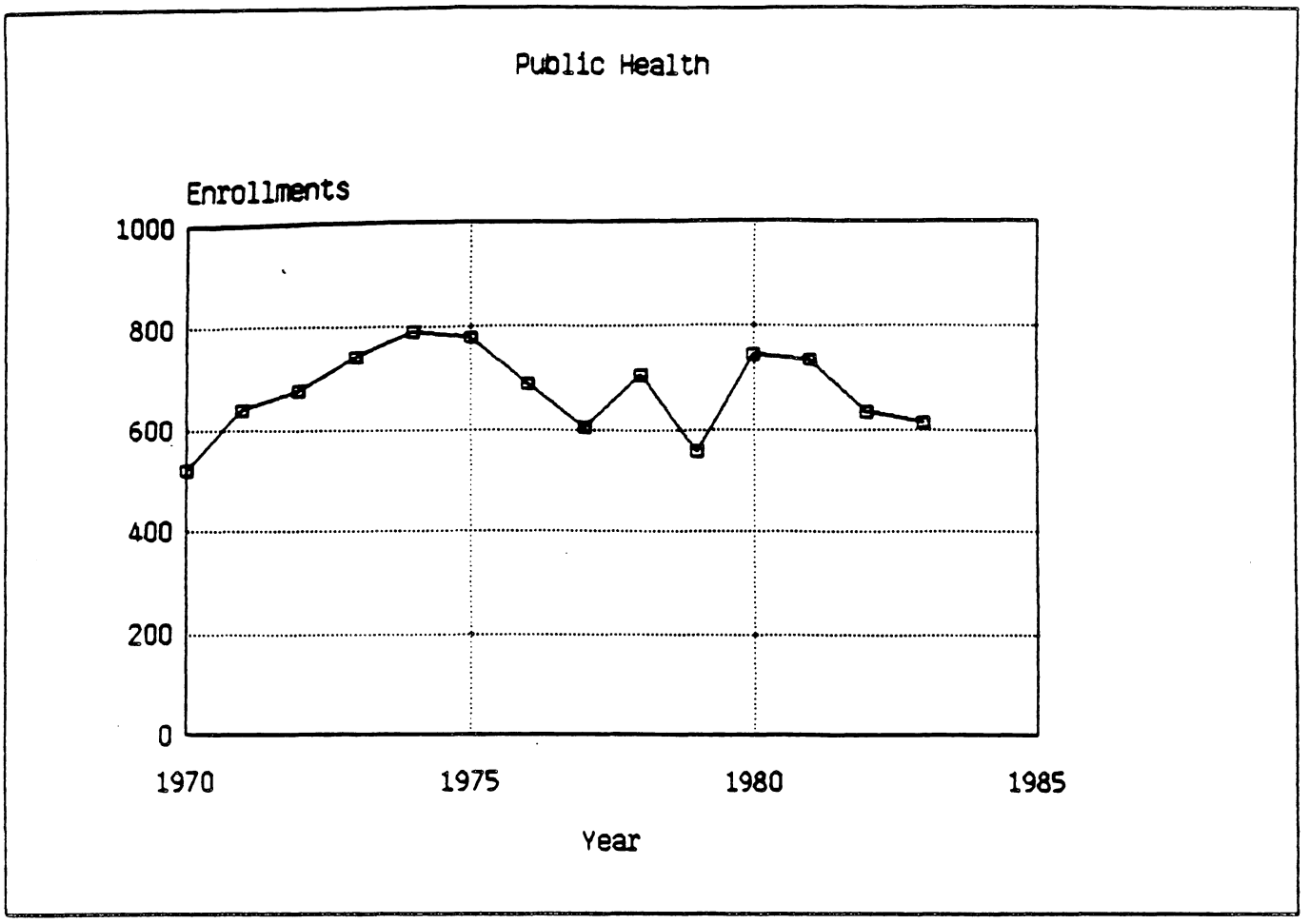

Medicine
Enrollments
2000
1900
1800
1700
1600
1500
1970
1975
1980
1985
Year

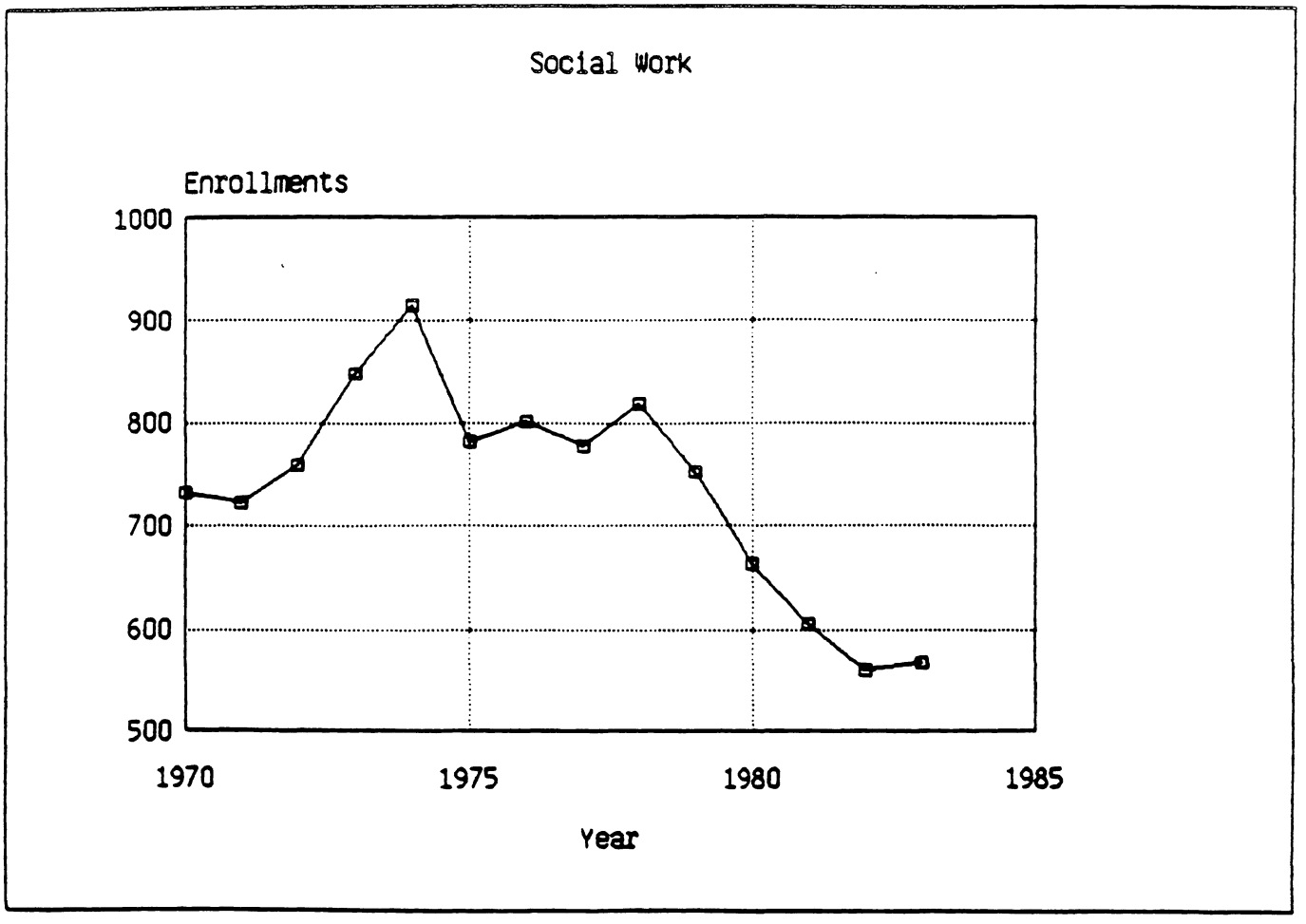

Music
Enrollments
1000
900
800
700
600
500
1970
1975
1980
1985
Year

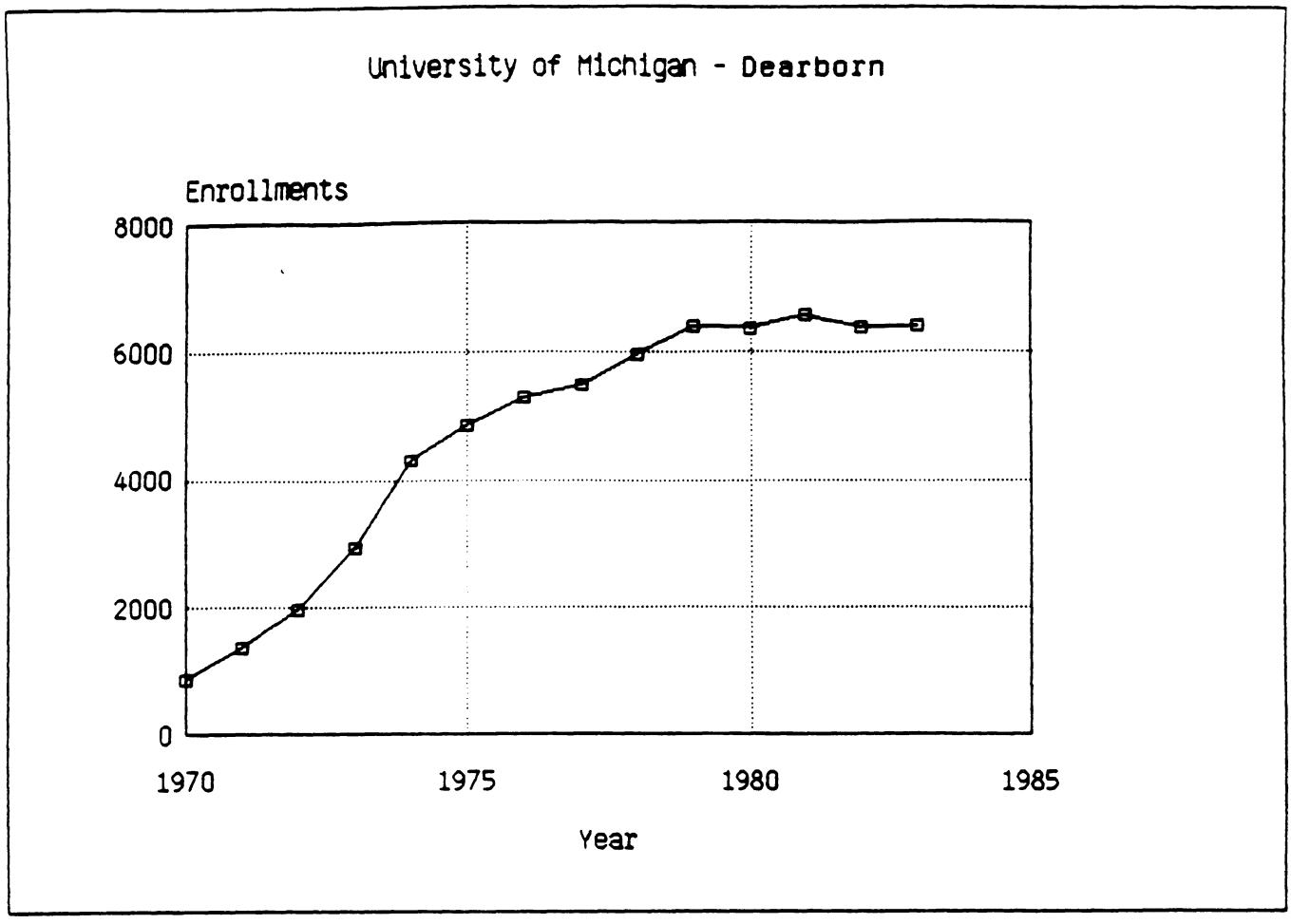

Natural Resources
Enrollments
1000
800
600
400
200
0
1970
1975
1980
1985
Year

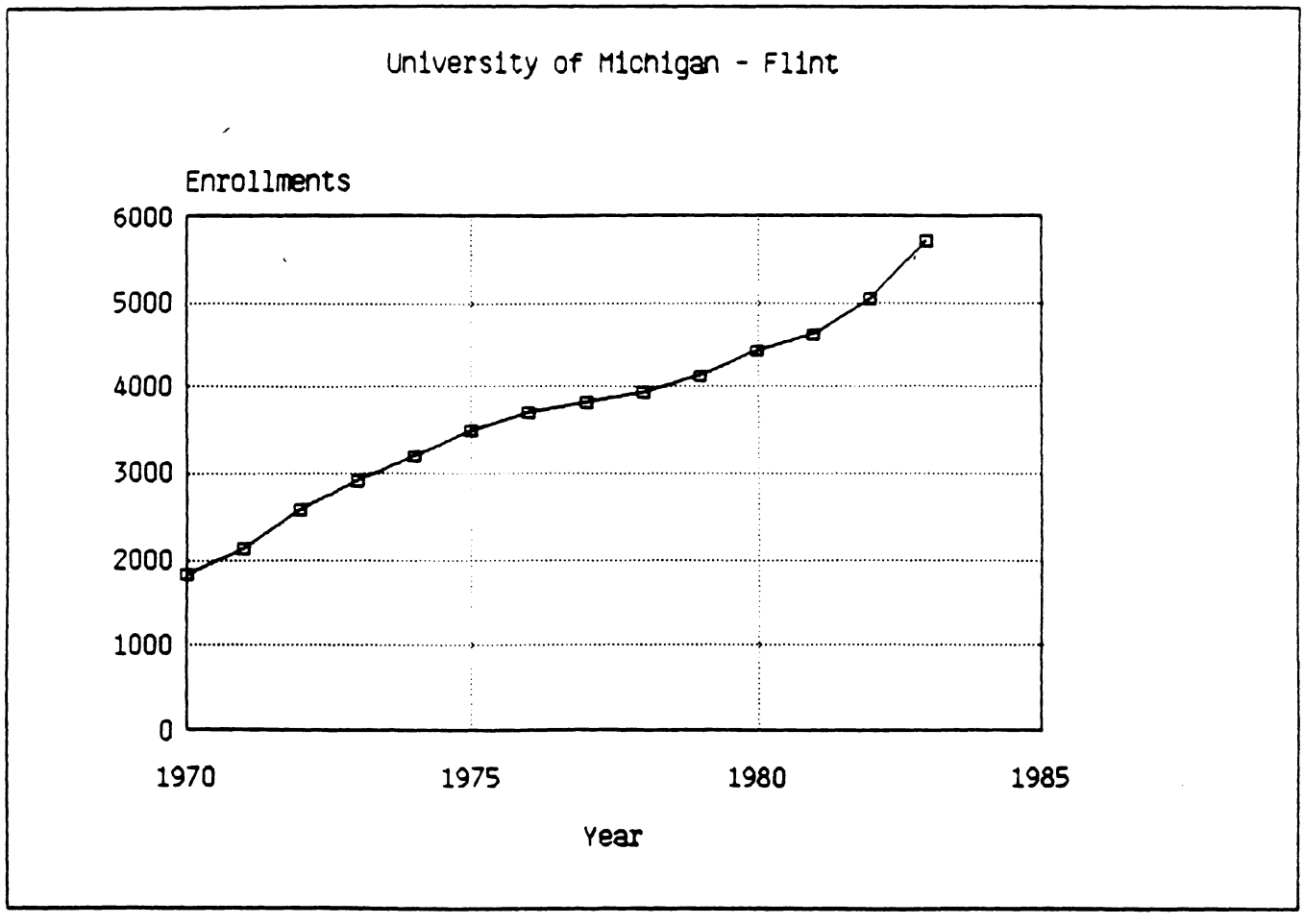

Nursing
Enrollments
1200
1100
1000
900
800
700
600
500
1970
1975
1980
1985
Year


Pharmacy
Enrollments
