

FACULTY OUTPUT AND SALARY COSTS
OF THE
STATE-RELATED UNIVERSITIES

ANALYSIS OF REPORTS SUBMITTED
UNDER 1975 ACTS 13A, 34A, 35A AND 38A

Staff Report of the
Joint State Government Commission of the
General Assembly of the Commonwealth of Pennsylvania
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INTRODUCTION

In order to exercise meaningful oversight of State appropriations and to provide a basis for an equitable reimbursement rationale, the General Assembly requires the State-related universities to submit each year detailed data on faculty output and salary costs.

Initiating this requirement were 1972 amendments to the appropriations bills for the State-related universities introduced by Senator Richard A. Snyder of the Senate Committee on Appropriations. The amendments have been reenacted each year. Last year the Legislature established a similar reporting requirement for the State colleges for 1976-1977.

Since the inception of the reporting, the staff of the Joint State Government Commission has annually compiled and analyzed the data for the appropriations committees of the Senate and House.

This report reviews the data required by 1975 Acts 13A, 34A, 35A and 38A from Temple University, the University of Pittsburgh, the Pennsylvania State University and Lincoln University for the period from September 1, 1975 through August 31, 1976. It does not attempt to evaluate or rank the performances of the universities. Rather it presents information on quantifiable costs and enables comparisons not only among but within the universities.

Specifically this report concentrates on evaluation and comparison of student credit hours produced, courses taught, degrees granted, class sizes,

university-related activities of faculty members and faculty workloads and salaries. Cost-related measures and predictors are presented to serve as a basis for evaluation.

The underlying legislative intent of the reporting requirement may be summarized as the encouragement of quality higher education within the means of Pennsylvania students and taxpayers. The staff analysis serves this purpose by pinpointing areas where significant economies might be achieved by decreases in the number of courses offered and sections scheduled and by increasing the number of hours spent by faculty in classroom contact. The analysis raises questions regarding such issues as the large portion of faculty time spent in activities not related to instruction and the low productivity and high cost associated with certain areas and levels of instruction. Serious attention to these matters may well lead to changes that would save millions of dollars and increase instructional output.

DONALD C. STEELE
Research Director
Joint State Government Commission
Room 450, Capitol Building
Harrisburg, Pennsylvania

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SUMMARY OF FINDINGS

1. The average faculty salary and average student credit-hour production--the basic determinants of salary cost per student credit hour--differ widely among departments in the same university as well as among universities (see Table 7, p. 16).

Average Full-Time Faculty Student Credit-Hour Production and Salaries
Fall 1975

	Penn State		Pittsburgh		Temple		Lincoln	
	S.C.H.*	Salary	S.C.H.*	Salary	S.C.H.*	Salary	S.C.H.*	Salary
University	239	\$8,500	196	\$8,100	206	\$9,400	158	\$7,400
English	207	8,500	154	8,800	189	8,900	173	6,500
Mathematics	224	10,700	235	9,000	216	9,900	220	6,600

*Student credit hours.

For full-time faculty teaching undergraduate courses only, a wide range of average student credit-hour production existed at the four universities for the 1975-1976 academic year: Lincoln's faculty produced 300 credit hours; faculty at the branch campuses of Penn State and Pittsburgh produced almost 600 credit hours.

2. The primary factors underlying the average student credit-hour production are class size, weekly classroom contact hours of faculty members and use of part-time faculty (see Table 8, p. 20 and Table 9, p. 22).

Primary Factors Underlying Average Student Credit-Hour Production
Fall 1975

	<u>Penn State</u>	<u>Pittsburgh</u>	<u>Temple</u>	<u>Lincoln</u>
Average class size	22.8	20.1	21.9	15.4
Average weekly contact hours	10.5	10.3	9.4	11.1
Part-time faculty student credit-hour production as percentage of total	20.2	21.5	22.8	5.6

The average class sizes and weekly contact hours are partially dependent upon the relative amounts of graduate work. At Penn State, the graduate student credit hours are 7.4% of total student credit hours; at Pittsburgh, 21.4%; and at Temple, 25.8%. Lincoln does not offer graduate-level instruction.

3. Average faculty salary is influenced by the distribution of faculty by rank. For all teaching faculty at the four universities, the average salary increases as the rank increases (see Table 6, p. 14).
4. Temple alone appears to operate efficiently during the summer term. Its salary cost of full-time teaching faculty per student credit hour was lower than Penn State's and Pittsburgh's due to a combination of a reduced number of faculty being compensated at low rates and a reduction in the number of courses taught (see Table 2, p. 4 and Table 5, p. 11).
5. Penn State's main campus full-time faculty in fall 1975 reported spending 65% more time on research than in the classroom. In comparison, Temple's full-time faculty spent 22% more time on research than in the classroom (see Table 4, p. 9).
6. Aside from the level of faculty salaries, the significant controllable factors affecting faculty salary cost per student credit hour are

(1) class size, (2) faculty classroom contact hours and (3) relative production of part-time faculty. On the basis of the analysis presented in this report (see pp. 21-23 and the production data for the academic year, 1975-1976, Table 1, p. 2) estimated cost reductions could be effected at the following rates.

For each increase of one student in the average class size--

Pennsylvania State University	\$2,100,000
University of Pittsburgh	1,000,000
Temple University	1,000,000
Lincoln University	42,000

For each increase of one hour in average weekly classroom contact of faculty--

Pennsylvania State University	\$7,500,000
University of Pittsburgh	3,600,000
Temple University	3,500,000
Lincoln University	151,000

For each increase of one percentage point in part-time faculty student credit-hour production--

Pennsylvania State University	\$700,000
University of Pittsburgh	300,000
Temple University	300,000
Lincoln University	14,000

It should be emphasized that there are limits to the extent to which these factors can be increased without deterioration in the quality of instruction. Such limits, however, cannot even be approximated on the basis of available data.

ANALYSIS OF FACULTY OUTPUT AND SALARY COSTS

I. STUDENT CREDIT-HOUR PRODUCTION

Comparison of student credit hours produced, degrees granted and courses taught at the four State-related universities brings to light a significantly different mix of instruction not only among the four schools but also within the schools between the academic year and the summer term. Table 1 presents the total number of student credit hours produced by level for the year beginning September 1, 1975, and for fall 1975 and summer 1976. In particular, the difference in mix is evidenced by the proportion of work done at the graduate level, which ranged from zero at Lincoln University to almost 30% at Temple University for 1975-1976.

