DOCUMENT RESUME

ED 096 928	HE 005 956
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TITLE	University Requirements and Resource Allocation in the Determination of Undergraduate Achievement. Final Report.
INSTITUTION	California Univ., Santa Barbara. Community and Organization Research Inst.
SPONS AGENCY	National Inst. of Education (DHEW), Washington, D.C.
BUREAU NO	BR-3-1405
PUB DATE	Aug 74
GRANT	NE-G-00-3-0151
NOTE	87p.
EDRS PRICE	MF-$0.75 HC-$4.20 PLUS POSTAGE
DESCRIPTORS	*Core Courses; *Curriculum Development; *Degree Requirements; *Experimental Programs; *Higher Education; Liberal Arts; Resource Allocations; Statistical Data; Student Needs; Success Factors; Surveys; Undergraduate Study

ABSTRACT

In the past decade, many colleges and universities have reduced or eliminated the number of required general education courses, which had the original purpose of assuring a 'well-rounded' liberal education. The important question is how such curriculum reforms, which increase student choice as opposed to university choice of courses, affect the product of higher education. In particular, does the removal of general education course requirements affect the student retention rate, grade-point average, or choice of major? In 1969, a randomly selected group of 485 entering students were given the option to not take the usual set of required general education courses. A control group of 485 students were not given this option. Four years later, the data were collected on these students. The findings generally support a move towards more student choice. The results of the study indicate that students in the experimental group had a higher retention rate and received more university resources, measured in dollars, than did students in the control group. Section 2 presents the hypotheses of interest, section 3 describes the data set, section 4 presents a discussion of the statistical tests of the hypotheses, and section 5 contains conclusions and recommendations. Appendices include the model of student learning and resource choice, statistical data, and the survey questionnaire. (Author/PG)

ED 096923

FINAL REPORT

to the

National Institute of Education

on

UNIVERSITY REQUIREMENTS AND RESOURCE ALLOCATION IN THE DETERMINATION OF UNDERGRADUATE ACHIEVEMENT

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August 1974

Project Number: 3-1405

Grant Number: NEG-00-3-0151

HE 005 956

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I. INTRODUCTION

In the past decade, many colleges and universities have reduced or eliminated the number of required general education courses, which had the original purpose of assuring a 'well-rounded,' liberal education. While the main reason for reducing student course requirements has probably been student pressure, these actions have benefitted the university by making study programs more attractive to prospective students. If an enrollment 'crunch' hits in the 1980's, one can expect colleges and universities to undertake more such curriculum reforms in order to attract new students.

The important question, of course, is how such curriculum reforms, which increase student choice as opposed to university choice of courses, affect the end-product of higher education. In particular, does the removal of general education course requirements affect the student retention rate, grade point average, or choice of major?

We attempt to answer these questions by analyzing the results of an experiment conducted on the Santa Barbara campus of the University of California. In autumn 1969, a randomly selected group of 485 entering students were given the option to not take the usual set of required general education 'breadth' courses. A control group of 485 students was not given this option. Four years later, in late 1973, we collected data on these students in order to answer the questions posed above.

Our findings would generally support a move towards more student choice, although the evidence is, in some cases, marginal. A caveat is also in order: we have no objective measure of the degree to which general education requirements do or do not contribute to a broad, liberal education, their original purpose. Nonetheless, even if such a measure existed, the value of such education for the majority of students is not clear. The criteria for assessing the success of the experiment employed here, while also subject to criticism on grounds of relevancy, are well-defined objective measures, such as retention, grade point average, etc.

The results of the study indicate that students in the experimental group had a higher retention rate and received more university resources, measured in dollars, than did students in the control group. However, there were no differences in grade point averages between the two groups, nor did the distributions of students across majors vary. There is also some evidence that achievement differences between students from low and high income families were smaller for the experimental than the control group.

A major portion of our study consisted of the development of an estimation of a model of student learning and resource choice; the findings of this investigation are reported in a separate paper attached to this report as Appendix A. This model yielded interesting results; for example, we found a strong and statistically significant relationship between the amount of university resources received by students and their achievement as measured by grade point average (GPA) adjusted for grading differences between departments.

These general findings and the evidence supporting them are discussed in greater detail in the pages which follow. Section II presents the hypotheses of interest, and in Section III the data set is described. Section IV contains a discussion of the statistical tests of the postulated hypotheses, and Section V gives our conclusions and policy recommendations.

II. DATA

The project utilized data gathered on a group of students as part of the general education experiment of the Santa Barbara campus of the University of California (UCSB). The following is a statement of the UCSB Senate Committee's description of the general education experiment:

> In January 1969 a special committee assigned to develop a way to implement the foregoing proposal reported the results of its planning to the Academic Senate. The Senate approved the committee's recommendations and directed the administration to put the program into effect on an experimental basis in the fall of 1969. In response to this directive, administrative personnel in the College of Letters and Science in the summer of 1969 made a random selection of about 20% (485) of the netering freshman class for fall 1969 to serve as the experimental subjects. Another 485 students were selected at random to serve as a control group required to continue in the existing general education program.
>
> Those students chosen for the experimental group were informed that they were freed of the usual general education requirements except for such University-wide obligations as Subject A and American Institutions. At the time that they were told of this opportunity to select their own pattern of general education courses, students were warned "gently" about

how their decisions might affect their meeting graduate school requirements should they choose to pursue graduate study after completing their bachelor degree work.

The raw data records for both groups of students were retrieved from the general computer files of the University. Information on courses taken, grades received in courses, majors chosen, and changes in majors were obtained from this source. Socio-economic data, high school records, and entering SAT scores on the verbal and mathematics tests were obtained from non-computerized files based on admission applications and financial aids records.

The financial resources received by students were computed by combining individual student information on courses taken with information on the costs per student of providing particular courses. The latter set of data was obtained from a number of different university financial records. The method for computing costs per student is outlined in detail in Appendix A.

All information was not available on all students. Hence, the sample size varies depending on the variables required for the analysis. This information is summarized in Table I, which shows that while, initially, there were 970 students in the experimental and control groups, by autumn 1973 only 502 had graduated or were within three quarters of graduation. Of these 502, we were able to obtain complete information on only 294. This latter subset provides the basis for a majority of our analysis.

TABLE I

Sample Sizes

	Control	Experimental	Total
Original Sample	485	485	970
Graduated or Within 3 Quarters of Graduation	230	272	502
Complete Information Available	126	168	294

III. HYPOTHESES

Family Background

The experimental and control groups should be identical in terms of their abilities and family backgrounds if differences in academic performance are to be attributed only to differences in experimental status. Therefore, we test several null hypotheses concerning the means and distributions of income, SAT, GPA, and sex between the two groups. The definitions of all variables are given in Table II. The results of these tests are presented in Table III. A glance at the Table (a, b, f) shows that in all cases, the hypothesis that the experimental and control groups are identical cannot be rejected at the .10 level of significance. Hence, the two groups are identical in terms of their entering characteristics and we can analyze performance measures by direct comparisons of the two groups.

TABLE II

Definitions of Variable Categories

GPA Classifications

1	0.00 - 1.99	4	2.50 - 2.74
2	2.00 - 2.24	5	2.75 - 3.49
3	2.25 - 2.49	6	3.50 - 4.50

Major Classifications

1	Natural Sciences (NSA)	5	Natural Sciences Related
2	Social Sciences (SSA)	6	Social Science Related
3	Arts	7	Miscellaneous
4	Humanities		

Graduation Status

1 Graduate on time (four years from date of entry)

2 Graduate no more than three quarters late

3 Graduate more than three quarters late

Parental Income

1 $0 - $9,999

2 $9,999 - $15,000

3 $15,000 and up

SATC = SAT, Verbal + SAT, Math

1	0 - 798	4	1199 - 1398
2	799 - 998	5	1399 - 1600
3	999 - 1198		

SAT, Verbal or SAT, Math

1	0 - 399	4	600 - 699
2	400 - 499	5	700 - 800
3	500 - 599		

TABLE III

Means and Distributions of Variables for Control and Experimental Groups

	Control	Experimental	Test Statistic for Null Hypothesis that Means or Distributions are Identical
Sex (a)			
Male	134 (49%)	119 (52%)	$\chi^2(1) = .21$
Female	138 (51%)	111 (48%)	
GPA (b)			
Mean and Standard Deviation	2.57 (1.16)	2.72 (1.08)	t = 1.53
Distribution			
1	0 (0%)	0 (0%)	
2	4 (2%)	6 (3%)	
3	11 (5%)	11 (6%)	$\chi^2(4) = 2.51$
4	39 (16%)	38 (19%)	
5	142 (60%)	112 (57%)	
6	42 (18%)	28 (14%)	
Graduation Status (c)			
1	201 (74%)	171 (74%)	
2	45 (17%)	43 (19%)	$\chi^2(2) = 1.34$
3	26 (10%)	16 (7%)	
Major (d)			
1	38 (14%)	34 (15%)	
2	115 (42%)	98 (43%)	
3	20 (7%)	20 (9%)	
4	49 (18%)	30 (13%)	$\chi^2(6) = 3.12$
5	8 (3%)	10 (4%)	
6	7 (3%)	7 (3%)	
7	35 (13%)	31 (13%)	
Income (e)			
Mean	$16,112 (7,763)	$16,908 (7,209)	t = .41
Distribution			
1	9 (4%)	13 (7%)	
2	110 (46%)	91 (48%)	$\chi^2(2) = 2.92$
3	121 (50%)	84 (45%)	
SAT, Verbal (f)	553.16 (80.91)	558.30 (79.45)	t = .72
SAT, Math (g)	569.14 (83.70)	577.85 (81.08)	t = 1.09