600
500
400
300
200
100
0
1970
1975
1980
1985
Year


Public Health
Enrollments
1000
800
600
400
200
0
1970
1975
1980
1985
Year


Social Work
Enrollments
1000
900
800
700
600
500
1970
1975
1980
1985
Year


University of Michigan - Dearborn
Enrollments
8000
6000
4000
2000
0
1970
1975
1980
1985
Year


University of Michigan - Flint
Enrollments
6000
5000
4000
3000
2000
1000
0
1970
1975
1980
1985
Year

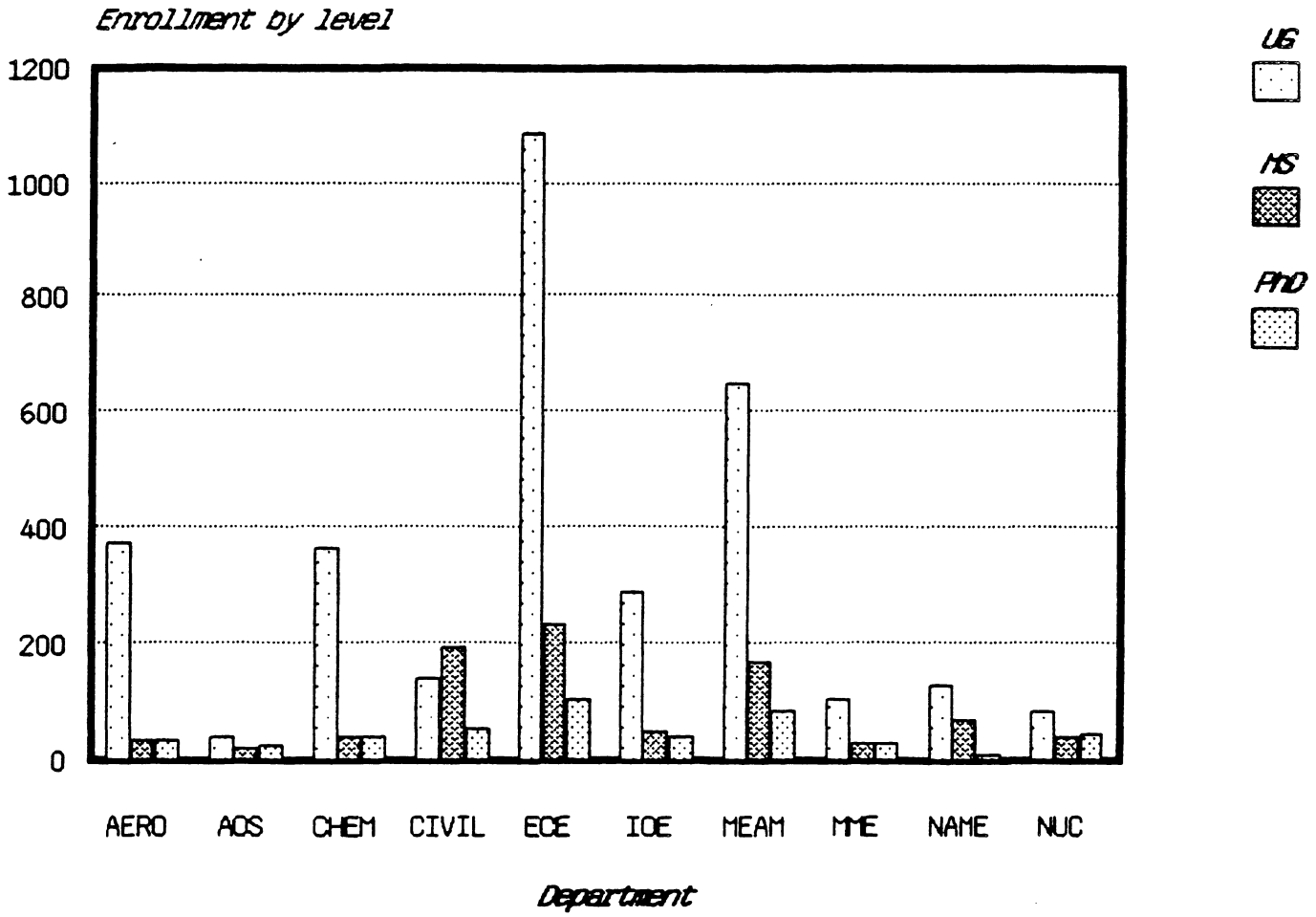
Comparative Instructional Loads of College Departments