The distributions of credits within the undergraduate and graduate levels also appear to differ widely. Some of these differences, however, may be superficial due to varying methods of assigning course credits. Pennsylvania State University and Temple University, for example, assign course credits to the lower or upper undergraduate division on the basis of the level of the student who is earning the course credits. On the other hand, the University of Pittsburgh and Lincoln University classify credits earned in introductory courses as lower division, regardless of the level of the student taking the course. Were the assignment practice of Pittsburgh and Lincoln to be used by the two other universities, realistic cost comparisons between introductory and advanced courses could be made.

Table 1
STUDENT CREDIT-HOUR PRODUCTION, 1975-1976

Period and instructional level	Pennsylvania State University			University of Pittsburgh			Temple University			Lincoln University		
	Student credit hours	Percentage subtotal	total	Student credit hours	Percentage subtotal	total	Student credit hours	Percentage subtotal	total	Student credit hours	Percentage subtotal	total
September 1, 1975 - August 31, 1976												
Undergraduate												
Lower division	845,712	57.6	52.6	420,400	65.4	49.7	314,578	55.9	39.3	23,452	73.0	73.0
Upper division	621,647	42.4	38.6	222,804	34.6	26.4	248,478	44.1	31.1	8,692	27.0	27.0
Subtotal	1,467,359	100.0	91.2	643,204	100.0	76.1	563,056	100.0	70.4	32,144 ^a	100.0	100.0
Graduate												
Master's	89,599	63.5	5.6	127,919	63.3	15.1	114,476	48.4	14.3	N.A.	N.A.	N.A.
1st professional	N.A.	N.A.	N.A.	42,135	20.8	5.0	102,180	43.2	12.8	N.A.	N.A.	N.A.
Ph.D.	51,750	36.5	3.2	32,038	15.9	3.8	19,788	8.4	2.5	N.A.	N.A.	N.A.
Subtotal	141,749	100.0	8.8	202,112	100.0	23.9	236,444	100.0	29.6	N.A.	N.A.	N.A.
Total--1975-1976	1,609,108	100.0	100.0	845,316	100.0	100.0	799,500	100.0	100.0	32,144	100.0	100.0
Fall 1975 ^b												
Undergraduate												
Lower division	292,288	60.0	55.6	197,527	67.1	52.7	177,694	67.6	50.2	11,473	76.4	76.4
Upper division	194,846	40.0	37.0	96,871	32.9	25.9	85,279	32.4	24.0	3,540	23.6	23.6
Subtotal	487,134	100.0	92.6	294,398	100.0	78.6	262,973	100.0	74.2	15,013 ^a	100.0	100.0
Graduate												
Master's	25,444	65.4	4.8	50,268	62.8	13.4	45,131	49.2	12.7	N.A.	N.A.	N.A.
1st professional	N.A.	N.A.	N.A.	18,697	23.4	5.0	37,970	41.4	10.7	N.A.	N.A.	N.A.
Ph.D.	13,476	34.6	2.6	11,048	13.8	3.0	8,593	9.4	2.4	N.A.	N.A.	N.A.
Subtotal	38,920	100.0	7.4	80,013	100.0	21.4	91,694	100.0	25.8	N.A.	N.A.	N.A.
Total--fall 1975	526,054	100.0	100.0	374,411	100.0	100.0	354,667	100.0	100.0	15,013	100.0	100.0
Summer 1976 ^c												
Undergraduate												
Lower division	29,985	40.5	28.7	48,602	62.7	38.7	20,976	41.4	19.8	980	49.4	49.4
Upper division	43,964	59.5	42.2	28,927	37.3	23.0	29,691	58.6	28.1	1,004	50.6	50.6
Subtotal	73,949	100.0	70.9	77,529	100.0	61.7	50,667	100.0	47.9	1,984 ^a	100.0	100.0
Graduate												
Master's	18,594	61.1	17.8	31,647	65.8	25.2	23,298	42.3	22.0	N.A.	N.A.	N.A.
1st professional	N.A.	N.A.	N.A.	6,768	14.1	5.4	29,145	52.9	27.6	N.A.	N.A.	N.A.
Ph.D.	11,836	38.9	11.3	9,678	20.1	7.7	2,655	4.8	2.5	N.A.	N.A.	N.A.
Subtotal	30,430	100.0	29.1	48,093	100.0	38.3	55,098	100.0	52.1	N.A.	N.A.	N.A.
Total--summer 1976	104,379	100.0	100.0	125,622	100.0	100.0	105,765	100.0	100.0	1,984	100.0	100.0

N.A. Not applicable.

a. Fall and spring based on ending enrollment; summer based on beginning enrollment.

b. One-third of academic year at Pennsylvania State University and one-half of academic year at the other three universities.

c. One-fourth of calendar year at Pennsylvania State University and one-third of calendar year at the other three universities.

SOURCE: Reports provided by the individual universities.

Although the graduate production at Penn State for 1975-1976 was less than 142,000 student credit hours--as compared with 202,000 and 236,000 student credit hours produced at Pittsburgh and Temple, respectively--more than 50,000, or one-third of Penn State's graduate credits, were reported as Ph.D. level credits. In contrast, only 16% of Pittsburgh's and 8% of Temple's credits were classified as Ph.D. level credits. As in the case of the undergraduate level, there may be some differences in the assignment of credits to various graduate levels.

While in 1976 Lincoln University for the first time offered summer courses, which accounted for about 6% of its total year's production, the other three universities decreased their undergraduate student credit-hour production by over 10,000 credit hours from the summer of 1975. The graduate student credit hours produced in the summer at the three State-related universities offering graduate work in 1975-1976 are similar in magnitude to those of the academic year when the relative lengths of the summer terms are taken into consideration. The distributions of summer-term graduate credits suggest different types of graduate work at the three universities.