Retention Rate

The required general education courses often serve a 'weeding out' function among freshmen and sophomores. Since the experimental group can choose to avoid such courses, we might expect a higher retention rate among that group. Table III presents the results (c) of a test of the null hypothesis that the distributions of experimental and control groups over three graduation status categories are identical; the hypothesis cannot be rejected at the .10 level of significance.

The hypothesis may be tested in greater detail employing the data of Table IV. Using this data, the null hypothesis that there are identical propertions of students in the experimental and control groups for categories 1 and 2 combined is rejected at the .05 level (χ = 1.99). Thus, we accept the alternative hypothesis that the proportion of students making 'normal progress' towards graduation, by which we mean students have graduated or are within three quarters of graduation, is higher in the experimental than in the control group. Furthermore, the source of this divergence appears to lie with the differing retention rates of males and females. We observe that 45% of males in the control group and 52% of males in the experimental group made 'normal progress,' but this difference between the groups is not statistically significant (t = 1.13). However, 57% of the females in the control group and 67% of the females in the experimental group made 'normal progress,' a difference which is statistically significant at the .10 level (t = 1.66). Therefore, in terms of the retention rate criteria, females appear to

TABLE IV

Cross-Tabulation of Graduation Status by Experimental/Control Status and by Sex*

Group	(1) Graduated	(2) Graduate Within 3 Quarters	(3) Drop or Longer Than 3 Quarters	Combined Categories (1) + (2)	Combined Categories Total (1)+(2)+(3)
Total	372	130	416	502	918
Male	179	74	264	253	517
Female	193	56	152	249	401
Male/Female Ratio	.9275	1.3214	1.7368	1.0161	1.289
Retention Rate Total	.4052	.1416	.4532	.5468	1.0000
Male	.3462	.1431	.5106	.4893	1.000
Female	.4813	.1397	.3791	.6210	1.000
Control	171	59	227	230	457
Male	86	33	143	119	262
Female	85	26	84	111	195
Male/Female Ratio	1.0118	1.2692	1.7024	1.0721	1.3436
Retention Rate Total	.3742	.1291	.4967	.5033	1.000
Male	.3282	.1260	.5458	.4542	1.000
Female	.4359	.1333	.4308	.5692	1.00
GEF	201	71	189	272	461
Male	93	41	121	134	255
Female	108	30	68	138	206
Male/Female Ratio	.8611	1.3667	1.7794	.9710	1.2379
Retention Rate Total	.4360	.1540	.4100	.5900	1.000
Male	.3647	.1608	.4745	.5255	1.000
Female	.5243	.1456	.3301	.6699	1.000

* We employed a nonparametric test statistic (t) for the tests of differences in proportions reported in the narrative.

benefit more than males by choosing their own courses.

Grade Point Average

If students are free to choose their own courses, they can both choose courses of interest to them as well as avoid courses which are reputed to fail high proportions of students or are in areas outside their competence. Free course choice should also enable the experimental group to avoid those traditionally required courses which take advantages of a captive audience by offering large lectures and instead enroll in courses which entail a higher per student allocation of university resources. Each of these factors could be expected to lead to higher grade point averages for the experimental than the control group. Table III shows that the mean GPA is 2.57 for the control group and 2.72 for the experimental group.

The simple null hypothesis that the mean GPA is identical for the two groups is rejected at the .10 level of significance; the alternative hypothesis that the experimental group has a higher mean GPA is accepted. However, we find no statistically significant differences in the distribution of students across GPA categories defined for each group (Table II).

Another test of the hypothesis is provided in Table V where GPA is regressed on income, SAT, sex, major, and experimental status dummy variables. (The variable control takes the value 1.0 if the observation is a student in the control group and takes the value 0.0 if the observation is a student in the experimental group.) The coefficient on this

TABLE V

Regression of Adjusted GPA by Family Income, Combined Verbal and Math SAT Scores, Sex, Major, and Experimental Status†
(Standard Errors in Parenthesis)

	Full Sample	Control	Experimental
Constant	1.96** (.19)	1.53** (.36)	2.16** (.24)
Income 2	-.015 (.083)	.028 (.11)	-.092 (.134)
Income 3	.083 (.080)	.189** (.102)	-.014 (.132)
SATC 2	.288** (.174)	.603** (.340)	.162 (.204)
SATC 3	.412** (.169)	.656** (.336)	.343** (.197)
SATC 4	.428** (.170)	.611** (.337)	.400** (.198)
SATC 5	.602** (.205)	.904** (.374)	.488** (.259)
SEX	.024 (.042)	.089* (.061)	-.020 (.057)
NSA	-.101* (.064)	-.122 (.100)	-.094 (.085)
SSA	-.153** (.054)	-.085 (.088)	-.212** (.071)
Control	-.049 (.039)		
R^2	.112	.141	.143
F	3.56**	2.11**	2.93**
S.E.	.333	.330	.332
N	294	126	168

* Significant at the .10 level, one-tail test

** Significant at the .05 level, one-tail test

† Since all independent variables are dummy variables, defined on the basis of the definitions in Table II, the F-value is identical to that found by a six-way analysis of variance procedure.

dummy variable 'control' representing experimental status is of the expected negative sign but statistically insignigicant.

GPA Differences Between Income Groups

Students from low-income homes may be relatively worse off than students from high-income homes in terms of preparation for material covered in general education courses. In particular, those classes emphasizing middle-class cultural values may put the low-income student at a relative disadvantage. Low-income students in the experimental group can avoid taking those general educational courses in which they have little interest or are at a disadvantage. Hence, the difference in GPA between low-income and high-income students is likely to be larger for the control than for the experimental sample.

The regression results reported in Table V enable us to test the null hypothesis that low-income and high-income students perform equally well in terms of GPA. Looking at the coefficient for Income 3, which represents the difference between the effect of high and low income on adjusted GPA, we see that the null hypothesis is rejected at the .05 level for the control group. However, for the experimental group, the null hypothesis is accepted. In other words, elimination of general education requirements also helps to reduce achievement differences between income groups by not forcing low-income students to take general education courses where they appear to face a particular disadvantage. It is also interesting to note that whereas there are sex differences in the control group, there are none in the experimental group according to the regression.

Choice of Major

If exposure to new course material affects student choice of major, we might expect to observe a different distribution of students across majors for the control than the experimental group. In particular, we might expect to observe higher proportions of control students choosing those kinds of majors to which they are forcibly exposed in the general education courses.

Table III provides the necessary information for a test of the null hypothesis that the distribution across majors is identical for control and experimental groups. The $\chi^2(4)$ of 2.51 indicates that we cannot reject this hypothesis. Nevertheless, there may exist differences between the control and experimental groups for the income distribution by major.

One might expect to find that the income distribution of students majoring in a particular discipline vary between the experimental and control samples if in the absence of general education requirements some income groups would not be exposed to a particular kind of course material. For example, some low-income students may have very little exposure to some kinds of humanities or social sciences courses in secondary school, especially if the secondary school was located in an area of low property wealth and, hence, provided relatively few special, or non-basic courses.

Table VI offers the results of a test of the null hypothesis that the income distribution of students majoring in the natural sciences varies between experimental and control group. The null hypothesis cannot be rejected; simple observation of the column percent figures reveals the distribution to be almost identical for the two groups.

Table VII presents information on the same null hypothesis for students majoring in the social sciences. Here, the hypothesis is rejected at the 10% level of significance, and we accept the alternative hypothesis that the income distributions do differ. Observation of the column percent figures reveals that the principal way in which the distribution varies is that one finds lower proportions of low income (5.0% vs. 13.2%) and higher proportions of high income students (50.5% vs. 38.2%) in the experimental group as compared with the control group.