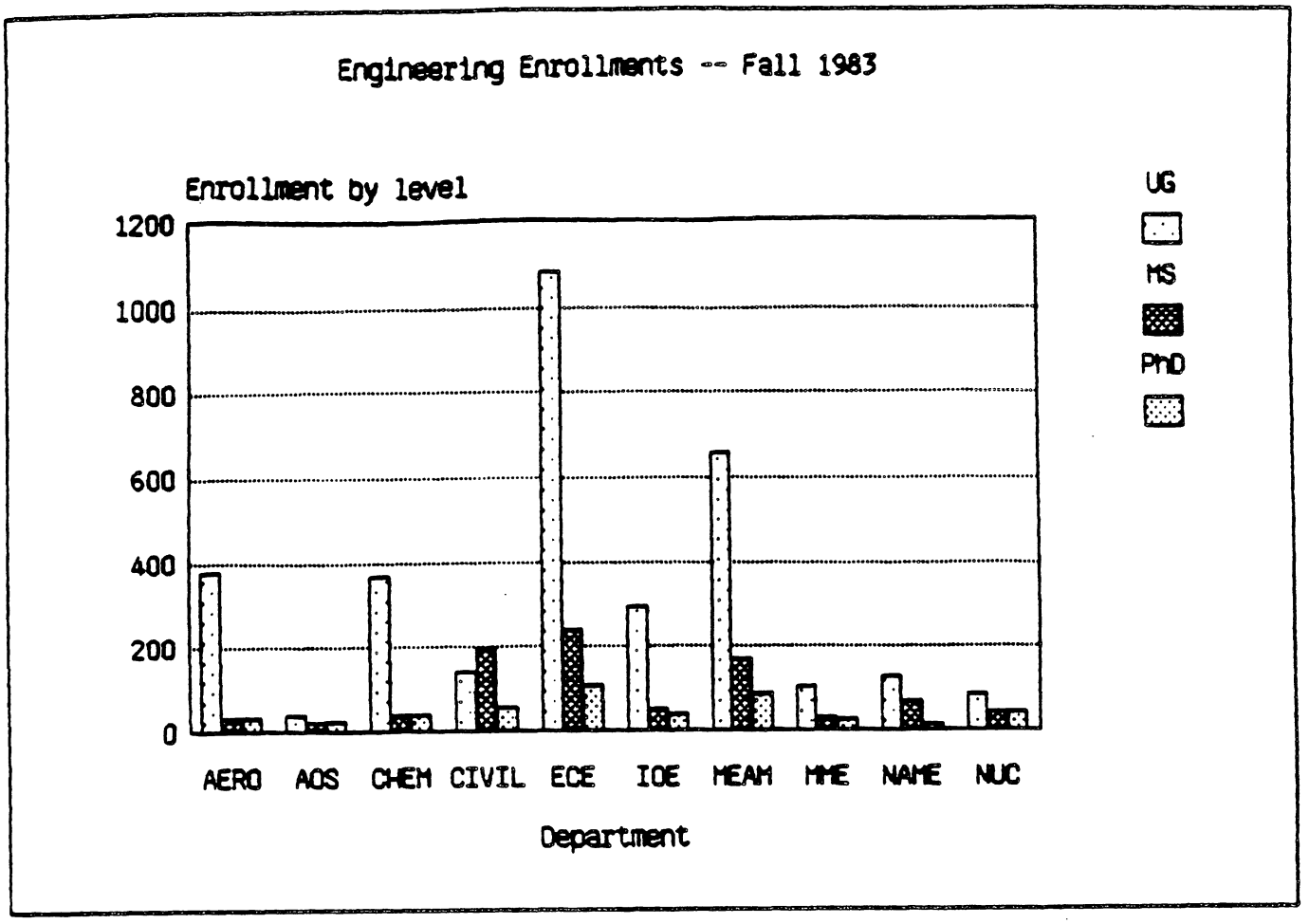
COMPARATIVE COLLEGE INSTRUCTIONAL LOADS

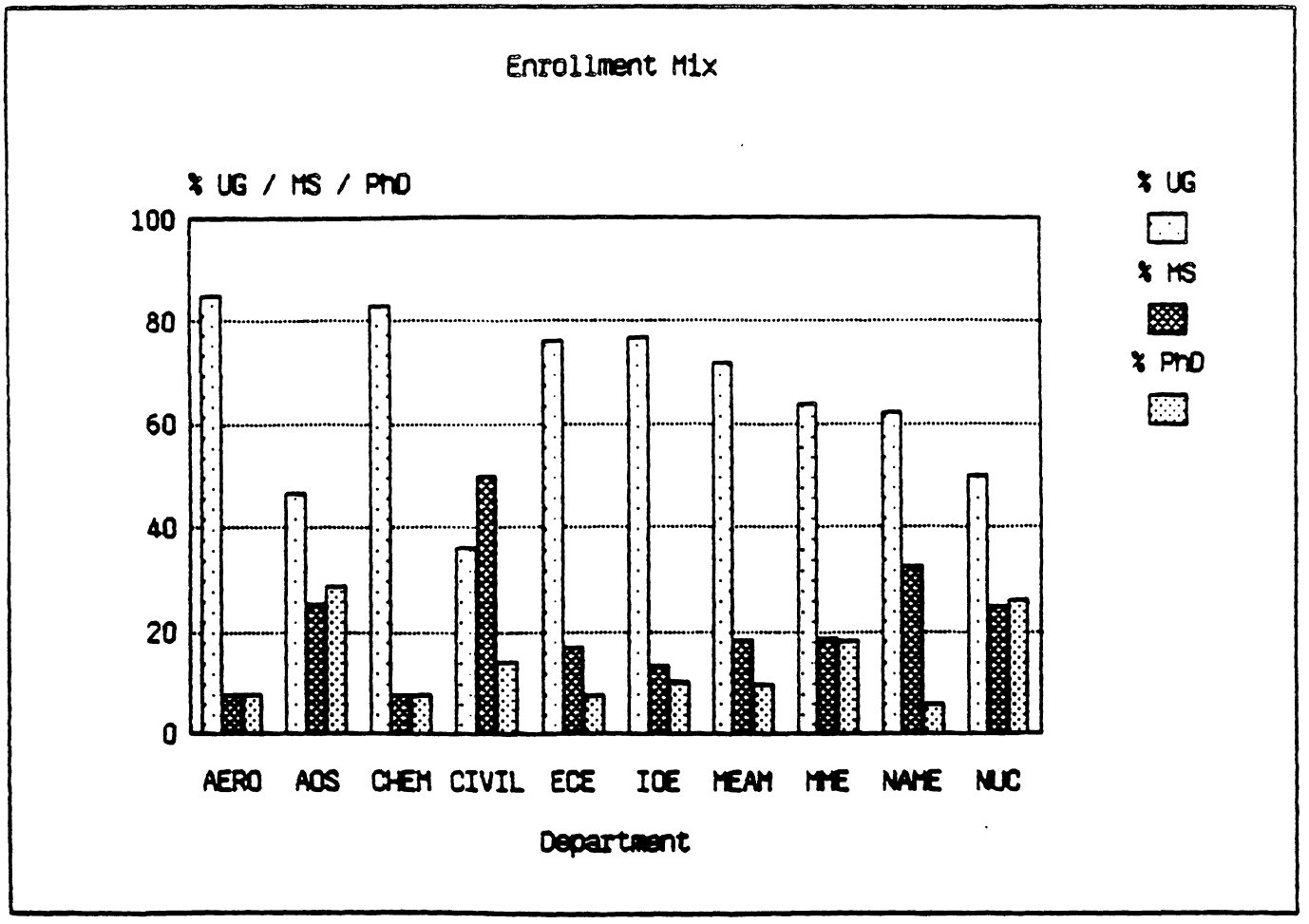
FIGURES:

- Enrollments by Department - Fall, 1983
- Enrollment Mix by Level
- Enrollment Distribution (B.S., M.S., Ph.D.)
- PhD Production
- PhD Enrollment per Faculty
- Student-to-Faculty Ratio
- Actual FTE to Needed FTE Ratios

Engineering Enrollments — Fall 1983

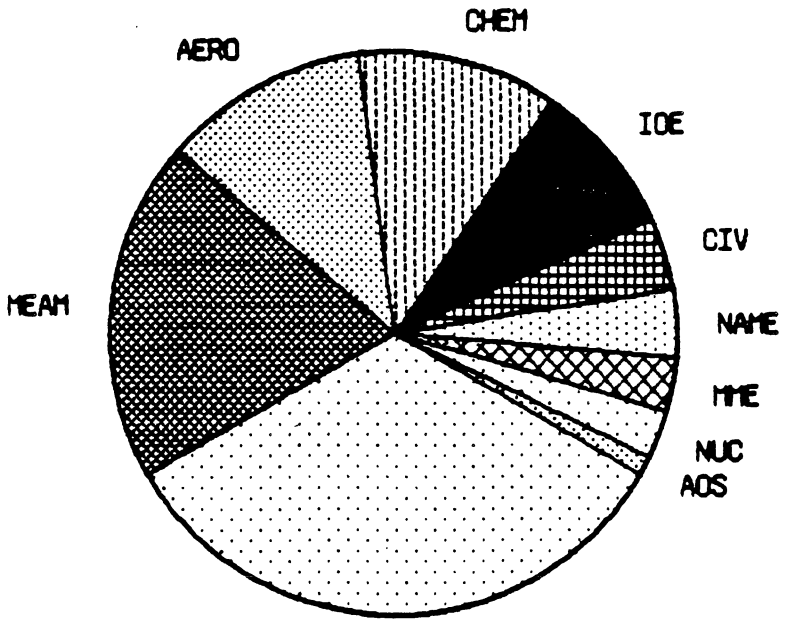



Engineering Enrollments -- Fall 1983
Enrollment by level
1200
1000
800
600
400
200
0
AERO AOS CHEM CIVIL ECE IOE MEAM MME NAME NUC
Department
UG
MS
PhD