II. COURSES TAUGHT AND DEGREES GRANTED

The number of courses which can be offered by a university is limited to a certain extent by the size of its student population. The number of courses, however, does not increase proportionately with the number of full-time equivalent students. For example, Table 2 shows that Lincoln taught 175 undergraduate courses in the fall of 1975 to 1,000 full-time equivalent students, while Pittsburgh taught 2,340 undergraduate courses--13 times the number of

Table 2

NUMBER OF COURSES TAUGHT, NUMBER OF DEGREES GRANTED AND STUDENT CREDIT HOURS PER DEGREE, 1973-1976

University	Courses taught				Degrees granted				Student credit hours per degree			
	Fall		Summer		A.B.	M.A.	1st prof.	Ph.D.	A.B.	M.A.	1st prof.	Ph.D.
	Undergraduate	Graduate	Undergraduate	Graduate								
Pennsylvania State University	2,982	780	921	674	7,647	1,582	N.A.	376	178	--	N.A.	--
	3,049	834	962	633	7,758	1,524	N.A.	404	185	--	N.A.	--
	3,090	840	969	616	8,283	1,416	N.A.	438	177	64	N.A.	118
University of Pittsburgh	2,212	1,235	1,127	968	3,951	2,038	254	411	153	--	N.A.	--
	2,312	1,269	1,128	1,026	3,601	2,026	264	422	172	--	N.A.	--
	2,340	1,311 ^a	1,208	946 ^a	3,768	2,124	244	386	171	60	173	83
Temple University	1,499	934	657	438	3,350	1,600	610	160	151	--	N.A.	--
	1,511	963	719	446	3,400	1,400	700	250	157	--	N.A.	--
	1,525	1,025	766	490	3,090	1,457	704	208	182	79	145	95
Lincoln University	164	N.A.	N.A.	N.A.	172	N.A.	N.A.	N.A.	195	N.A.	N.A.	N.A.
	176	N.A.	N.A.	N.A.	191	N.A.	N.A.	N.A.	186	N.A.	N.A.	N.A.
	175	N.A.	N.P.	N.A.	200	N.A.	N.A.	N.A.	161	N.A.	N.A.	N.A.

N.A. Not applicable. N.P. Not provided.

a. Courses of the first professional dental medicine program not included.

SOURCE: Reports provided by the individual universities.

courses taught by Lincoln--to approximately 20 times as many full-time equivalent undergraduate students. Penn State, with approximately 2.5 times as many full-time equivalent undergraduate students as Pittsburgh, offered only one-third more courses than Pittsburgh. A further comparison of the number of undergraduate courses taught at Temple (1,525) with the 2,340 undergraduate courses at Pittsburgh, which is only slightly larger than Temple, raises the question as to the justification for so many courses at Pittsburgh.

Were the only goal of the students at the universities to earn degrees and were the number of new registrants for degrees more or less constant each year, the extent to which they attain their goal within the expected time period could be measured by the relationship of the total student credit hours produced towards the degree to the number of student credit hours required to obtain the degree--120 to 123 for an A.B. degree and 24 to 30 for a master's degree. Today, however, the student goals and the demands on the universities are manifold. In the first place, many students are admitted without having had sufficient high-school preparation to be eligible for college-level courses and, as a result, additional courses are required. Other students are taking only courses of interest to them and do not plan to complete the work required for a degree. Still other students are interspersing their academic studies with periods of other work.

A comparison of the number of student credit hours per degree shown in the last four columns of Table 2 with the number of credits noted above required for each degree indicates that many of the students digress from traditional study patterns for A.B. and master's degrees. At the Ph.D. level, many students in the past have completed the required courses--the number varying from

department to department--but have not completed a doctoral dissertation and earned a degree. The number of credit hours per degree reported by Pittsburgh and Temple at the Ph.D. level reflects this pattern. The significantly larger number reported by Penn State may be due to a different method of assignment of courses by level.

III. CLASS SIZE

A maximum average undergraduate class size can be estimated by dividing the undergraduate student credit hours produced in the fall (Table 1) by the number of undergraduate courses offered in the fall (Table 2) and further dividing by the average number of credit hours per course (two at Penn State and three at the other universities). This calculation assumes that one section is scheduled for each course. Such a scheduling might have resulted in average class sizes of 28 students at Lincoln, 42 at Pittsburgh, 57 at Temple and 78 at Penn State.

The actual number of sections taught per course shown on Table 3 and the class sizes estimated on the basis of distributions of class size reported by the universities corroborate the conclusion that class sizes could all be significantly increased if fewer sections were scheduled. In fact, at the undergraduate level at the three large universities the average number of sections per course for the fall term was greater than two. At the graduate level the average number of sections per course may reflect a possible difference in reporting sections as well as different types of graduate work at the three universities. Pittsburgh, out of 5,440 graduate sections taught, reported 3,812 sections of one student each in graduate independent study, thesis and dissertation for fall 1975.

Table 3

SECTIONS PER COURSE AND AVERAGE SECTION SIZE^a

University	Fall						Summer					
	Undergraduate			Graduate			Undergraduate			Graduate		
	Sections per course	Section size	Section size	Sections per course	Section size	Section size	Sections per course	Section size	Section size	Sections per course	Section size	Section size
Pennsylvania State University	2.1 ^b	27.8 ^b	8.3	1.4	1.6 ^b	18.9 ^b	1.4	9.4	1.4	18.9 ^b	1.4	9.4
	2.2 ^b	28.0 ^b	5.6	2.3	1.7 ^b	20.5 ^b	2.7	4.6	2.7	20.5 ^b	2.7	4.6
	2.2	28.0	4.8	2.3	1.7	18.5	2.8	3.8	2.8	18.5	2.8	3.8
University of Pittsburgh	2.2	23.1	5.2	3.5	2.0	12.4	5.6	3.0	5.6	12.4	5.6	3.0
	2.4	20.8	6.9	4.5	2.0	13.4	5.4	4.9	5.4	13.4	5.4	4.9
	2.3	22.6	5.2 ^c	4.1 ^c	1.8	12.8	4.9 ^c	3.5 ^c	4.9 ^c	12.8	4.9 ^c	3.5 ^c
Temple University	2.1	23.3	16.8	1.2	1.2	15.9	1.1	12.8	1.1	15.9	1.1	12.8
	2.3	23.1	17.5	1.2	1.4	15.6	1.1	14.2	1.1	15.6	1.1	14.2
	2.1	25.7	17.8	1.3	1.3	15.8	1.2	13.8	1.2	15.8	1.2	13.8
Lincoln University	1.5	19.3	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
	1.5	20.1	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
	1.5	19.7	N.A.	N.A.	N.P.	N.P.	N.A.	N.A.	N.P.	N.P.	N.A.	N.A.