We again test the null hypothesis of identical income distributions, but this time for students majoring in the humanities. The figures shown in Table VIII confirm that the hypothesis is again rejected but only at the 15% level of significance. Observation of the column percent figures reveals a somewhat different picture than was true for the social sciences. The porportion of low-income students in the experimental group (3.2%) is lower than for the control group (4.8%), but the proportion of high-income students is also lower in the experimental (44.4%) than the control group (47.6%).

These tests offer some weak evidence that the distributions of students by parental income do vary between experimental and control groups for majors in the social sciences and arts and humanities.

TABLE VI

Cross-Tabulation of Natural Science Majors by Experimental/Control Status and Parental Income Category

Income	Count Row Pct Col Pct Tot Pct	Experimental 0.0	Control 1.0	Row Total
Low	1.00	1 50.0 2.7 1.5	1 50.0 3.2 1.5	2 2.9
Medium	2.00	19 54.3 51.4 27.9	16 45.7 51.6 23.5	35 51.5
High	3.00	17 54.8 45.9 25.0	14 45.2 45.2 20.6	31 45.6
	Column Total	37 54.4	31 45.6	68 100

$\chi^2(2) = .018$ s = .99

TABLE VII

Cross-Tabulation of Social Science Majors by Experimental/Control Status and Parental Income Category

Income	Count Row Pct Col Pct Tot Pct	Experimental 0.0	Control 1.0	Row Total
Low	1.00	5 33.3 5.0 2.8	10 66.7 13.2 5.6	15 8.5
Medium	2.00	45 54.9 44.6 25.4	37 45.1 48.7 20.9	82 46.3
High	3.00	51 63.8 50.5 28.8	29 36.3 38.2 16.4	80 45.2
	Column Total	101 57.1	76 42.9	177 100

$\chi^2(2) = 5.067$ $s = .079$

TABLE VIII

Cross-Tabulation of Arts and Humanities Majors by Experimental/Control Status and Parental Income Category

Income	Count Row Pct Col Pct Tot Pct	Experimental 0.0	Control 1.0	Row Total
Low	1.00	2 50.0 3.2 1.9	2 50.0 4.8 1.9	4 3.8
Medium	2.00	33 62.3 52.4 31.4	20 37.7 47.6 19.0	53 50.5
High	3.00	28 58.3 44.4 26.7	20 41.7 47.6 19.0	48 45.7
	Column Total	63 60.0	42 40.0	105 100.0

$\chi^2(2) = .335$ s = .846

Furthermore, one observes lower proportions of low-income students in these majors for the experimental than the control group. This finding is consistent with our speculation that in the absence of general education requirements, low-income students may not be exposed to particular kinds of course material in the social sciences and arts and humanities, or the exposure may come too late in the college course of study to have much effect on major choice.

University Resources Received

We postulated a model, derived from economic theory, that students simultaneously determine their level of achievement, as measured by an adjusted grade point average, and the amount of university resources which they receive. The full results of estimating that model are given in Appendix A, where the variables in the model are defined and discussed in some detail (pp. 8-9). For example, the measure of output--adjusted GPA--is developed on pages 12-13, and the calcualtion of the resource measure is contained in pages 14-16.

In the body of this report, we only highlight some results which focus only on differences in learning or resources received between the experimental and control groups,and which are not reported in Appendix A.

In Table IX, we illustrate the regression of total dollar value of university resources [LR] received by a student on his adjusted GPA [Lq], his entering SAT score [LSAT], a dummy variable indicating whether the student engaged in extracurricular activities [LACT = 1] or not

TABLE IX

Estimates of the Resources Equation for the Full Sample, Controlling for Experimental Status
(Standard Errors in Parenthesis)

	OLS[1]	OLS[2]	TSLS
Constant	3.52**	3.77**	17.56**
	(1.02)	(1.35)	(7.10)
Lq	.356**	.363**	8.86**
	(.169)	(.171)	(3.58)
DUMq	-.062	-.072	-9.23*
	(.248)	(.250)	(6.53)
LSAT	.0267	-.0091	-2.94*
	(.150)	(.197)	(1.38)
DUMSAT	.0006	.0844	3.36*
	(.029)	(.299)	(2.02)
LACT	-.137**	-.137**	.241
	(.042)	(.042)	(.209)
LYp	-.0031	-.0044	-.154
	(.053)	(.053)	(.225)
Control		-.580	-16.06*
		(2.06)	(9.91)
R^2	.09	.09	--
S.E.	.311	.312	.975

* Significance at the .10 level, one-tail test

** Significance at the .05 level, one-tail test

† We follow common practice and use standard t-tests for the consistent TSLS estimates, even though the precise sampling distributions are unknown.

[LACT = 0], estimated family income [LYp], and a dummy variable [Control] indicating whether the student was in the control group [1] or in the experimental [0]. We have also included two variables to allow the slope coefficients on GPA and SAT to differ between the control and experimental groups. Those variables take the form, DUMq = Control × Lq, and DUMSAT = Control × LSAT.

In Table IX, we have reported three equations. OLS[1] is estimated using ordinary least squares and omitting the Control dummy. OLS[2] is estimated using ordinary least squares and including the Control dummy. TSLS is estimated using two stage least squares, which takes account of the fact that both GPA and university resources are endogenous variables (see Appendix A).

Since students in the control group are constrained to taking general education courses, they have less choice about the amount of university resources which they receive. They may prefer to take a small seminar but may be constrained to enroll in a large lecture. The experimental group does not face the same constraint; hence, we might expect them to choose courses which give them a larger total quantity of university resources. The results indicate this is in fact the case. The coefficient on Control is negative and statistically significant in the TSLS equation, indicating, ceteris paribus, that students in the control group receive fewer university resources.

Effectiveness of University Resources

Table X illustrates the results of estimating the other equation in the model of student learning. Here, the model is in the form of an educational production function, hypothesizing that learning [Lq] is a function of university resources received [LR], entering SAT scores [LSAT], and dummy variables measuring sex [LX = 1 if the student is female], major in school [NSA for natural science majors; SSA for social science majors], and whether or not the student is in the experimental or the control group [Control]. Again, we have formed a new resource variable to test whether or not changes in university resources are equally effective for the two groups: DUMR = Control × LR.

Given the model (again, see Appendix A), the equation which provides the most reliable results is the TSLS equation. The estimated coefficients indicate that we cannot reject the null hypothesis that resources are equally effective for the two groups. Also, we cannot reject the null hypothesis that entering SAT scores have the same size effects for both groups. The results are also interesting in that they indicate a statistically significant relationship between resources received and student learning: the coefficient on LR for the experimental group, a production elasticity, is .44. In other words, increasing the resources received by 10% should be reflected in an increase in adjusted GPA of 4.4%. As noted in the review of the literature included in Appendix A, this finding is contrary to the results found by most researchers.

TABLE X

Estimates of the Student Learning Equation for the Full Sample, Controlling for Experimental Status

	OLS[1]	OLS[2]	TSLS
Constant	-1.51**	-1.98**	-3.36**
	(.51)	(.64)	(1.08)
LR	.055*	.056*	.439**
	(.036)	(.036)	(.244)
DUMR	.037	.026	.241
	(.057)	(.057)	(.447)
LSAT	.30**	.37**	.33**
	(.07)	(.09)	(.12)
DUMSAT	-.022	-.18*	-.13
	(.031)	(.14)	(.25)
LX	.020	.021	.031
	(.018)	(.018)	(.027)
NSA	-.026	-.027	.130*
	(.030)	(.030)	(.081)
SSA	-.031	-.035*	.166**
	(.027)	(.027)	(.098)
Control		1.16	
		(.97)	
R^2	.11	.12	--
S.E.	.145	[illegible]	.193

IV. CONCLUSION

The results of the Santa Barbara experiment suggest that reduction of general education requirements has not had a deleterious effect on student learning. On the contrary, while there are no statistically significant differences in grade point averages between the experimental and control groups, there is a higher retention rate for the experimental group. Furthermore, students in the experimental group choose courses where they obtain more university resources than do students in the control group, and the probable cause for the difference is the university-imposed constraint on student choice of courses for the control group.

General education requirements appear to affect students of low and high income groups differently. While there are achievement differences between income groups for the control sample, there are not statistically significant differences for the experimental sample. Also, we noted that lower proportions of low-income students choose majors in the social sciences and arts and humanities in the absence of required general education courses. We also tested hypotheses about the differences in the distribution of students by sex, income or SAT categories within the experimental and control groups. The distributions of these variables only differed within groups on the basis of sex. The computational tables are given in Appendix B.