Enrollment Mix
% UG / MS / PhD
100
80
60
40
20
0
AERO AOS CHEM CIVIL ECE IOE MEAM MME NAME NUC
Department
% UG
% MS
% PhD

Undergraduate Enrollment

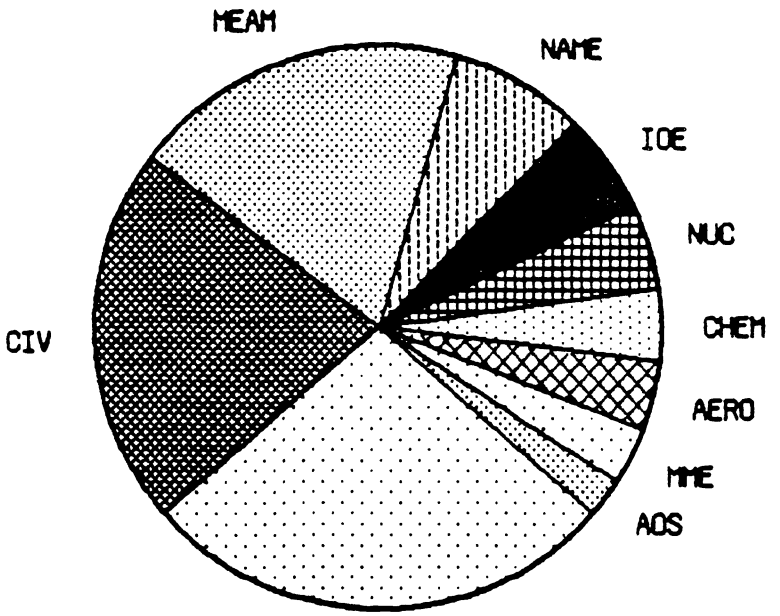
Fall-1983



(4212 Total)

M.S. Enrollments

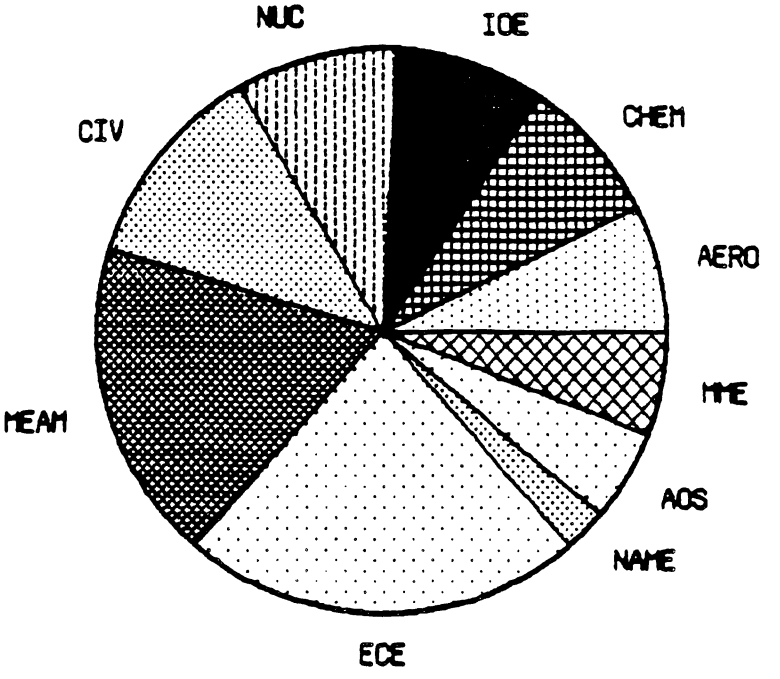
Fall-1983



(941 Total)

PHD Enrollments

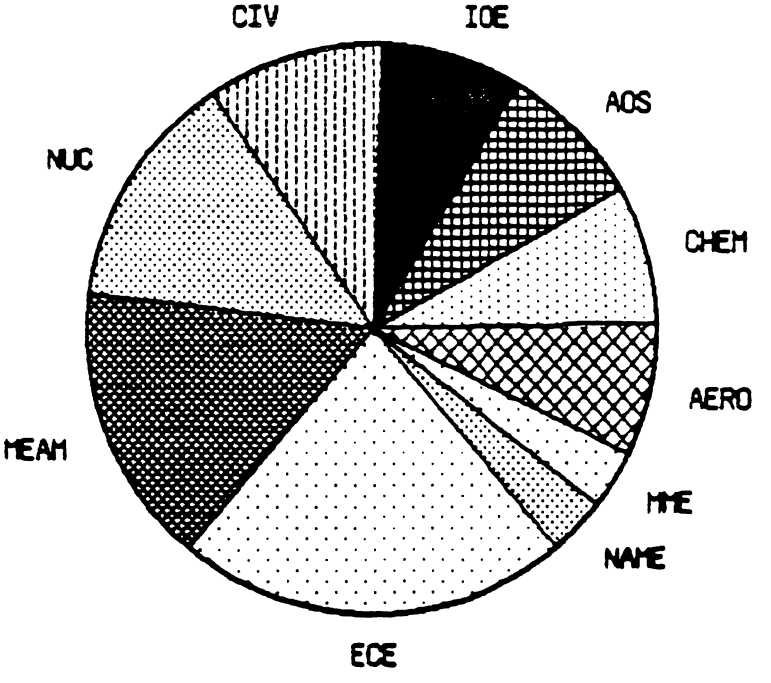
Fall - 1983



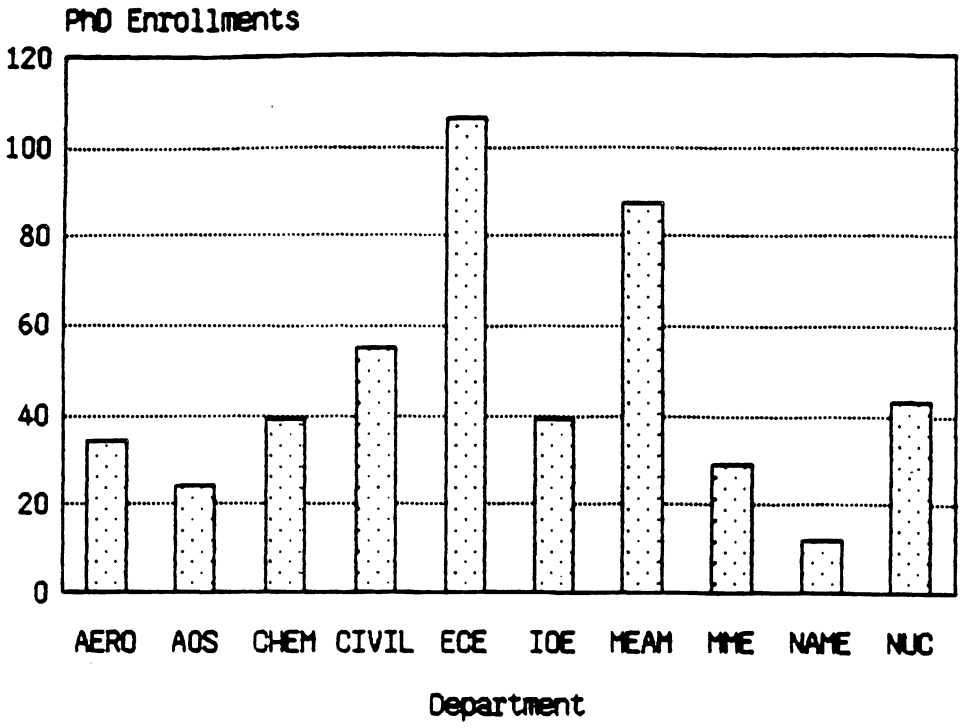
(489 Total)