N.A. Not applicable. N.P. Not provided.

a. Section sizes estimated on the basis of distributions of class size reported by the universities.

b. Includes undergraduate/graduate courses.

c. Courses and sections of the first professional dental medicine program not included.

SOURCE: Reports provided by the individual universities.

Although the percentage of undergraduate student credit hours produced in summer 1976 ranged from 15% to 26% of those produced in the fall 1975, the number of courses taught ranged from 30% to 50% of those taught in the fall. Possibly, in light of the few undergraduate student credit hours produced, further reductions in the number of summer courses are feasible. The information furnished by Lincoln in regard to summer courses was incomplete.

IV. UNIVERSITY-RELATED ACTIVITIES OF FULL-TIME FACULTY MEMBERS

The distributions of full-time faculty by reported work-related hours per week for fall 1975 as well as the average hours spent by faculty in various activities are shown on Table 4. Data for Pennsylvania State University and the University of Pittsburgh are presented by main and branch campuses for comparison purposes.

Analysis of hours devoted to specific activities leads to three significant conclusions. First, time spent in classroom contact and instructional support is not greatly influenced by the magnitude of the graduate student credit-hour production at a university. While Temple produced more than 90,000 graduate student credit hours for fall 1975 and the main campus of of Pittsburgh produced about 80,000 student credit hours, Penn State produced less than 55,000 student credit hours at the main campus for the same period of time. However, at all three, the full-time faculty spent on the average of 28 hours per week in classroom contact and instructional support. For the same semester, the faculty at Lincoln, who teach no graduate courses, reported an average of 33.2 hours in these activities, while faculty at the Pittsburgh and Penn State branch campuses with a small graduate program averaged nearly 41 hours per week.

Table 4

DISTRIBUTIONS OF FULL-TIME FACULTY BY REPORTED WORK-RELATED HOURS AND AVERAGE HOURS SPENT IN SPECIFIED ACTIVITIES, FALL 1975

	Pennsylvania State University		University of Pittsburgh		Temple University	Lincoln University
	Main campus	Branch campuses	Main campus	Branch campuses		
Full-time faculty	1,777	861	1,344	169	1,328	82
Distribution of faculty by average total hours per week						
Less than 30	0	0	3	0	16	3
30-39	15	23	37	13	64	14
40-49	770	256	373	45	280	17
50-59	715	332	532	60	455	29
60-69	214	179	272	38	344	7
70-79	58	60	89	11	160	7
80 or more	5	11	38	2	9	5
Range of total hours per week	30-96	30-91	13-103	30-83	20-150	18-108
Average hours per week	51.4	54.8	55.1	54.1	56.3	52.3
Distribution of average hours per week by activity						
Undergraduate contact	5.9	13.2	4.6	13.4	5.9	11.1
Graduate contact	3.0	.4	5.3	---a	3.5	N.A.
Instructional support	19.0	27.1	17.5	27.3	18.0 ^b	22.1
Research	14.7	7.5	14.6	2.2	11.5	10.6
Public and university service	8.8	6.6	13.1	11.2	17.4 ^c	8.5

N.A. Not applicable.

- a. Average hours spent in graduate contact equal .04.
- b. Includes other contact hours which were not assigned.
- c. Includes "other hours."

SOURCE: Activity reports furnished by full-time faculty members, fall 1975.

Second, because of large professional school classes, Temple faculty members on the average do not spend substantially more time in graduate classroom contact than faculty members at the main campus of Penn State but produce a significantly greater percentage of student credit hours. Penn State faculty spent on the average only one-half hour less in graduate contact during fall 1975 than Temple faculty.

Third, in fall 1976 more hours on the average were spent in research than in classroom contact, at Temple and at the main campuses of Pittsburgh and Penn State. While some of this research is departmentally oriented, a large portion is separately budgeted and may be privately compensated. For example, it is estimated that the work accounting for almost 40% of the research hours at Penn State is separately budgeted.

V. FULL-TIME TEACHING FACULTY WORKLOADS AND SALARIES

In order to compare the student credit-hour workloads of faculty teaching at similar levels, the faculty members are divided on Table 5 into three different sets--faculty teaching at the undergraduate level only, at the graduate level only and at both the undergraduate and graduate levels. For each level the table presents the number of faculty members, average student credit hours produced per faculty member, average faculty salary and the unit cost--faculty salary divided by the student credit hours produced.

Faculty teaching undergraduate level only

The significantly higher average student credit-hour production for faculty teaching only at the undergraduate level at the branch campuses of Penn State

Table 5

AVERAGE STUDENT CREDIT-HOUR PRODUCTION AND SALARY COSTS FOR FULL-TIME TEACHING FACULTY, 1975-1976

Level of instruction	Academic year				Summer		
	Average number of faculty	Average production per faculty member	Salary cost per student credit hour	Average salary	Number of faculty	Average S.C.H. production ³ per faculty member	Salary cost per student credit hour
Undergraduate only							
Pennsylvania State University	268	460	\$34	\$15,620	106	138	\$55
Main campus ¹	773	589	23	13,823			
Branch campuses ¹							
University of Pittsburgh ²	284	397	33	13,159	110	82	71
Main campus	170	598	24	14,347			
Branch campuses	168	429	36	15,405	157 ^a	87	29
Temple University	93	299	45	14,689			
Lincoln University							part-time faculty only
Graduate only							
Pennsylvania State University	265	101	210	21,213	372	39	277
University of Pittsburgh ²	351	221	80	17,748	387	62	134
Temple University	382	288	72	20,607	261 ^a	143	27
Undergraduate and Graduate							
Pennsylvania State University	1,125	519	36	18,460	385	143	68
University of Pittsburgh ²	547	449	40	17,890	177	103	79
Temple University	772	411	45	18,654	344 ^a	94	40
All levels							
Pennsylvania State University	2,431	489	35	16,975	863	98	103
University of Pittsburgh ²	1,352	398	41	16,414	674	76	103
Temple University	1,322	378	50	18,806	694 ^b	120	33
Lincoln University	93	300	45	14,689			part-time faculty only

S.C.H. Student credit hour.

1. Estimated on the assumption that the average salary and average student credit-hour production of faculty members teaching partially or entirely at the graduate level are similar at the main and branch campuses.