The results of this study suggest the beneficial effects of allowing students to choose their own courses outweight the adverse effects of such a curriculum reform. Students strongly concur with this conclusion. A questionnaire was distributed to students in the control and experimental groups four years after the experiment had begun (spring 1973). When asked what kind of general education program they prefer, 61% of the experimental and 39% of the control group wanted no program or a program of recommended courses only. Another 45% of the control and 24% of the experimental group opted for a program with fewer requirements. The full results of this questionnaire are reported in Appendix C.

APPENDIX A

UNIVERSITY RESOURCES IN THE PRODUCTION OF EDUCATION:

A Model of Individual Student Choice*

by

Robert McGuckin and Donald Winkler.**

*The project presented or reported herein was performed pursuant to a grant from the National Institute of Education, Department of Health, Education, and Welfare. However, the opinions expressed herein do not necessarily reflect the position or policy of the National Institute of Education, and no official endorsement by the National Institute of Education should be inferred.

**The authors wish to thank Alexander Bocast and Cathy Kasala for their tireless and careful efforts in developing the data for this project.

INTRODUCTION

In recent years universities have come under attack from students for offering impersonal educational services and for limiting choice with respect to courses taken. The target of the latter complaint is the set of required general education or breadth courses. By requesting personalized instruction, students are in effect demanding more university resources, which primarily means more hours of faculty-student contact and smaller class sizes. As such, university resources should be correlated with the work effort of the student. A small seminar generally requires a greater student work effort than does a large lecture.

Assuming students are utility maximizers with respect to leisure, consumption, and expected future income, their actions imply an assumption that more school resources and accompanying greater student time input are reflected in higher levels of those kinds of outputs which determine future money and non-money income. One possible proxy for future money and non-money income is student cognitive achievement, as measured by grade point averages or achievement on standardized examinations.

An experiment carried out on one of the University of California campuses allows us to test some of these implicit assumptions of students. In the autumn of 1969, a randomly selected group of 485 entering students were given the option to not take the usual set of required general education breadth courses. A control group of 485 students was not given this option.

The continuing students in each group were followed until graduation in spring 1973. The resulting data contains information on entering level of educational attainment and aptitude [SAT scores], the courses taken while in college, the grades received in each course, the grade point average for all courses taken, and, in a few cases, scores on the Graduate Record Examination. Also various other information concerning nonacademic activities and parental income are available for the sample. By consulting university records and budgets, we derive information on the university resources received in each course as well as a measure of total university resources received by each student over the four-year period.

Employing this set of data on the two 1969 cohorts, we test the hypothesis that university resources are a determinant of student cognitive achievement, and, hence, future economic welfare by estimating a production function for higher education. Furthermore, since some students were more constrained than others in the choice of courses and thus resources received, we can test the hypothesis that greater choice in courses, by being in the experimental cohort, is reflected in higher educational attainment.

In the following pages we provide a brief review of the literature on university productivity, present a theoretical model of individual maximizing behaviour, discuss the derivation of our input and output measures, estimate the structural equations of that model, and, lastly, discuss the implications of our findings.

REVIEW OF LITERATURE

Research on production in higher education began with an attempt to explain why most scientists with Ph.D.'s have historically received their baccalaureate degrees from a relatively small number of institutions.[1] For example, a study by Knapp and Greenbaum [1953] concluded that the most productive colleges, using the number of baccalaureates obtaining Ph.D.'s as the measure of institutional output, were those which were the most expensive to attend. However, since the study did not control for level of educational attainment of students upon entering college, this finding does not imply a causal relationship between university resources received and output so measured.

A more recent study by Astin [1968] attempted to determine the "educational value-added" by institutions to their students. The measure of institutional output was average Graduate Record Examination [GRE] field test score, controlling for the level of educational attainment of students upon entering college as measured by scores on the National Merit Scholarship Qualifying Test. Astin discovered that resource characteristics of colleges and universities explained only a minute proportion of total variance in achievement between institutions. However, the statistical technique employed in that study was step-wise regression, always entering measures of student characteristics in the regression first. Furthermore, as shown by his data, measures of school resources and student characteristics are highly correlated. As a result of his procedures, any variance in achievement which could be explained either by variation in school resources or variation in student characteristics was automatically attributed to the student characteristics alone. This procedure imports a downward bias to the estimated productivities of school resources. In addition Astin's, as well as research by others in the field, suffers from incomplete model specification. Most studies have failed to allow for the effects of student choice on the estimated elasticities of educational attainment with respect to university inputs. In particular, a cross-university study of the type conducted by Astin must account for the demand by students for the particular type of service flows offered by each university. If student choice of university is related to measured student characteristics (and we suspect it is), then the effects of university resources will be obscured in a simple regression framework which does not account for this choice process. In fact, in a world of perfect adjustment, students with time for shopping will ensure that university service flows have equal productivity at the margin. Thus, Astin's study offers support that universities operate in a well-functioning market.

Other research has been done at a more disaggregated level. For example, Razin and Campbell [1972] attempted to determine whether resources were efficiently allocated between academic departments at the University of Minnesota. The measure of output used was the expected value of the future income stream for a student majoring in a particular discipline.[2] As there was no control for the expected value of the income stream for high school graduates upon entering college, an implicit assumption of the study is that the figure is identical for students entering all disciplines. After estimating a departmental cost function, Razin and Campbell compared differences between departments in the present values of future income and the marginal costs of educating students. They concluded that resources are seriously misallocated in the University of Minnesota.

Another study at the departmental level focused on graduate education only. Breneman [1970] attempted to explained departmental differences in the proportion of graduate students obtaining Ph.D.'s at the University of California. He found no statistically significant relationship between faculty-student ratios and that proportion, but the relationship between number of students receiving financial assistance and his measure of output was highly significant and important. If students do not face the constraint of having to work while attending school, then financial assistance may be a proxy for student input to the production process because the absence of a work constraint enables them to spend more time in study.

Lastly, a study by Perl [1970] regressed two measures of higher education output--proportion of entrants graduating from college and proportion of baccalaureates going on to attend graduate school--on measures of student educational attainment upon entering college, financial characteristics of students, and university inputs. His findings accord with Breneman's in that he found a strong negative relationship between hours worked per week by students and the output measures. Furthermore, he found statistically significant relationships between per student expenditures on instructional activities and the second output measure but not the first.

In summary, the literature on the impacts of college resources on higher education output measures is inconclusive.[3] In part, this can be attributed to faulty model specification and a consequent downward bias in the estimates of the importance of college inputs. We hope to make a contribution by undertaking a study of the production process in higher education with emphasis on the students choice of educational service flows. Specifically, we investigate how the menu of courses, and the resources associated with that menu, taken by students during their enrollment at a particular educational institution affect their cognitive achievement upon graduation.

A MODEL OF EDUCATIONAL ATTAINMENT

The model developed here assumes that individual students seek to maximize the value of their educational attainment net of costs. Educational attainment q is captured in a single dimensional measure based on adjusted grade point averages while costs are presumed to reflect a leisure-work trade-off reflected in 'purchased' university services

University behavior, by the administration, departments and individual faculty, is not considered explicitly in the formulation of this model. That is, we assume that students operate generally in a world which offers them a fixed menu of courses, each of which provides varying amounts of resources. Further, we argue below that the students' costs, in terms of alternatives foregone, are directly related to the service flows chosen from this fixed menu.

A more complete model could be developed by assuming that the administration seeks to maximize the educational attainment per student within a fixed budget given current enrollments which determine its overall budget. Abstracting from recruitment, maintenance and other nonacademic functions, the administration allocates its funds among departments on the basis of quality (in large part historically determined at any point in time and generally slow to change) and number of students enrolled in the departments course offerings.

Although departments react to student demands in their competition for enrollments (and thus larger budgets) by offering new courses and rechanneling instructor hours into popular courses, there are substantial lags in the process. First, the administration generally will not increase full time equivalents (F.T.E.) immediately. Three reasons account for this: (1) F.T.E.'s are calculated in terms of discrete blocks of student hours. Thus, if a department has a 20:1 faculty/student ratio, and each faculty member is required to teach 5 courses per year, then each F.T.E. requires an increase of 100 students or about 20% of a department with 500 majors (this percentage will be somewhat lower for departments with large numbers of so-called service courses); (2) The administration must view the increase as a permanent one which often may mean a time lag of a year or two at the higher enrollment levels; (3) The existence of university-wide restrictions on student course programs (e.g. general educational requirements) restrict the range of effective student demand. Short of overriding student pressure in the aggregate, it is difficult to affect quick changes in this component of the course structure. In fact, general education requirements may be viewed as a way by which politically strong departments have been able to put a floor under their enrollments.