PHD Production

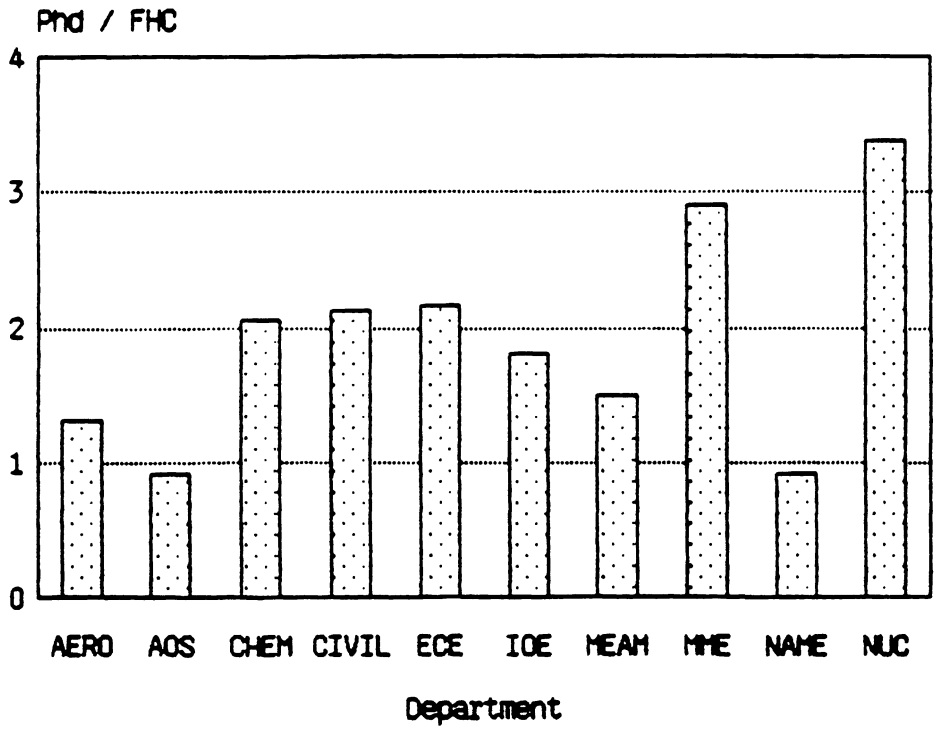
1971 - 1981

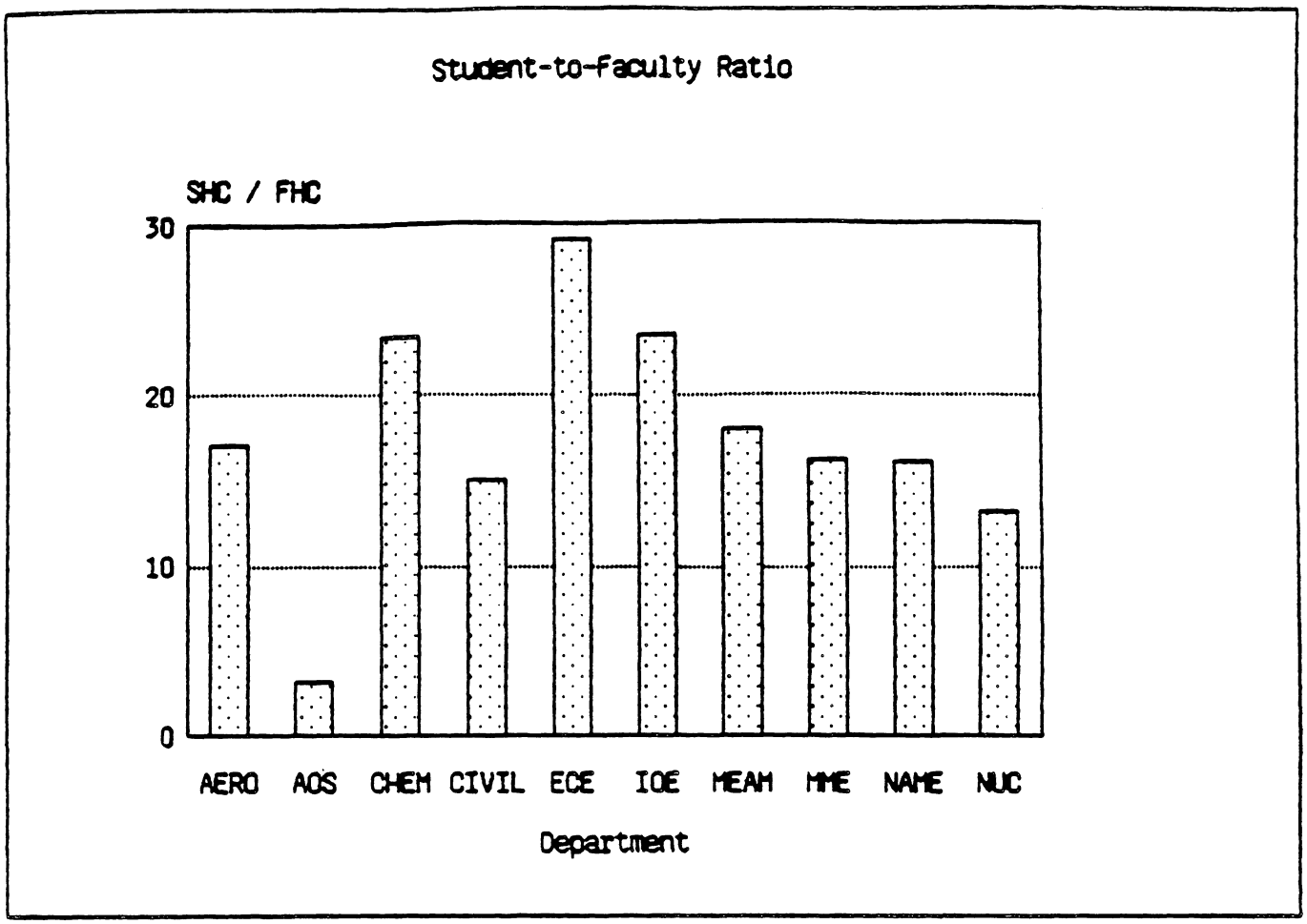


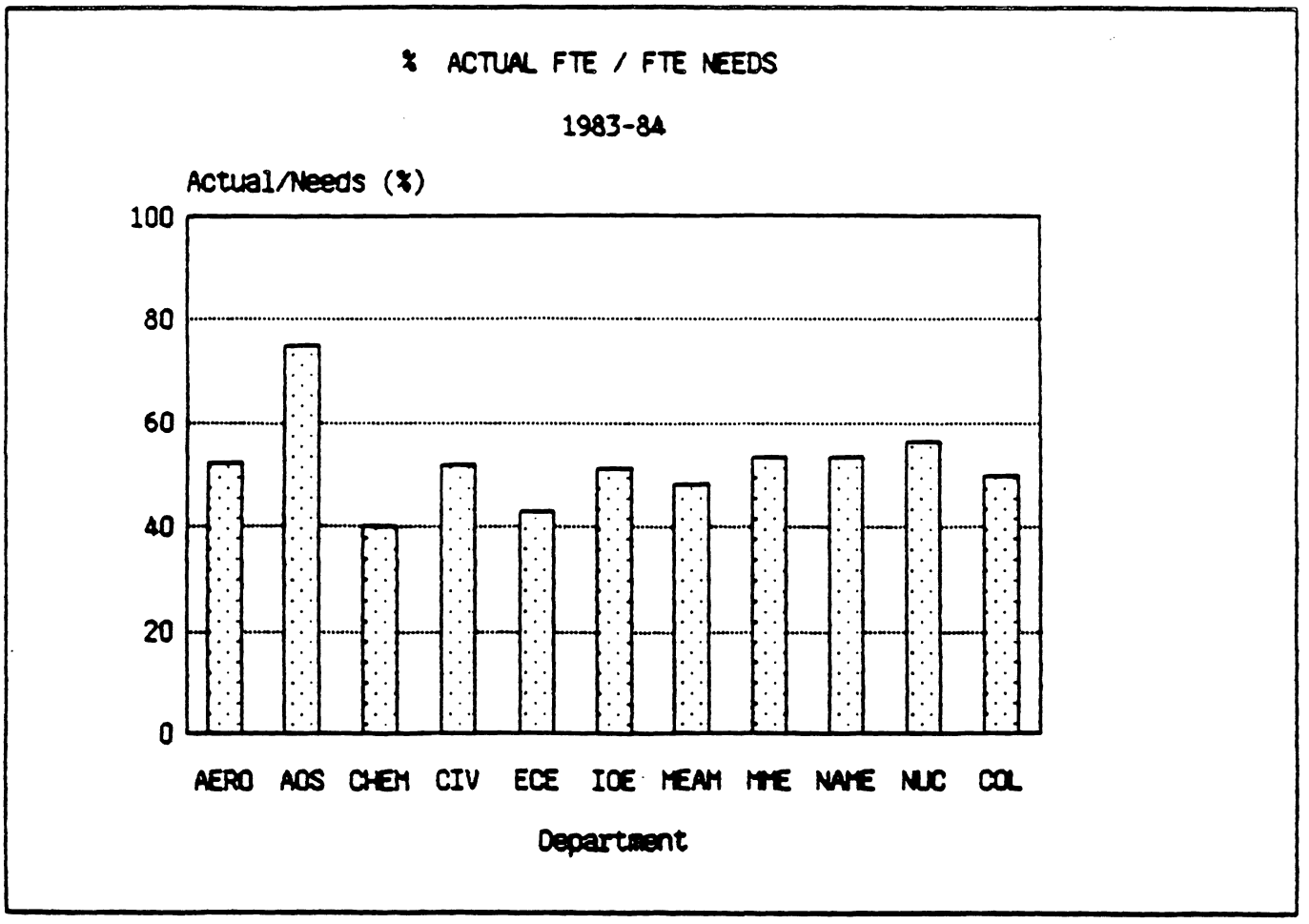
PhD Enrollments - Fall 1983



PhD Enrollment per Faculty




Student-to-Faculty Ratio
SHC / FHC
30
20
10
0
AERO
AOS
CHEM
CIVIL
ECE
IOE
MEAM
MME
NAME
NUC
Department


% ACTUAL FTE / FTE NEEDS
1983-84
Actual/Needs (%)
100
80
60
40
20
0
AERO
AOS
CHEM
CIV
ECE
IOE
MEAM
MME
NAME
NUC
COL
Department