2. Dental school statistics excluded.

3. Average student credit-hour production at Penn State is multiplied by 1.50 to be comparable to the other universities.

a. Total number of full-time faculty for three summer sessions.

b. All teaching faculty equals 762 faculty minus 68 faculty who taught in two or more of the 1976 summer sessions.

SOURCE: Reports provided by the individual universities.

and Pittsburgh shown on Table 5 is consistent with the 40-hour work week in contact and instructional support indicated on Table 4 for these branch campuses. Although it might be expected that the workload of all faculty teaching only undergraduate courses would be very similar, in fact the average student credit-hour production for the academic year ranges from 300 at Lincoln to almost 600 at the branch campuses.

For the faculty teaching undergraduate courses only, the average unit cost for the academic year ranges from \$23 at the branch campuses of Penn State to \$45 at Lincoln. The unit costs of the main campuses of Penn State and Pittsburgh are similar although the average salary is almost \$2,500 greater at Penn State than Pittsburgh. Penn State's low unit cost has been accomplished by larger faculty workloads at the main campus.

Faculty teaching graduate level only

Academic year--Table 5 furnishes similar comparisons for faculty teaching at the graduate level only. While the average salary of the faculty in this set at Temple is only \$600 less than that of the average faculty salary at Penn State, the average unit cost at Temple is only \$72 as compared with \$210 at Penn State. This difference is caused by the wide spread in average academic year production--101 student credit hours at Penn State and 288 at Temple. Over the last three academic years, the average production of Penn State faculty teaching graduate courses only decreased while their average salary increased. The large student credit-hour workload at Temple reflects to some extent the unique workload of the faculty in its professional schools.

Summer--The number of faculty teaching graduate level only in summer 1976 at both Penn State and Pittsburgh was larger than in the fall (40% larger at

Penn State) and average student credit-hour production was less than 40% of that of the academic year at each of the schools. As a result, the credit-hour costs rose drastically. In contrast, Temple maintained its average production cost by reducing the number of faculty teaching graduate courses only in the summer from 382 to 261 and paying faculty at reduced salary rates. Penn State's average summer salary rate per term is greater than the academic-year rate.

Full-time teaching faculty by rank

In addition to the effect of different levels of instruction on the faculty salary cost per student credit hour, differences in ranks held by the faculty members also affect the unit cost. Table 6 shows the fall 1975 average salaries by rank for full-time teaching faculty. The distribution of the faculty by rank, also shown on Table 6, is an important factor in determining the overall average salary. Temple not only paid the highest salaries in each rank but employed the largest percentage of teaching faculty in the highest paying ranks and the lowest percentage in the rank of instructor.

The average contact hours per week for the four ranks of teaching faculty indicate that the average number of hours spent in classroom contact usually increases as the rank decreases, i.e., the highest paid faculty spend the least time in the classroom. The one exception was Pittsburgh, where associate professors spent more time on the average in classroom contact than assistant professors. Assistant professors and instructors at Penn State and instructors at Pittsburgh and Temple had an average of more than 12 hours per week of classroom contact in the fall of 1975. As Table 6 indicates, the average teaching faculty member in each rank at Lincoln failed to attain an average of 12 classroom contact hours per week.

Table 6

AVERAGE SALARIES OF FULL-TIME TEACHING FACULTY AND WEEKLY CONTACT HOURS BY RANK, FALL 1975

University	Professor			Associate professor			Assistant professor			Instructor					
	Number	Percent ²	Average fall salary	Number	Percent ²	Average fall salary	Number	Percent ²	Average fall salary	Number	Percent ²	Average fall salary	Number	Percent ²	Average fall salary
Penn State ¹	469	20.5	\$11,580	601	26.3	\$8,979	848	37.1	\$7,239	369	16.1	\$5,569	369	16.1	\$5,569
Pittsburgh	293	23.3	11,060	413	32.9	8,213	422	33.6	6,634	128	10.2	4,896	128	10.2	4,896
Temple	369	27.9	12,310	414	31.4	9,651	407	30.8	7,519	131	9.9	6,200	131	9.9	6,200
Lincoln	20	25.3	N.P.	14	17.7	N.P.	26	32.9	N.P.	19	24.1	N.P.	19	24.1	N.P.

N.P. Not provided.

1. Salaries adjusted to reflect one-half of academic year.

2. Percentage of the faculty in the four ranks in the specified rank.

SOURCE: Reports provided by the individual universities.

VI. AVERAGE PRODUCTION AND UNIT COSTS FOR ALL FULL-TIME FACULTY

Instructional support faculty

In addition to full-time teaching faculty, academic administrators and other personnel are involved in instructional programs. The number and the rank distribution of instructional support faculty determine the additional salary cost attributable to these faculty. This additional cost varies by department within each school. On the average for the 1975-1976 academic year, salaries of full-time instructional support faculty--numbering 213 at Penn State and 89 at Pittsburgh, not including faculty of the School of Dental Medicine--increased the unit costs by \$2.91 and \$2.39, respectively. While there is no reason to presume that Temple's case is atypical, no faculty data or salaries were provided for the instructional-support category.

Departmental breakdown of production and unit costs for one semester

Table 7 presents the average unit costs when the salaries of nonteaching full-time faculty are included. The averages are shown for individual departments and colleges and limited to one semester or one-half of the academic year. The average full-time faculty production university-wide for one semester (fall 1975) ranges from 158 student credit hours at Lincoln University to 239 student credit hours at Penn State, as shown in the last row of Table 7. However, the average student credit-hour production per faculty member ranges from 88 in the Pittsburgh Foreign Languages Department to 404 in the Law School at Temple. The unit cost for Pittsburgh's Foreign Languages Department is high (\$99.47) because of the low full-time faculty production. It should be noted, however, that the unit cost falls to \$62 (see Table 9) in this department when