Thus, for purposes of this study, we assume reasonably slow adjustment times and focus our attention on a model of student choice in a fixed environment. In addition to the reasons for adjustment lags discussed above, we also note that even where adjustments are reasonably quick, they tend to affect a very small percentage of the courses offered (due in part to fixed faculty resources in the short run) and for most students offer little in the way of new alternatives or have small affects on their total service flows.

For the individual student, educational attainment q is reflected in an increase in his stock of human capital. Despite the multitude of problems associated with accurate grading, to the student, grading offers both a measuring rod of his own achievements and an information source which he can utilize to "advertise" himself. That is, grades provide employers and graduate schools with a method for evaluating an individual's human capital. Knowing this, the student has a positive motivation to achieve a high G.P.A.

Just as purely statistical comparisons of grades across institutions suffer from differences in grading standards and the mix of educational services received, so do comparisons across departments within a particular institution. For this reason, the G.P.A.'s utilized as measures of q are adjusted for departmental differences. These adjustments are discussed in detail in the section following.

Another aspect of the student's educational attainment relates to the choice of major. We do not provide for formal specification of the major choice in this model, but differences in major are accounted for in the productive relationship. Thus, the model assumes that students choose their major early in the career.

Formal Specification of the Model

Each student is assumed to maximize the net value of his education attainment written

(1) $V_n = \int p\,dq - pq + [pq - C] = \int p\,dq - C$

where

V_n = net value of educational attainment

p = value of educational attainment

q = educational attainment

C = cost of producing a level of q

The student is faced with a technical constraint of the form

(2) q = q(SAT, R, X, M)

where

SAT = measure of native intelligence

R = measure of resources or service flows supplied by the university

X = other individual characteristics associated with the student

M = a variable reflecting differences in service flows or the nature of production associated with the student's major department.

The predicted signs associated with equation (2) are

$$\frac{\partial q}{\partial SAT} > 0 \quad \text{and} \quad \frac{\partial q}{\partial R} > 0.$$

We make no apriori hypothesis concerning

$\frac{\partial q}{\partial M}$ because M enters the functions as a dummy variable reflecting differences in technology across departments. Also $\frac{\partial q}{\partial X}$ has no apriori sign.

The value of educational attainment is presumed to vary directly both with expected future income y_f (defined for the student's major field of study) and with the quantity of educational attainment. Thus, we have

(3) $p = p[\, q,\ y_f \,]$,

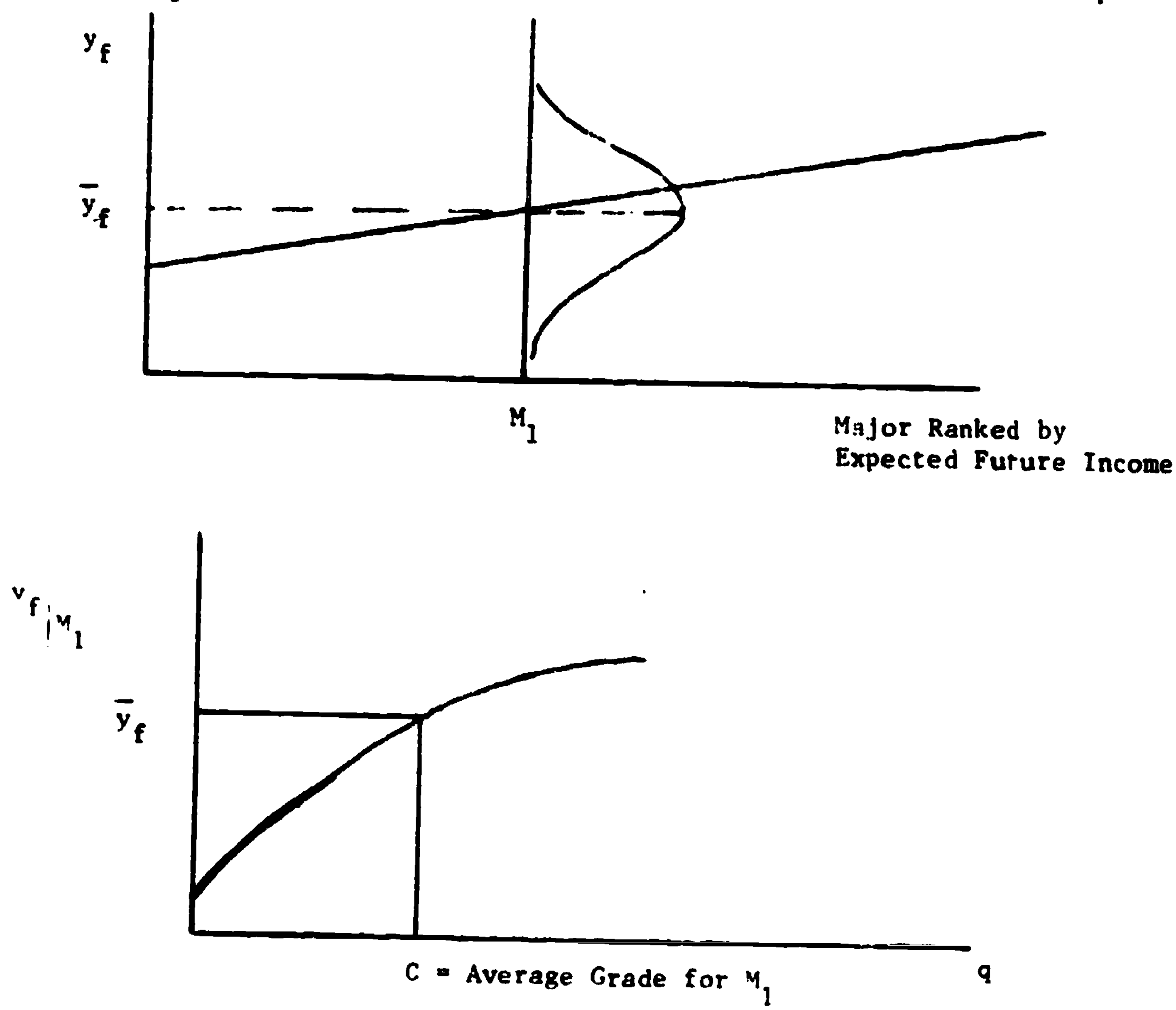
where

$$\frac{\partial p}{\partial q} > 0 \text{ and } \frac{\partial p}{\partial y_f} > 0.$$

Note that y_f is defined as the average or expected income from the students major field, not as the relationship of future income to educational attainment. If we presume that the distribution of expected incomes is the same for all fields with the exception that means vary, then we can view the relationship of q to expected future income in terms of the likelihood that it would be relatively high within the major class. This is illustrated in Figure 1. Also note that the dollar value placed on an individual college graduate increases with his stock of human capital. Therefore, p varies directly with q.[4]

Figure 1

The role of y_f and q in determining the value of education attainment p.



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The costs of increasing the net value of q arise from the tradeoff between future income and current consumption. An increase, other things equal, in q requires a decrease in leisure activities since work time is the only choice variable available. Now assume that the time cost associated with increasing q is proportional to the resources 'purchased' from the university. This can be written as

(4) $$C = wR, \qquad w > 0$$

where

w = student time required per unit of resources received, and

R = university services received or purchased by the student.

We further assume that w varies with the student's ability (SAT), financial backing as represented by his parental income y_p and his preference for nonacademic activities (ACT). Thus, we have

(5) $$w = w(SAT, y_p, ACT)$$

where

$$\frac{\partial w}{\partial SAT} < 0 \; ; \quad \frac{\partial w}{\partial y_p} < 0 \; ; \quad \text{and} \quad \frac{\partial w}{\partial ACT} > 0.$$

Increases in either ability or parental income will tend to reduce the price of increasing the volume of university services received while stronger preferences for nonacademic activities will increase the opportunity costs associated with purchasing resources.