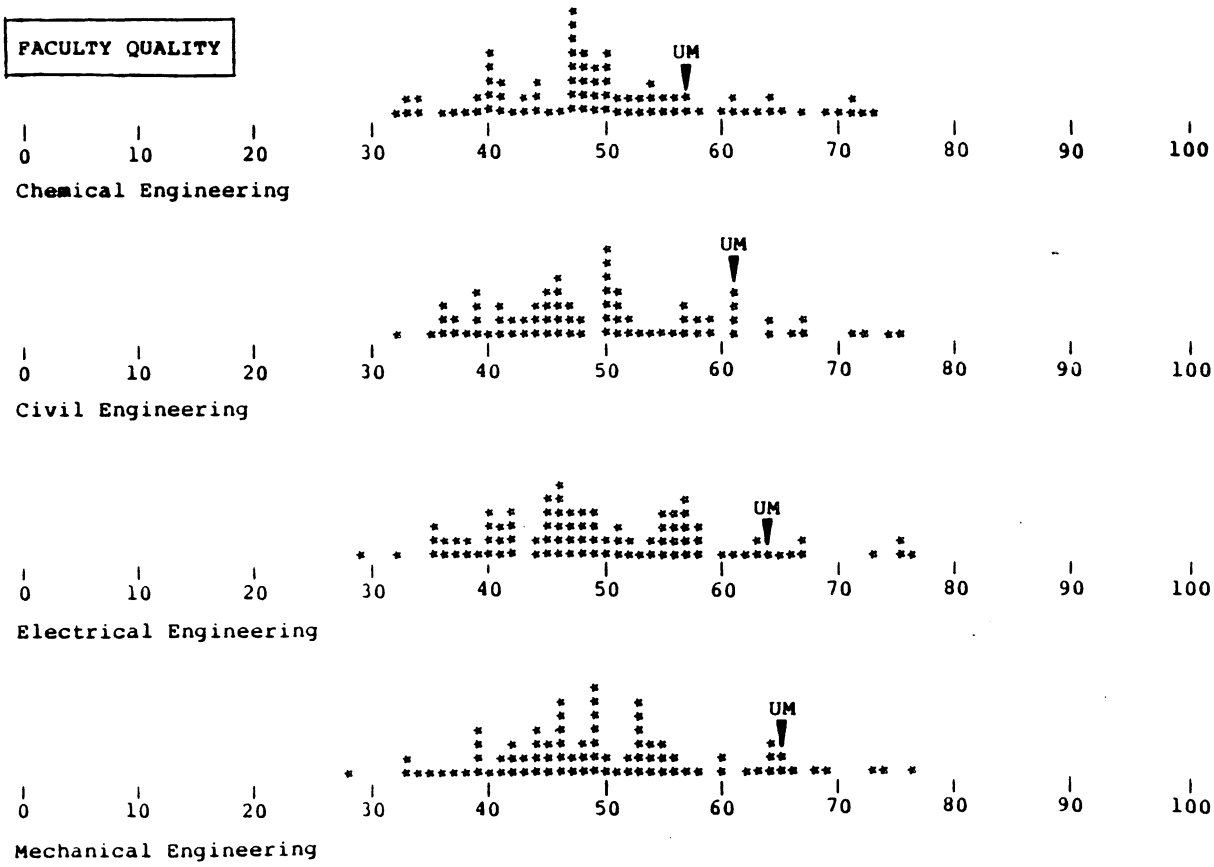
Program Quality Ratings

PROGRAM QUALITY RATINGS

FIGURES:

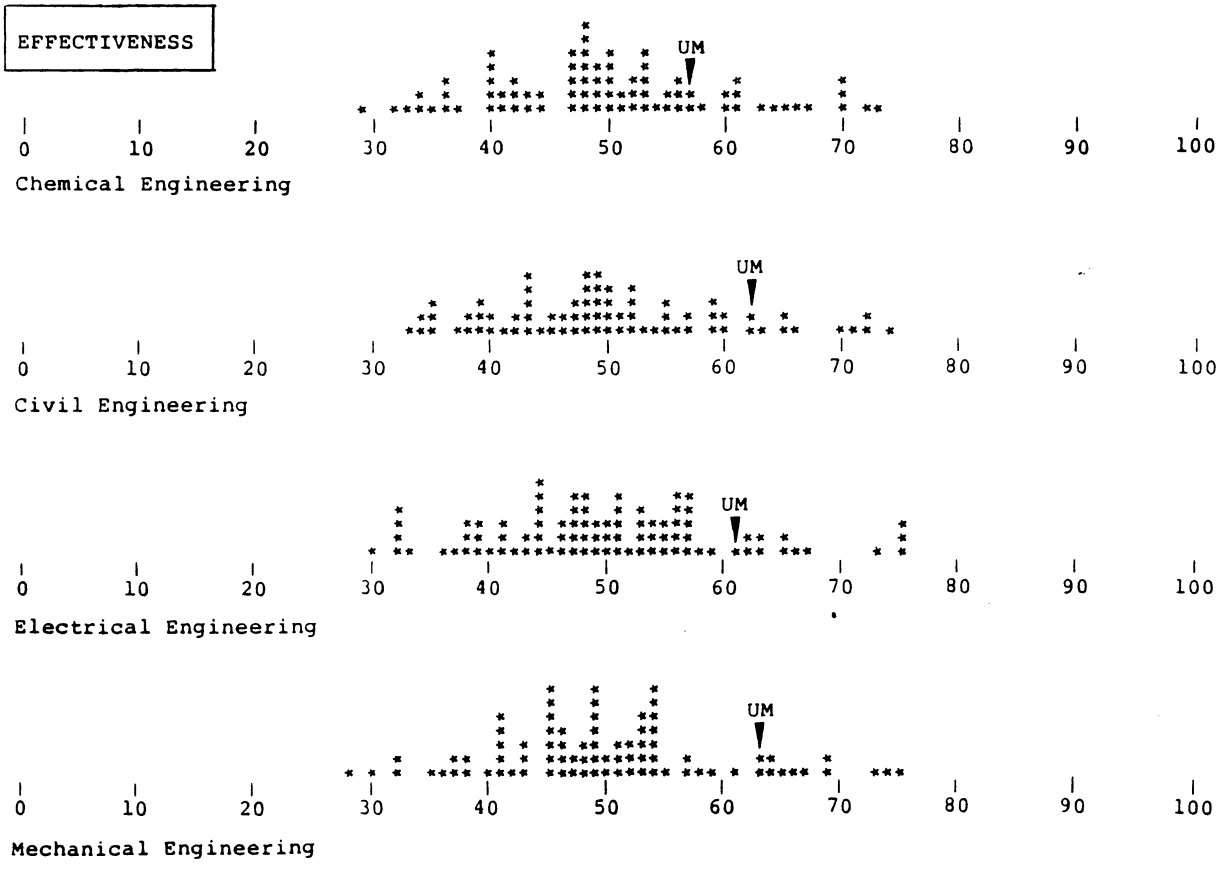
- Faculty Quality
- Program Effectiveness
- Program Familiarity
- Program Improvement
- Gourman Ratings

FACULTY QUALITY



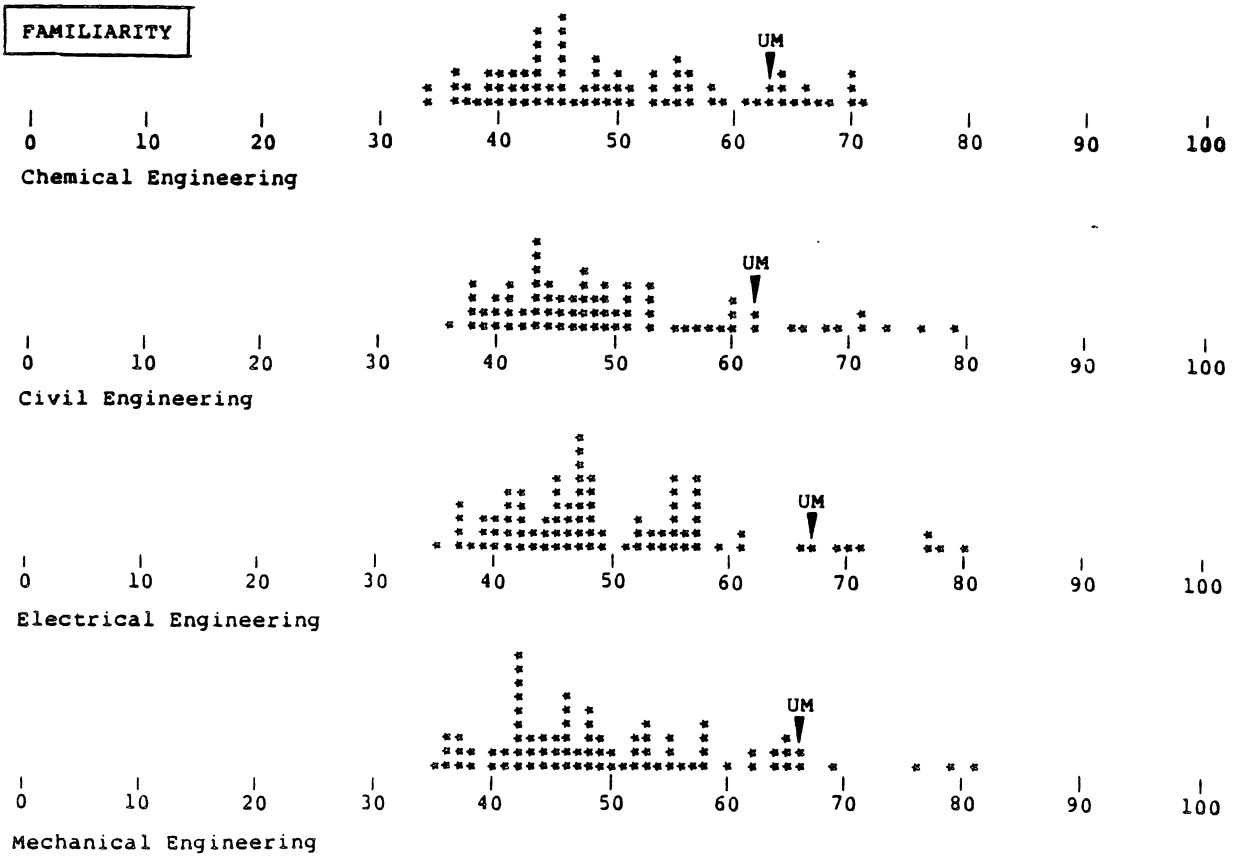
SOURCE: Conference Board of Associated Research Councils