Table 7

AVERAGE WORKLOAD OF FULL-TIME FACULTY AND SALARY COST PER STUDENT CREDIT HOUR BY DEPARTMENT OR COLLEGE, FALL 1975

Department or College ¹	Pennsylvania State University			University of Pittsburgh			Temple University			Lincoln University		
	Number of faculty	Average student credit hour ²	Salary cost per student credit hour	Number of faculty	Average student credit hour production	Salary cost per student credit hour	Number of faculty	Average student credit hour production	Salary cost per student credit hour	Number of faculty	Average student credit hour production	Salary cost per student credit hour
Liberal Arts and Sciences	136	371	\$26.24	145	202	\$38.07	77	270	\$37.60	12	236	\$34.52
Science courses	40	182	51.21	45	88	99.47	39	160	53.19	7	168	38.26
Foreign languages	38	224	47.68	43	235	38.39	45	216	45.53	7	220	29.85
Mathematics	19	300	32.10	22	214	47.01	23	197	50.56	3	219	37.39
Political science	60	207	41.34	44	154	57.32	79	189	46.93	11	173	37.94
English	25	310	30.42	31	203	47.01	46	249	38.40	5	158	59.11
History												
School of Education	138	230	37.21	157	151	50.47	191	169	56.56	2	210	44.50
School of Engineering	183	139	71.05	109	183	49.84	26	246	36.47	N.A.	N.A.	N.A.
School of Business Administration	67	379	27.50	43	231	47.46	144	268	37.80	4	235	29.66
Professional Schools												
Law	N.A.	N.A.	N.A.	22	373	30.82	35	404 ^c	28.24 ^c	N.A.	N.A.	N.A.
Pharmacy	N.A.	N.A.	N.A.	29	170	38.08	29	302 ^c	36.29 ^c	N.A.	N.A.	N.A.
Dentistry	N.A.	N.A.	N.A.	82	---	---	108	100 ^c	105.37 ^c	N.A.	N.A.	N.A.
School of Agriculture	216	104	84.64	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
University												
Main Campus	1,777	205	44.44	1,344	179 ^b	46.03 ^b	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Branch campuses	861	307	23.22	169	322	21.50	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
University total	2,638	239	35.52	1,513	196 ^b	41.27 ^b	1,328	206 ^d	45.68 ^d	82	158 ^e	44.32

N.A. Not applicable.

1. Department figures reflect only main campus faculty, student credit hours and salary. Where total department salaries were not given, averages were based on the total of faculty whose salary and student credit hours were known.

2. Average student credit-hour production at Penn State equals 1.5 times the fall 1975 student credit-hour production.

a. First professional student credit hours for the dental school were not divided into full- and part-time classifications.

b. Does not include salary and student credit-hour production of the school of dentistry.

c. Inconsistent data adjusted.

d. Based on student credit-hour production and salary of 1,330 faculty.

e. Average student credit-hour production for Lincoln was based on student credit-hour production of 89 full-time faculty.

SOURCE: Reports provided by the individual universities.

the part-time faculty are included. The Law School at Temple, with high productivity, has a unit cost of \$28.24. Temple has attained this low unit cost in spite of a high average faculty salary--\$11,403 (Table 8)--as opposed to the Pittsburgh Foreign Languages Department average salary of \$8,758.

In order to observe the effect of productivity on costs, Chart 1 displays the salary cost per student credit hour for each department shown on Table 7 by the average student credit-hour workload for all full-time faculty. The distribution of unit costs demonstrates a greater variance within universities than among them. The universities are identified on the chart by different symbols. A few of the observations have been labeled to demonstrate the differences in the same department at the various universities. The number in the brackets beside the name of the department is the average class size, one of the factors affecting the unit cost (see Table 8).

The curve presented on the chart was calculated as a least squares fit to an inverse relationship between the unit cost and the average student credit-hour production for the various departments at the three universities. The equation as drawn is:

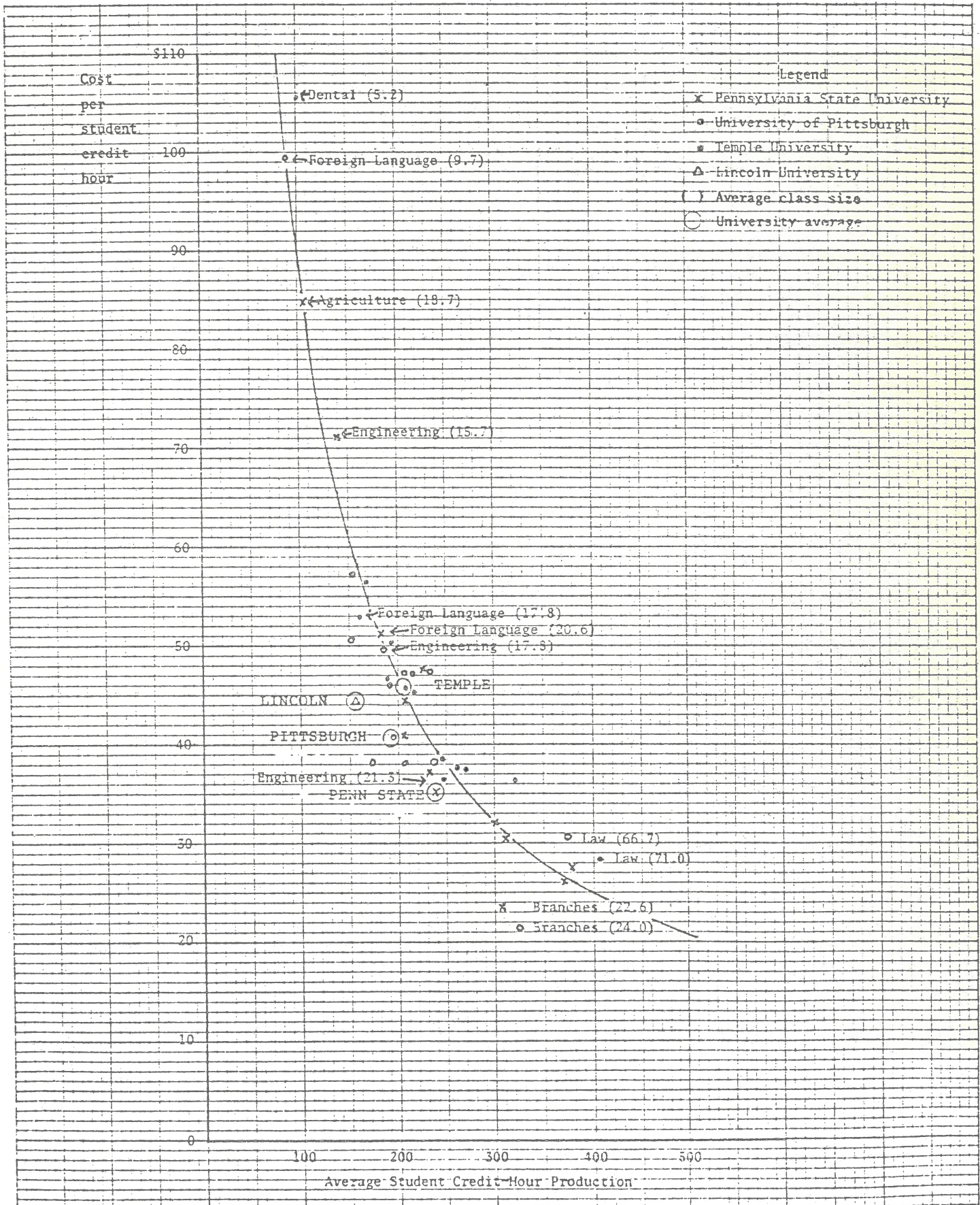
$$\frac{\text{Salary cost}}{\text{Student credit hours}} = \$3.60 + \frac{\$8,600}{\text{Average student credit-hour production}}$$