From the first order condition for a maximum of equation (1) with respect to resources, we derive the usual condition that the value marginal product must equal the marginal cost of the input. That is,

(6) $$VMP = p\frac{dq}{dR} = \frac{dC}{dR} = w = VMC$$

Equations (2) and (6) provide a simultaneous system in the variables q and R. To implement the model, we assumed log-linear forms for equations (3), (4) and (5). This gives us

(2)' $$q = \alpha \, SAT^{\beta_1} R^{\beta_2} X^{\beta_3} M^{\beta_4},$$

where the β_i are the elasticities of educational output with respect to the variables. Also, we have

(7) $$\frac{\partial q}{\partial R} = \beta_2 (q/R) \; ; \quad \beta_2 > 0.$$

Now, we write the demand equation (3) as

(3)' $q = b\, p^{\alpha_1} (y_f)^{\alpha_2}$

where α_1 (>0) is the elasticity of the value of educational attainment with respect to q and α_2 (>0) can be interpreted as the elasticity of demand for future income. Alternatively (3)' can be written as

(3)" $p = b^{-(1/\alpha_1)}\, q^{(1/\alpha_1)}\, (y_f)^{-(\alpha_2/\alpha_1)}$

Combining (7) and (3)" yields an expression for the VMP

(8) $VMP = \beta_2\, B^{-(1/\alpha_1)} q^{(\frac{\alpha_1+1}{\alpha_1})}\, (y_f)^{(\frac{-\alpha_2}{\alpha_1})}\, R.$

Letting the w function represented in equation (5) be

(5)' $w = d(SAT)^{r_1}\, (ACT)^{r_2}\, (y_p)^{r_3},$

and substituting equations (5)' and (8) into equation (6) gives

$$\beta_2\, b^{-1/\alpha_1}\, q^{(\frac{\alpha_1+1}{\alpha_1})}\, (y_f)^{-(\alpha_2/\alpha_1)}\, R = d(SAT)^{r_1}\, (ACT)^{r_2}\, (y_p)^{r_3}.$$

Solving for this last expression for R gives

(6)' $R = \beta_2\, db^{(1/\alpha_1)}\, y_f^{(\frac{\alpha_2}{\alpha_1})}\, y_p^{r_3}\, (ACT)^{r_2}\, (SAT)^{r_1}\, q^{(\frac{\alpha_1+1}{\alpha_1})}.$

Both equations (2)' and (6)' meet the necessary conditions for identification since each is overidentified as they stand. In the following sections, we discuss the data and measures utilized to represent q and R and the exogeneous variables of the system: X, M, y_f, y_p, ACT, and SAT.

THE OUTPUT MEASURE

When students enroll in college and select their menu of courses as well as major discipline of study, their decision can be simplistically characterized as choosing between expected future income and current leisure (including current consumption in our framework). For our purposes, income is not defined narrowly; it may include money income, income in the form of self-produced consumption goods, and psychic income. As a proxy for expected future income, we employ an adjusted measure of grade point average. Studies by Weisbrod and Karpoff [1968] and by Wise [1972] have found important relationships between grade point average or rank in class and expected earnings. Our assumption is, furthermore, that within a given major an increase in grade point average is reflected in higher future non-money income.

One difficulty with using grade point average [GPA] as a measure of output is that grading practices may vary across departments. Ideally, we would like to have a more objective measure of educational attainment which could be compared across departments. One such measure is the battery of test scores on the Graduate Record Examination [GRE]; that battery includes tests of verbal and quantitative skills and proficiency in a major field of study. Such scores are available for only a small subset of our sample and, then not on the basis of major field of study. Hence, in general we must employ GPA scores, adjusted to make them comparable across departments. One possible method to adjust GPA would be to simply change the grading scale for each department such that the mean GPA was equal across departments; but this method would also remove any real differences in learning between departments.

Since mean GRE scores are available by department for all students taking the tests, our procedure is to adjust departmental GPA using these figures. If a perfect GRE score in a field exam is 800 points and a perfect GPA in any department is 4.0 points, then for department with a mean GRE of 800, the adjusted GPA should equal 4.0. If mean GRE were 600 and actual GPA were 4.0, adjusted GPA should be lower than actual GPA. Adjusted GPA is calculated according to the formula:

$$\frac{\overline{GRE}_i * GPA_{ij}}{GRE_i^m} = \hat{GPA}_{ij}$$

where: $\overline{GRE}_j$ = mean raw GRE score in the field exam of the jth department

GRE_j^m = maximum GRE score in the field exam of the jth department

GPA_{ij} = actual GPA for the ith student in the jth department

$\hat{GPA}_{ij}$ = adjusted GPA for the ith student in the jth department

According to this formula, for the example given, adjusted GPA would be [600/800] × 4.0 = 3.0.

THE RESOURCE MEASURE

Aggregate university resources received by individual students are determined by weighting each class taken by an appropriate resource index. The index, valued by university cost figures, reflects several components of university resources--rank of faculty, numbers of student-faculty hours, class size and support services--and is calculated separately by department and type of class (upper and lower division and independent and regularly scheduled classes). While our procedures enable us to examine various components of the index individually, here we discuss in detail only the calculation of the cost per student for the classes taken in each department.

For each department, budgeted salary, y_i , and budgeted F.T.E. (faculty positions), F_i , are recorded for each faculty rank ($i = 1,\ldots,6$). An average salary for that rank $\bar{y}_i$ is then computed by simply dividing budgeted salary by budgeted F.T.E. Thus we have

$$\bar{y}_i = \frac{y_i}{F_i} \qquad (i = 1, \ldots, 6).$$

Due to leaves of absence, sabbaticals, etc. actual F.T.E., $\hat{F}_i$, differs from budgeted F.T.E. By multiplying average salary by actual F.T.E. we obtain an estimate of the total actual expenditures F_i for each faculty rank in each department ($E_i = \bar{y}_i \times \hat{F}_i$).

The next step is to record the number of student contact hours by rank of faculty and type of class (or division). While our sample is composed of undergraduates, contact hours were also obtained for graduate courses since some faculty time is correctly attributed to teaching at the graduate level. Also, some undergraduates enroll in graduate courses.

By dividing actual expenditures by aggregate student contact hours, we obtain an estimate of the cost per student contact hour for each faculty rank in each department ($CSCH_i$). Letting H_i^j represent the contact hours of the ith rank of faculty in the jth division (type of class) we can represent cost per student contact hour as

$$CSCH_i = \sum_j (E_i/H_i^j) = E_i \left(\sum_j 1/H_i^j\right) \qquad (i = 1, \ldots, 6).$$

Thus, $CSCH_i$ has two components; average faculty salary and F.T.E. per contact hour.

Cost per student for the ith rank and jth division CS_i^j is then obtained by dividing the cost per student contact hour by actual class size times the inverse of the number of hours per class for the jth division. Thus we have

$$CS_i^j = \frac{CSCH_i}{S^j \times (\frac{1}{CH^j})} \qquad (i,j = 1, \ldots, 6)$$

where

S^j = average class size in the jth division, and

CH^j = average number of hours per class in the jth division.[5]

With the above information by faculty rank, class division, and department, we can calculate estimates of average resources received by, say, students taking a regularly scheduled lower division course in the department of economics by summing the weighted faculty rank estimates, where the weights are the ratios of student contact hours in regularly scheduled lower division economics courses by a particular faculty rank to the total student contact hours in regularly scheduled lower division economics course by all faculty ranks. Similar procedures are used for upper division and independent study courses. In general, the weights[6] can be represented as

$$W_i^j = H_i^j / \sum_i H_i^j \qquad (i,j = 1, \ldots, 6)$$

Using these weights[5] the cost per student in the jth division is given by

$$CS^j = \sum_i CS_i^j \, W_i^j \qquad (j = 1, \ldots, 6)$$

In a similar fashion we also obtain, by department only, measures of average cost per student for support services based on salary data (SS) and average cost per student for budgeted supplies and equipment expenditures (SE). Since these measures are calculated on a per student basis, they can readily be added to the figures for CS^j to obtain a measure of resources including both academic personnel and other costs.

The above data, collected and calculated by department, division, and category (rank) of contact hour is weighted and summarized for each student in the sample. Thus, for each student total resources received in the jth category, R^j, is based on the formula

$$R^j = \sum_d (N_d^j) (CS_d^j + SS_d + SE_d) \qquad (j = 1, . . . ,6)$$

where N_d^j represents the number of classes taken in the jth division of the dth department (d = 1, . . . ,32). Average and total resources received are readily calculated from information on the total number of courses taken in each of the j categories ($EN^j = \sum_d N_d^j$). Letting R stand for total resources and $\bar{R}$ for average resources, we have

$$R = \sum_j R^j \qquad (j = 1, . . . ,6)$$

and

$$\bar{R} = \sum_j R^j / EN^j \qquad (j = 1, . . . ,6).$$

Since GPA figures represent average achievement, it is a variant, $\bar{R}_1$, of $\bar{R}$ which is primarily employed in the empirical section. In particular $\bar{R}_1$ stands for $\bar{R}$ sans non-academic personnel resources SS_d and SE_d. The simple correlation between $\bar{R}_1$ and $\bar{R}$ was .92, indicating there is little difference between these alternative measures of resources. Since $\bar{R}_1$ is the most direct component of student choice, and this measure yields the best empirical results, we restrict our discussion to it.