EFFECTIVENESS



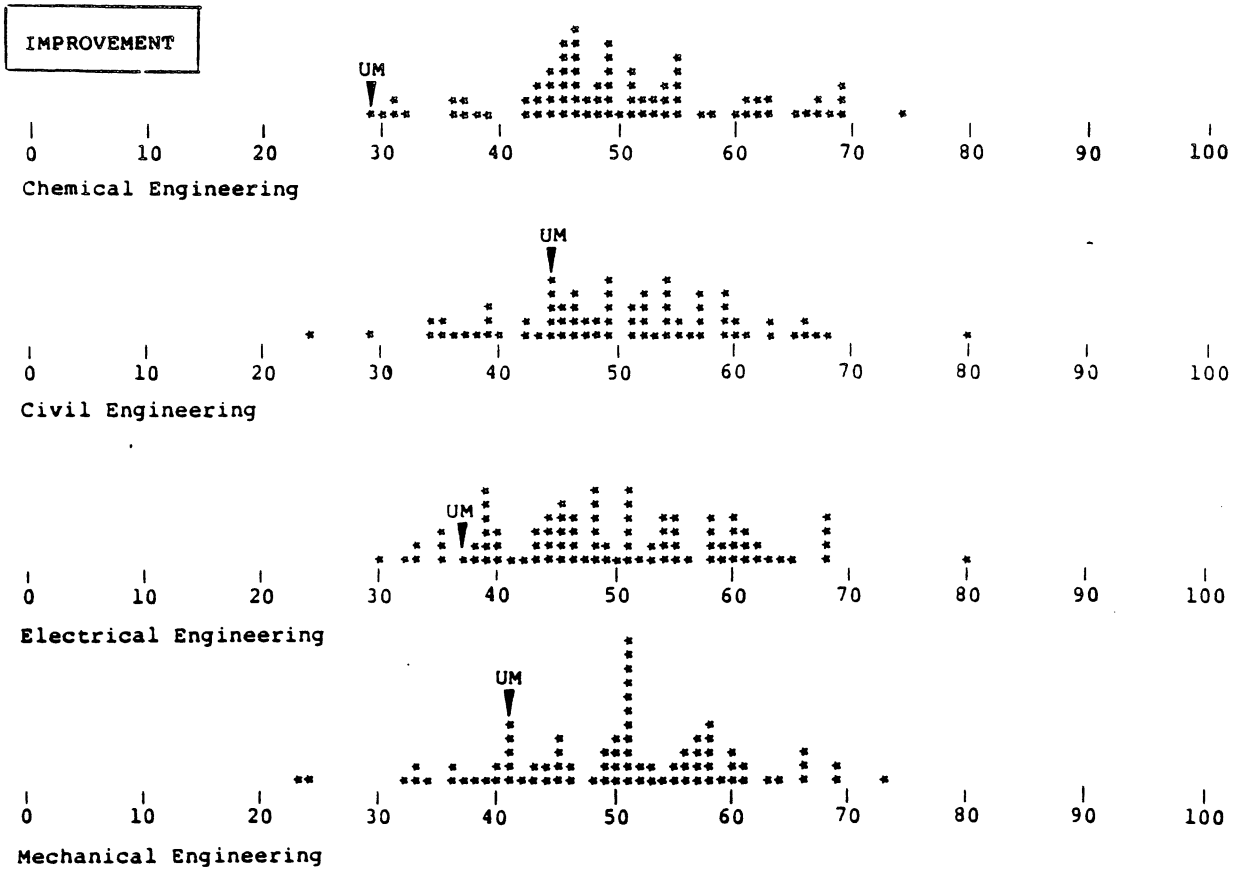
SOURCE: Conference Board of Associated Research Councils

FAMILIARITY



SOURCE: Conference Board of Associated Research Councils

IMPROVEMENT



SOURCE: Conference Board of Associated Research Councils

1983 GOURMAN RANKINGS OF ENGINEERING PROGRAMS

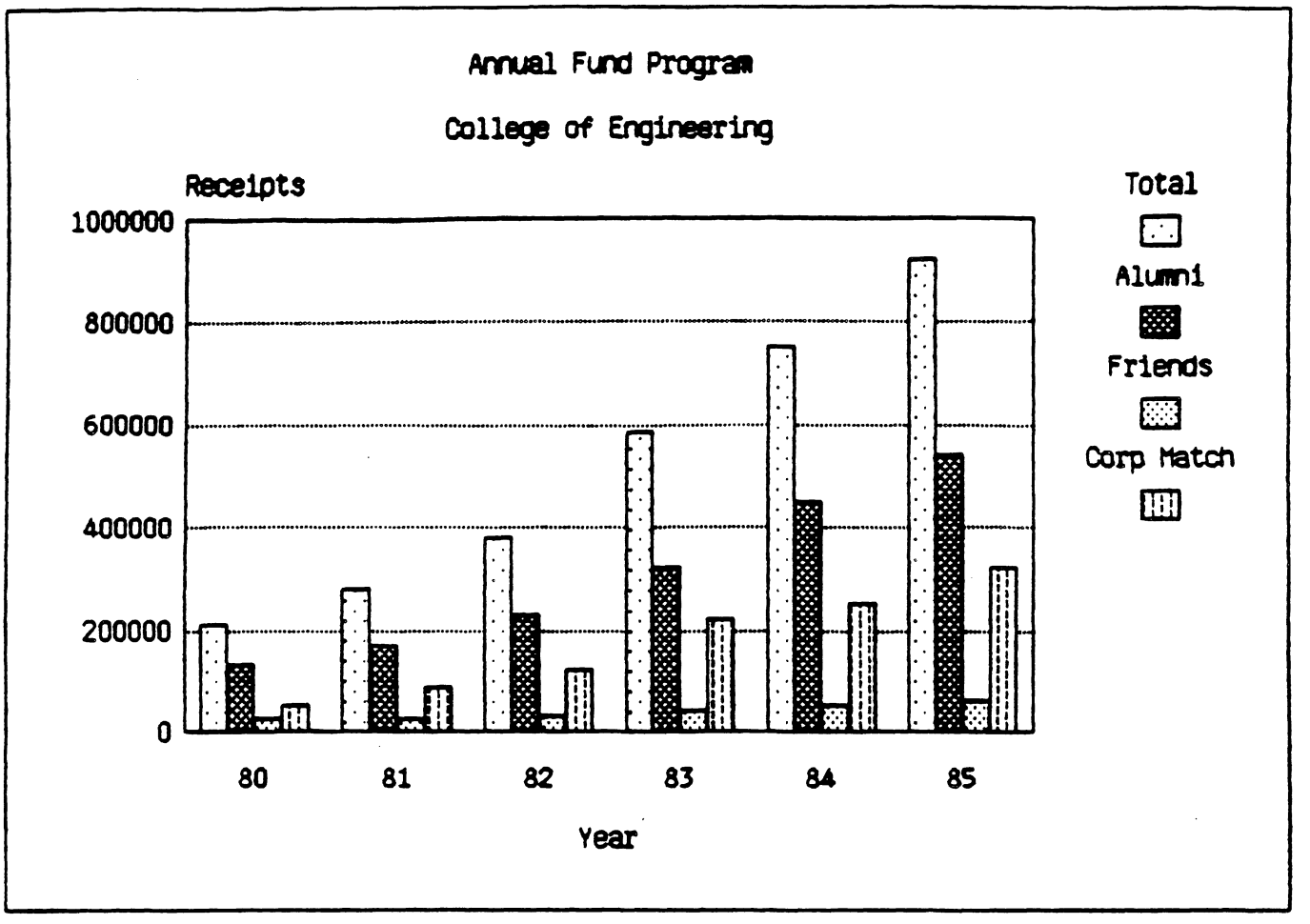
	U.G.	GRAD
AEROSPACE	MIT	MIT
	Michigan	Caltech
	Princeton	Michigan
	Minnesota	Princeton
	Illinois	Stanford
	Stanford	Cornell
	Brown	Illinois
	Ohio State	Purdue
	Iowa State	Minnesota
	Kansas	Georgia Tech
CIVIL	Cal-Berkeley	Cal-Berkeley
	Illinois	Illinois
	MIT	MIT
	Stanford	Stanford
	Cornell	Cornell
	Purdue	Caltech
	Michigan	Purdue
	Columbia	Michigan
	Northwestern	Columbia
	Carnegie	Wisconsin
INDUSTRIAL	Stanford	Michigan
	Michigan	Cal-Berkeley
	Cal-Berkeley	Stanford
	Purdue	Purdue
	Northwestern	Wisconsin
	Georgia Tech	Cornell
	Cornell	Georgia Tech
	Ohio State	Northwestern
	Columbia	Columbia
	Texas A&M	Ohio State
METALLURGICAL	Illinois	Illinois
	Colorado	Columbia
	Missouri	Pittsburgh
	Columbia	MIT
	Minnesota	Carnegie
	Penn State	Colorado
	Carnegie	Penn
	Case	Minnesota
	Michigan	Michigan
	Ohio State	Lehigh
NAVAL (U.G. only)	MIT	
	Michigan	
	Cal-Berkeley	
	NY Maritime (SUNY)	
	US Naval Academy	
	US Coast Guard	
	Texas A&M	
	Webb Institute	