An algebraic simplification can be obtained by transforming the equation into totals, i.e., substituting the quotient of total student credit hours and the total faculty for the average student credit-hour production. The resulting equation becomes:

Total salary costs = \$3.60 x total student credit hours + \$8,600 x total number of faculty.

Chart 1

UNIT COST AS RELATED TO AVERAGE STUDENT CREDIT-HOUR PRODUCTION



$Y = 3.00 + 8600 \dots R^2 = 917$

Calc / SCH = y

o / av SCH = x

$$\bar{y} = 3.6 + 86x_1$$

$$R^2 = .9172 \quad R = .9577$$

Variations of Coeff.

$$S_{b_{y_1}} = \frac{\sqrt{\frac{\sum x^2 \sum y^2 - (\sum xy)^2}{(n-2)(\sum x^2)}}}{\sigma_x \sqrt{n-1}} = 4.8 \checkmark$$

Standard Error

$$S = \sigma_y \sqrt{1-R^2} \sqrt{\frac{n}{n-n-1}} = 5.6 \checkmark$$

The curve demonstrates the drastic effect on the unit cost as student credit-hour production decreases.

VII. PRIMARY FACTORS AFFECTING COSTS

Table 8 shows the primary factors affecting faculty salary cost per student credit hour for the departments under observation and for the universities as a whole. Larger class sizes and increased average faculty contact hours tend to decrease the unit cost, while larger percentages of student credit hours at the graduate level and higher faculty salaries tend to increase the unit cost.

While the average class sizes of the engineering departments at Penn State, Pittsburgh and Temple of 15.7, 17.8 and 21.3 partially account for the full-time faculty costs per student credit hour of \$71.05, \$49.84 and \$36.47, respectively, the large difference in unit cost between Penn State and Pittsburgh is further due to the fewer contact hours at Penn State and the higher average faculty salaries.

The foreign languages departments in general are relatively expensive. However, at Pittsburgh, with an average class size of 9.7, the cost of foreign languages is well above the cost of all other observations on the chart. At the other end of the scale, as the chart indicates, are the branch campuses of Penn State and Pittsburgh. Because of the lower average full-time faculty salaries and relatively high average number of contact hours at these branches, their costs are approximately one-half those of the main campus, although the average class sizes were comparable.

← This regression on p 21 includes the ^{university} ~~university~~ ^{range} ~~university~~ salary costs unimportant in determining unit costs only output matters.

Table 8

PRIMARY FACTORS AFFECTING UNIT SALARY COSTS BY DEPARTMENT, FALL 1975

Department or college ¹	Pennsylvania State University				University of Pittsburgh				Temple University				Lincoln University									
	Class ² size	Average contact hours of full-time faculty ³	Professors as percent of total faculty	Graduate student credit hours as percent of total	Class ² size	Average contact hours of full-time faculty	Professors as percent of total faculty	Graduate student credit hours as percent of total	Class ² size	Average contact hours of full-time faculty	Professors as percent of total faculty	Graduate student credit hours as percent of total	Class ² size	Average contact hours of full-time faculty	Professors as percent of total faculty	Graduate student credit hours as percent of total						
Liberal Arts & Sciences	35.6	10.4	43.4	9.1	\$9,738	29.2	6.9	31.7	8.5	\$7,671	44.1	6.1	37.7	7.7	\$10,134	20.2	10.4	41.7	N.A.	N.A.	\$8,158	
Science courses	20.6	8.9	27.5	9.0	9,329	9.7	9.1	26.7	7.8	8,758	17.8	9.0	15.4	7.2	8,517	16.4	12.7	14.3	N.A.	N.A.	6,437	
Foreign languages	28.1	8.0	28.9	4.0	10,674	30.2	7.8	16.3	2.6	9,012	29.7	7.3	31.1	3.4	9,856	18.8	11.7	14.3	N.A.	N.A.	6,566	
Mathematics	39.3	7.6	26.3	5.9	9,620	24.1	8.9	31.8	7.5	10,837	26.3	7.5	39.1	12.2	9,951	16.2	12.0	33.3	N.A.	N.A.	8,186	
Political science	23.1	9.0	21.7	5.8	8,549	16.6	9.3	29.5	5.4	8,829	26.6	7.1	25.3	3.2	8,864	12.0	11.0	18.2	N.A.	N.A.	6,545	
English	31.0	9.1	32.0	7.0	9,421	22.8	8.9	29.0	7.1	9,324	37.6	6.6	26.1	6.9	9,566	16.8	9.6	40.0	N.A.	N.A.	9,310	
School of Education	20.8	11.0	25.4	20.4	8,551	13.0	11.7	21.7	57.7	7,638	17.5	9.6	34.0	51.6	9,541	14.0	15.0	50.0	N.A.	N.A.	9,345	
School of Engineering	15.7	8.8	28.4	15.7	9,844	17.8	10.3	22.0	25.2	9,126	21.3	11.5	3.8	.6	8,961	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	
School of Business Administration	53.2	7.1	32.8	8.2	10,425	38.5	6.0	25.6	64.3	10,958	31.9	8.4	34.0	24.1	10,129	23.2	11.0 ^d	0	N.A.	N.A.	6,081 ^d	
Professional Schools	N.A.	N.A.	N.A.	N.A.	N.A.	66.7	5.6	45.5	99.7	11,489	71.0 ^c	5.7	48.6	100.0	11,403 ^c	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Law	N.A.	N.A.	N.A.	N.A.	N.A.	16.3	10.4	3.4	4.4	6,482	32.3 ^c	9.3	48.3	100.0	10,296 ^c	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Pharmacy	N.A.	N.A.	N.A.	N.A.	N.A.	16.3	19.2	2.4	83.8	7,592	5.2 ^c	19.1	14.8	100.0	10,505 ^c	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Dentistry	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
School of Agriculture	18.7	5.6	39.4	16.8	6,832	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
University	23.0	8.9	26.2	10.9	9,129	19.3 ^b	9.9	20.5	25.6	8,199	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Main Campus	22.6	13.6	3.3	1.8	7,140	24.0	13.4	6.5	.1	6,914	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Branch campuses	22.8	10.5	18.7	7.4	8,479	20.1 ^b	10.3	19.0	21.3	8,055	21.9	9.4	26.3	25.9	3,405	15.4	11.1	24.4	N.A.	N.A.	7,384	