TABLE 1a

Measures of Resources for a University Academic Department

	faculty rank (i)					
	1	2	3	4	5	6
	professor	associate professor	assistant professor	lecturer	teaching assistant	instructor
Salary:	Y_1	Y_2	Y_3	Y_4	Y_5	Y_6
Budgeted FTE:	F_1	F_2	.	.	.	F_6
Actual FTE:	$\hat{F}_1$	$\hat{F}_2$	.	.	.	$\hat{F}_6$
Student contact* hours [SCH_i]:	$\sum_{j=1}^{6} H_1^j$	$\sum_j H_2^j$	.	.	.	$\sum_j H_6^j$
Average salary [$\overline{Y}_i$]:	Y_1/F_1	Y_2/F_2	.	.	.	Y_6/F_6
Aggregate salary [E_i]:	$\overline{Y}_1 * \hat{F}_1$	$\overline{Y}_2 * \hat{F}_2$	.	.	.	$\overline{Y}_6 * \hat{F}_6$
Cost per student contact hour [CSCH]:	$\frac{E_1}{SCH_1}$	$\frac{E_2}{SCH_2}$	.	.	.	$\frac{E_6}{SCH_6}$
Average class size in jth division :	S^j	S^j	.	.	.	S^j
Average hours/ class in jth division:	CH^j	CH^j	.	.	.	CH^j
Cost [illegible]udent in jth division [CS_i^j]:	$\frac{CSCH_1}{S^j * \frac{1}{CH^j}}$	$\frac{CSCH_2}{S^j * \frac{1}{CH^j}}$	.	.	.	$\frac{CSCH_6}{S^j * \frac{1}{CH^j}}$
Total enrollment in courses [EN]:	$\sum_j EN_1^j$	$\sum_j EN_2^j$	.	.	.	$\sum_j EN_6^j$
Expenditures on support personnel [ESP] per student [SS]:	$\frac{ESP}{EN}$	$\frac{ESP}{EN}$	.	.	.	$\frac{ESP}{EN}$
Expenditures on supply & equipment [ESE] per student [SE]:	$\frac{ESE}{EN}$	$\frac{ESE}{EN}$	.	.	.	$\frac{ESE}{EN}$

*the six divisions of classes are independent study and regularly scheduled courses in lower, upper and graduate level courses.

EXOGENOUS VARIABLES

The variable SAT was obtained directly from student files. In the results reported, we utilized the simple sum of the verbal and quantitative tests. Parental income, Y_p, was estimated from occupational data from both parents. Conversion of occupational information to income equivalents was based on data from the U.S. Census [1970] and the U.S. Department of Labor.[7] While these calculations necessarily involve some imprecision, other alternatives were not available.

Expected future income for each major is not included in the empirical tests since we were unable to develop income figures for numerous major fields. In fact the best estimates by major that we could find were for Ph. D.'s only. Therefore, we omitted this variable from the set of estimates reported in this paper.

The other exogenous variables of the model are all binary in nature. The variable X represents sex of the individual student and takes the value one for males and zero for females. ACT is a dummy variable indicating whether the student participated in student government, athletics, and other extracurricular activities (ACT=1) or not (ACT=0). Finally, majors were classified into four varibales, each of which took the value of one if the student's major was in that group and took the value zero otherwise. The groupings were humanities [HUMAN], arts [ART], social sciences [SSA], and natural sciences [NSA]. Because the number of majors in the arts was small, we combined humanities and arts into one dummy variable; that is the variable which is omitted from the regressions in order to avoid perfect collinearity with the constant term.

ESTIMATION

The results of estimating equations (2') and (6') are reported in Table 1. The Table gives the estimates obtained from both two-stage least squares [TSLS] and for comparison ordinary least squares [OLS]. Although strictly speaking, the t-test is not valid for TSLS we follow common practice in reporting the t-values in parenthesis below each estimate and use

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Table 1

Two-Stage Least Squares (TSLS) and Ordinary Least Squares (OLS) Estimates of Equations (2') and (6')

(T-Values in Parenthesis)

Equation (2')		Dependent Variable	Constant	LR	LSAT	LX	R^2	Sample
(1)	TSLS	Lq	-3.806	.672*	.259*	.034**	--	Maximum
			(3.23)	(2.57)	(2.54)	(1.33)		n=336
(2)	OLS	Lq	-1.669	.079*	.310*	.025**	.10	
			(3.47)	(2.69)	(4.66)	(1.47)		
(3)	TSLS	Lq	-2.113	.297	.244*	.029	--	Control
			(.72)	(.43)	(2.01)	(.64)		n=126
(4)	OLS	Lq	-1.242	.085**	.244*	.040	.10	
			(1.47)	(1.55)	(2.13)	(1.47)		
(5)	TSLS	Lq	-3.331	.439*	.328*	.049	--	Experimental
			(2.92)	(2.21)	(2.84)	(1.24)		n=168
(6)	OLS	Lq	-1.730	.042	.346*	.003	.15	
			(2.67)	(1.08)	(3.88)	(.11)		
(7)	TSLS	Lq	-3.249	.484*	.292*	.036**	--	Combined
			(3.14)	(2.41)	(3.29)	(1.474)		n=294
(8)	OLS	Lq	-1.540	.068*	.309*	.020	.11	
			(3.04)	(2.20)	(4.32)	(1.11)		

Equation (6')			Constant	Lq	LSAT	LACT	LY_p	R^2	Sample
(1)	TSLS	LR	8.045	4.459*	-1.127*	.158	--	--	Maximum
			(2.89)	(2.74)	(2.05)	(1.15)			n=336
(2)	OLS	LR	3.299	.322*	.057	- .121*	--	.07	
			(3.48)	(2.78)	(.41)	(3.14)			
(3)	TSLS	LR	3.718	2.029*	-1.69	.062	- .126	--	Control
			(1.96)	(2.01)	(.55)	(.64)	(1.04)		n=126
(4)	OLS	LR	2.990	.332*	.083	- .044	.011	.06	
			(2.20)	(1.98)	(.42)	(.79)	(.17)		
(5)	TSLS	LR	12.772	5.940*	-1.890*	.245	- .232	--	Experimental
			(2.45)	(2.54)	(2.01)	(1.01)	(1.06)		n=168
(6)	OLS	LR	3.879	.310*	- .002	- .212*	- .026	.11	
			(2.65)	(1.65)	(.007)	(3.49)	(.33)		
(7)	TSLS	LR	8.642	4.80*	-1.150*	.185	- .253*	--	Combined
			(2.91)	(2.97)	(2.13)	(1.24)	(1.69)		n=294
(8)	OLS	LR	3.436	.338*	.039	- .137*	- .004	.08	
			(3.39)	(2.65)	(.262)	(3.26)	(.07)		

The variable symbols are the same as those used in the text. L signifies natural logarithm. A * and ** indicate respectively significance at the 5 and 10 percent level. All tests are one-tailed except for LX. The estimates for the major dummies are not shown to conserve space.

them as a rough guide for purposes of testing the hypothesis of interest. Since the TSLS estimates are consistent our primary interest focuses on their values.

Structures of the model were estimated for four subsets of the initial sample of those 502 students remaining from the 970 who started in the experiment. The subsets were chosen on the basis of available data. Results are reported for a maximum grouping of 336 students in both the experimental and control cohorts; all data except parental income are available for this grouping. The results are also reported separately for an experimental cohort [n = 168], a control cohort [n = 129] and a combination of the cohorts [n = 294]. Each of these samples have observations on all variables available. Appendix I gives information on the means and simple correlations among the variables for the combined cohorts.

DISCUSSION OF THE ESTIMATES

As noted above, Table 1 presents the OLS and TSLS estimates of equations (2') and (6'). The corresponding estimated elasticities for the TSLS estimates are summarized in Table 2, and those are the results primarily discussed in this section.

One of the first things to be noted is the lack of statistical significance for the paramaters estimated for the control group, which has the smallest number of observations of any of the samples. For this reason, we generally limit our discussion of findings to the results for the combined and the experimental sample. However, we do note that both the OLS and TSLS estimates for the control group are approximately of the same size and sign as the estimates for the other groups.[8]

The elasticity of q, educational attainment, with respect to SAT is, as predicted, always positive. The order of magnitude however is small, ranging in value from .24 to .33. The elasticity of q with respect to resources, R, is also consistently positive as predicted and ranges in value from .30 to .67. Interestingly, this estimate is larger for the combined cohort and the maximum sample than for the experimental group. This suggests that the estimated elasticity for the control group is larger than that for the experimental group even though the actual value estimated from the control cohort is only .30. On the other hand, the estimated elasticity of q with respect to SAT is smaller for the full sample than for the experimental sample implying a smaller elasticity for the control group as well. (In this case the control group estimate is significant.) These observations suggest that, relative to the control group, changes in achievement of the experimental group are less strongly related to resources and more strongly related to SAT.