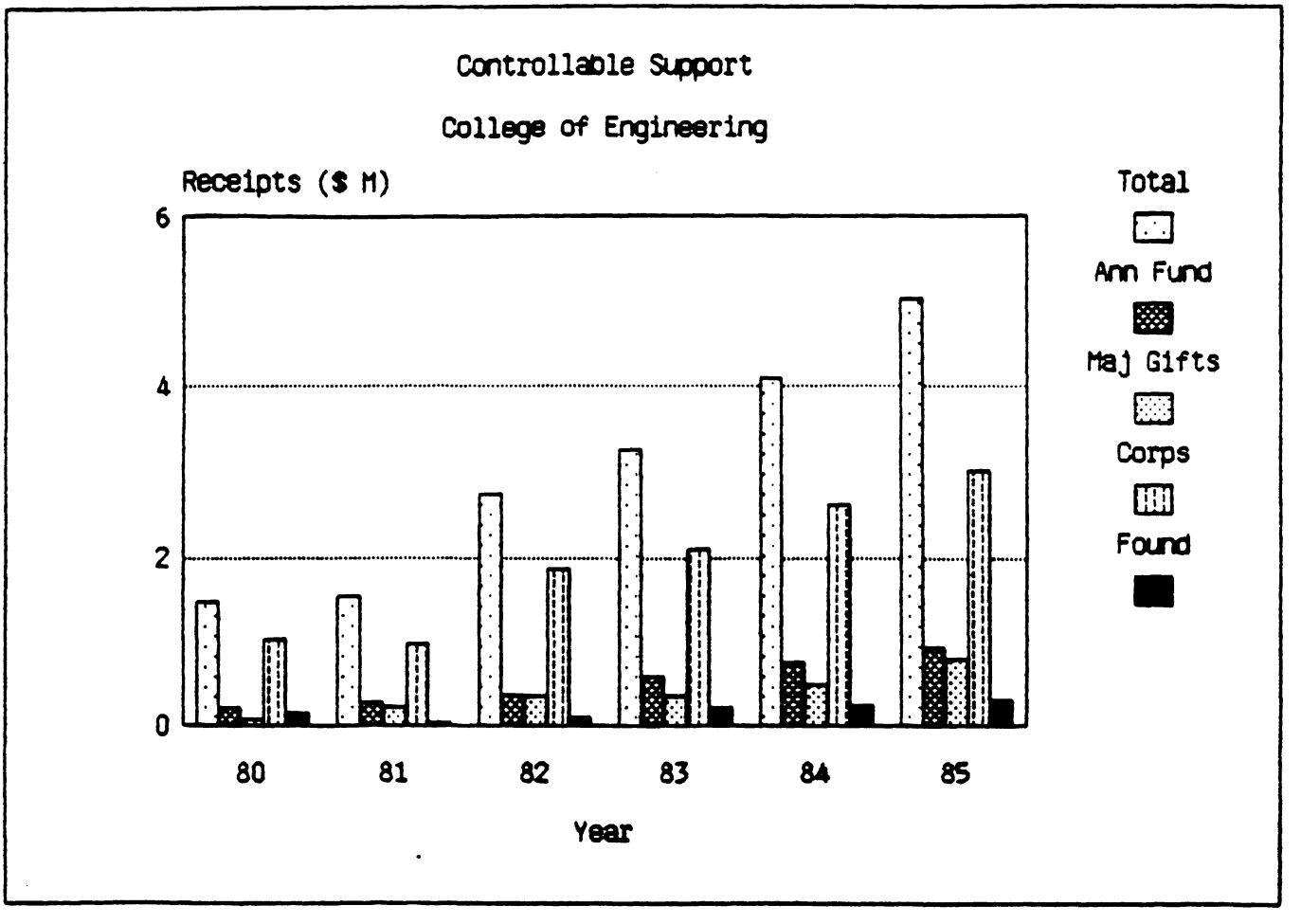
	U.G.	GRAD
CHEMICAL	Princeton	Wisconsin
	Wisconsin	Princeton
	Cal-Berkeley	Cal-Berkeley
	Minnesota	Minnesota
	MIT	MIT
	Stanford	Illinois
	Illinois	Stanford
	Caltech	Caltech
	Michigan	Michigan
	Delaware	Delaware
ELECTRICAL	MIT	MIT
	Stanford	Cal-Berkeley
	Cal-Berkeley	Stanford
	Illinois	Illinois
	Michigan	Michigan
	Princeton	Princeton
	Purdue	Caltech
	Cornell	Purdue
	Minnesota	Cornell
	Wisconsin	UCLA
MECHANICAL	MIT	MIT
	Stanford	Stanford
	Cal-Berkeley	Cal-Berkeley
	Michigan	Caltech
	Brown	Michigan
	Minnesota	Minnesota
	Illinois	Illinois
	Purdue	Purdue
	Cornell	Princeton
	Princeton	UCLA
NUCLEAR	Columbia	MIT
	Michigan	Michigan
	Wisconsin	Wisconsin
	Virginia	Cal-Berkeley
	Penn State	Georgia Tech
	RPI	Virginia
	Texas A&M	Columbia
	Arizona	Illinois
	Illinois	RPI
	Cal-Berkeley	Texas A&M
MATERIALS (U.G. only)	Cornell	
	Northwestern	
	Michigan	
	Cal-Berkeley	
	MIT	
	Brown	
	RPI	
	Vanderbilt	
	Case	
	Carnegie	
ENVIRONMENTAL (U.G. only)	Michigan	
	Harvard	
	Northwestern	
	Penn State	
	RPI	
ENG SCI (U.G. only)	Caltech	
	Harvard	
	Michigan	
	Georgia Tech	
	Penn State	
	Iowa State	
	Yale	

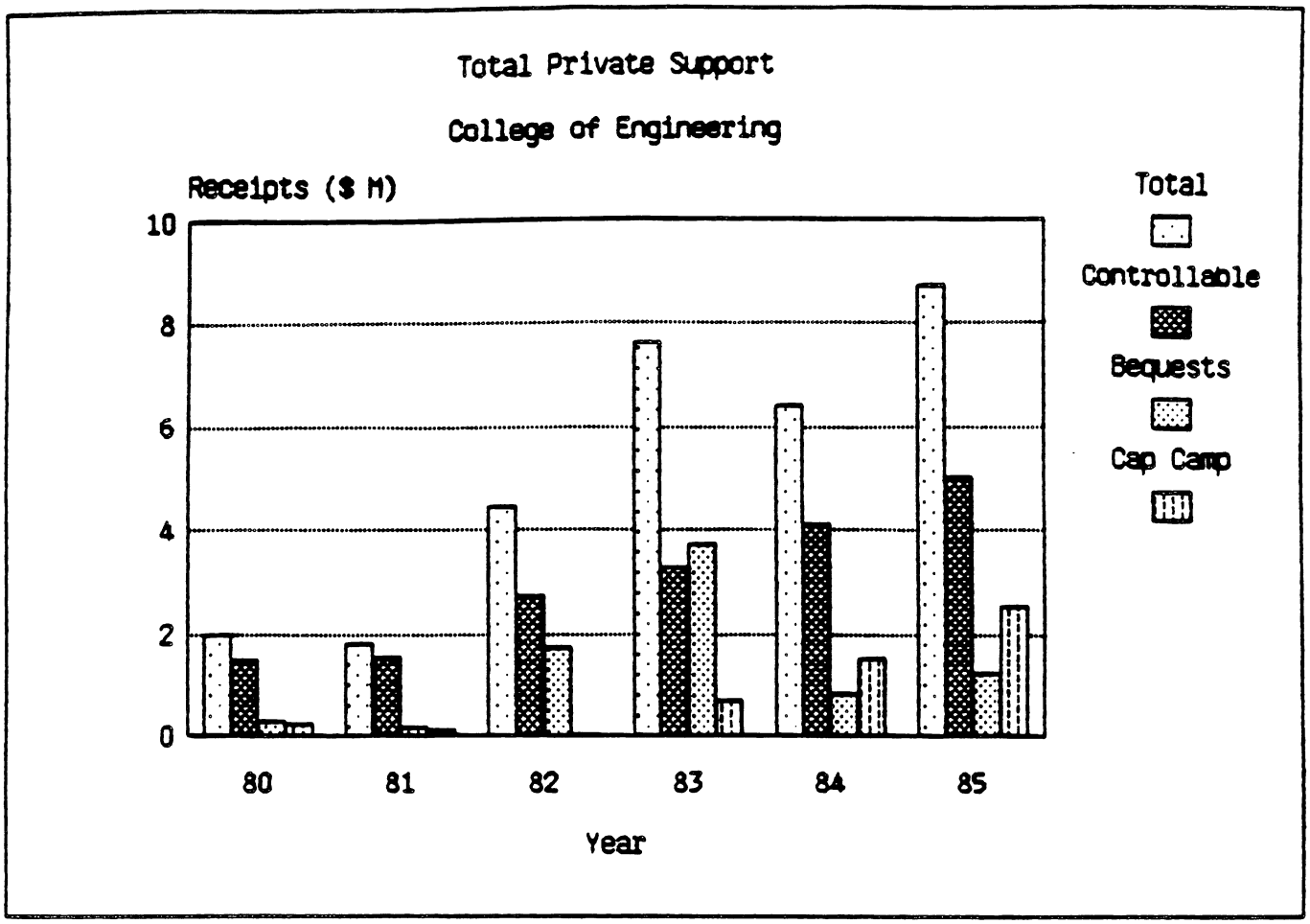
Development Activities

FIGURES:

- Annual Fund Program
- Controllable Support
- Total Private Support


Annual Fund Program
College of Engineering
Receipts
1000000
800000
600000
400000
200000
0
80
81
82
83
84
85
Year
Total
Alumni
Friends
Corp Match


Controllable Support
College of Engineering
Receipts ($ M)
6
4
2
0
80
81
82
83
84
85
Year
Total
Ann Fund
Maj Gifts
Corps
Found


Total Private Support
College of Engineering
Receipts ($ M)
10
8
6
4
2
0
80
81
82
83
84
85
Year
Total
Controllable
Bequests
Cap Camp