N.A. Not applicable.
 1. Department figures reflect only main campus faculty contact hours, student credit hours produced and salary; where total department salaries were not given, averages were based on total of faculty whose salary and student credit hours produced were known.
 2. Full-time student credit hours produced (multiplied by 1.5 for Penn State) divided by full-time contact hours.
 3. Salaries adjusted to reflect one-half of academic year.
 a. First professional student credit hours for the dental school were not divided into full- and part-time classifications.
 b. Not including dental school faculty student credit hours.
 c. Inconsistent data adjusted.
 d. Economics Department.

SOURCE: Reports provided by the individual universities.

VIII. UNIT COSTS FOR ALL FULL- AND PART-TIME FACULTY

Regression equation

In order to estimate the quantitative effect of the factors shown in Table 8 on unit cost and to take into account the varying use of part-time faculty, a number of linear regression equations were calculated for the three large universities. Data from Lincoln arrived late and had too many inconsistencies to permit its use. Actual unit costs including full- and part-time faculty for various departments as well as the percentage of total student credit hours produced by part-time faculty members are shown on Table 9.

The salary cost per student credit hour (Y) includes all faculty, teaching and nonteaching, full- and part-time. The following were included as independent variables:

X_1 = class size, i.e., full-time student credit hours produced in the fall divided by fall classroom contact hours; adjusted in the case of Penn State to represent one-half of the academic year.

X_2 = average weekly classroom contact hours of full-time faculty for the fall term.

X_3 = graduate student credit hours as percent of total student credit hours produced for the fall term.

X_4 = part-time faculty student credit-hour production as percent of total student credit-hour production for the fall term.

The following equation was determined based on 34 observations from the three schools (standard errors shown in parentheses):

$$\hat{Y} = \$130 - \$1.40X_1 - \$5.00X_2 + \$0.053X_3 - \$0.46X_4 \quad R^2 = .866$$

(5.4) (.13) (.53) (.08) (.06)

Table 9

FACULTY SALARY COSTS PER STUDENT CREDIT HOUR, FALL 1975

Department or college ¹	Pennsylvania State University		University of Pittsburgh ³		Temple University		Lincoln University	
	Full-time unit cost	Percentage part-time unit cost production ²	Full-time unit cost	Percentage part-time unit cost production ²	Full-time unit cost	Percentage part-time unit cost production ²	Full-time unit cost	Percentage part-time unit cost production ²
Selected Sciences	\$26.24	18.39	\$38.07	9.32	\$37.60	41.51	\$34.52	2.93
Foreign Languages	51.21	58.63	99.47	51.60	53.19	44.05	38.26	9.44
Mathematics	47.68	68.11	38.39	37.07	45.53	34.39	29.85	4.23
Political Science	32.10	12.74	47.01	23.86	50.56	33.49	37.39	10.98
English	41.34	44.64	57.32	61.31	46.93	36.38	37.94	5.89
History	30.42	14.06	47.01	16.44	38.40	39.15	59.11	0
Psychology	21.17	7.21	27.10	33.01	35.68	29.83	33.96	0
School of Education	37.21	16.65	50.47	12.73	56.56	48.73	44.50	0
School of Engineering	71.05	9.08	49.84	7.85	36.47	36.44	N.A.	N.A.
School of Agriculture	84.64	5.34	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
School of Business Administration	--a	--a	--a	--a	37.80	33.45	29.66	.78
All other main campus departments	44.62	24.09	46.43	22.45	48.28	44.49	78.71	11.05
Branch campuses	23.22	12.90	21.50	12.21	N.A.	N.A.	N.A.	N.A.

N.A. Not applicable.

1. Individual department data for main campuses only for Penn State and Pittsburgh.

2. Percentage of total student credit hours produced by part-time faculty.

3. Does not include school of dental medicine.

a. Included in all other main campus departments for Penn State and Pittsburgh.

SOURCE: Reports provided by the individual universities.

Relative strength of variables affecting costs

The class size and contact hours--approximately equal in importance--carried the greatest weight in determining the salary cost per student credit hour. The equation indicates that an increase of one student in the average class size results in reduction in the unit cost of \$1.40, while an average increase of one classroom contact hour per faculty member decreases the unit cost by \$5.00. These reductions represent 3.6% and 12.9%, respectively, of the mean cost of \$38.73 of all 34 observations.

The percentage of student credit hours at the graduate level was not significant in determining the unit cost except as reflected in the average class size or contact hours.

The equation indicates possible savings of \$.46 in unit cost for each percentage point increase in student credit hours produced by part-time faculty members. Table 9 provides a comparison of the unit costs resulting from different uses of part-time faculty for individual departments at the four universities.

The inclusion of part-time faculty salaries and student credit hours in the unit-cost calculation normally decreases the departmental unit costs as Table 9 indicates and sometimes dramatically--e.g., foreign languages at Penn State and Pittsburgh where over one-half of total departmental student credit hours are produced by part-time faculty. In contrast, the unit cost was not significantly decreased by the use of part-time faculty in the School of Agriculture at Penn State, where only 5% of the total student credit hours were produced by part-time faculty. It is interesting to note that the departments of English and mathematics at the three large universities have reduced their unit costs considerably by having from one-third to two-thirds of the student credit hours in the departments produced by part-time faculty members.