The difficulty with this formulation of the problem is that there is no reason to assume that a linear interpolation of the significant estimated elasticities gives a correct elasticity for the control cohort. For this reason we constructed a dummy variable representing the two cohorts and used it to allow the estimated elasticities to vary between the groups. This procedure allows a direct t-test for differences between groups. Using this procedure the difference between $\epsilon[q, R]$ for the control and experimental cohorts was only .0005 and not significant (t = .09). Similar tests showed that $\epsilon[q, SAT]$ did not differ between the two cohorts.

One possible explanation for a finding that the elasticity of q with respect to R is the same or lower for the experimental group than the control group is that the marginal productivity of resources may be larger for the control than for the experimental group. This would be in accord with the diminishing marginal productivity hypothesis as the experimental group receives more resources ($52.45 per class) than does the control group ($48.50). These figures support the contention made earlier that the primary effect of general education requirements is to constrain the students' purchase of resources. In short, general education requirements reduce the resources received by students since most GER courses are relatively low cost lower division courses. The experimental group also has a higher average achievement level (2.30) than does the control group (2.25). Using these mean figures and the elasticities reported in Table 2, we calculate a marginal product of .022 for the combined cohort and .019 for the experimental cohort. Interpolation of these results under the as-

Table 2

Elasticity Values Based on the TSLS

Estimates Shown in Table 1

		Two Stage Least Squares Estimates			
Paramater	Predicted Sign	Maximum Sample n=336	Control Cohort n=126	Experimental Cohort n=168	Combined Cohorts n=294
[q, SAT]	> 0	.26*	.24*	.33*	.29*
[q, R]	> 0	.67*	.30	.44*	.48*
[q, X]	--	.03**	.03	.05	.04**
[w, SAT]	< 0	-1.13*	-1.69	-1.89*	-1.15*
[w, ACT][1]	< 0	.16*	.06	.25	.19
[w, y_p]	< 0	--	- .13	- .23	- .25*
[P, q]	> 0	.29*	.97*	.20*	.26*

Source: Table 1.

[1]Note that the dummy variable used to measure ACT is defined as 1.0 when a student takes no activities. Therefore, this sign is reversed from that hypothesized in the theory section. A * and ** indicate respectively significance at the 5 and 10 percent level.

sumption that both groups have an identical production function provides an estimate of .025 as the marginal product for the control group.[9] Furthermore, if we assume that both elasticity estimates are the same as indicated by the dummy variable regression then the marginal products are .019 and .021 for the experimental and control groups respectively.

We did not predict the sign of the elasticity of q with respect to sex, but the results indicate a positive, though generally statistically insignificant elasticity. If the results were statistically significant, we could conclude that, ceteris paribus, males tend to attain higher levels of achievement than do women.[10]

As discussed earlier, w represents the student time required per unit of resources received. We predicted the elasticity of w with respect to SAT would be negative because the higher is student ability, the smaller is the time required to attain a given level of achievement. In accordance with our prediction, the results indicate a consistently negative elasticity estimate.

Similarly, we predicted the elasticity of w with respect to participation in extracurricular affairs would be positive, indicating that such participation is reflected in increasing amounts of time required to attain a given level of achievement. Because of the way participation in extracurricular affairs is measured, this prediction translates to a negative elasticity of w with respect to ACT. The results are mixed, with the TLS estimates showing insignificant positive elasticities and the OLS estimates generally showing negative elasticities.

Lastly, we expected a negative elasticity of w with respect to family income. If family income is high, students should feel less pressure to spend time working; hence, their subjective estimate of the effective time required to attain a given achievement level decreases as family income increases. The estimated elasticities are negative but statistically insignificant except for the combined cohorts.

The last elasticity reported is the value of educational attainment, p, with respect to the quantity of educational attainment. We predicted the value of educational attainment would increase with increases in q or a positive elasticity. The elasticity is negative if the coefficient on q in the resources equation (6') is less than 1. For the TSLS results we find a positive elasticity implying the value of q increases with educational attainment.

SUMMARY

In general, our results validate the proposed model. Furthermore, the results are not in accord with past studies which typically show a strong relationship between achievement and SAT scores, but a very weak and statistically insignificant relationship between achievement and university resources received. Among the more interesting of our results are the positive, statistically significant estimates of elasticities of achievement with respect to both resources and SAT. Furthermore, these estimates suggest that within one university the responsiveness of student achievement is higher with respect to university resources than to increases in entering SAT scores. (All estimates of the elasticity of q with respect to R are greater than the corresponding elasticity of q with respect to SAT.) Since the mean SAT score for the maximum sample is 568, above the national average, universities and colleges with less prepared students may find these magnitudes reversed, although if our interpretation of previous cross-university studies is correct (student selection of educational institutions is efficient), then this result should be quite general.

FOOTNOTES

1 For example, see R.H. Knapp and H.B. Goodrich, Origins of American Scientists (Chicago: 1952).

2 There is a substantial literature relating earnings of college graduates to college "quality." For example, see the studies by Hunt [1963], Weisbrod and Karpoff [1968], and Daniere and Mechling [1970].

3 College outputs, of course, are not confined to productivity measures of the type discussed here; there exists a large body of research on the socializing effects of colleges. For example, see Feldman and Newcomb [1969] and Withey [1971].

4 See, for example, Karpoff and Weisbrod [1968] who found a positive correlation between income and educational attainment as measured by rank in class.

5 We note that it would conceptually be better to utilize $CSCH_i$ and use the individual students hours per class in developing his resource measure. However, since we only have information on the department and type of each course, CH^j is the best alternative.

6 Note that the $\sum_i W_i^j = 1$ and the $\sum_j \sum_i W_i^j$ = the number of divisions utilized in the class breakdown.

7 The data was compiled from the following sources:

1) Handbook of Labor Statistics, 1972, U.S. Department of Labor, Bureau of Labor Statistics, Bulletin 1735.
2) U.S. Bureau of Labor Statistics, Employment and Earnings, Vol. 16, July-December, 1969.
3) National Survey of Professional, Administrative, Technical and Clerical Pay, June 1969, U.S. Department of Labor, Bureau of Labor Statistics, Bulletin 1654.
4) Statistical Abstract of the United States, 1972, United States Department of Commerce publication, Social and Economic Statistics Administration, Bureau of the Census.

8 Nevertheless Chow tests based on the residuals from TSLS indicate we must reject the hypothesis of identical structures for both equations ($F = 2.07$ and $F = 1.60$ for the resource and production equations respectively). When the test was applied to the OLS estimates the production equation showed no difference in structure ($F = .90$).

9 The calculations are summarized as follows:

	Combined Cohorts	Control Cohort	Experimental Cohort
q:	2.28	2.25	2.30
R:	$50.75	$48.50	$52.45
$\frac{R}{q}$:	22.26	21.56	22.89
[illegible](q, R):	.48	.53*	.44
$\frac{\partial q}{\partial R}$:	.022	.025**	.019

* -- Weighted Average.
** -- Estimated.

10 It is worth noting that a simple mean test based on the total number of students remaining in the program (502) and the total initial sample (970) indicates that females do have a significantly higher retention rate than males.

Appendix

Table A1

Means and Standard Deviations

For the Combined Cohorts (n = 294)*

		Mean	Standard Deviation
(1)	Average Grade Point Index (GPA)	3.05	.43
(2)	q	2.28	.35
(3)	R_1	50.75	18.54
(4)	SAT (Combined Verbal and Math)	1128	140
(5)	Y_p	17.99	5.46
(6)	SEX (1 = Male 0 = Female)	.46	--
(7)	ACT (1 = No Outside Activities; 0 = Outside Activities)	.73	--
(8)	Natural Science (Per Cent)	22%	--
(9)	Social Science (Per Cent)	59%	--
(10)	Humanities and Arts (Per Cent)	19%	--
(11)	Experimental Cohort	168	--
(12)	Control Cohort	126	--

See Text for definition of terms.

*The individual cohorts had nearly identical values for all exogeneous variables.

Appendix

Table A2

Correlation Matrix For the Combined Cohorts (n = 294)

	q	SAT	$\bar{R}_1$	$\bar{R}$	GPA
q	1.0	.25	.20	.16	.95
SAT		1.0	.06	.11	.24
R_1			1.0	.92	.18
R				1.0	.13
GPA					1.0

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APPENDIX B

Distribution of Total Sample by Income and GPA

GPA Category	Income Category 1	2	3	Total
1	0	0	0	0
2	0	.597	.796	1.39
3	.199	2.39	1.79	4.38
4	1.19	8.36	4.38	13.94
7	2.58	20.91	19.9	43.42
8	.398	4.98	6.77	12.15
Total	4.38	37.25	33.66	75.29

$\chi^2(8) = 9.57$ s = 0.30

Distribution of Control Sample by Income and GPA

GPA Category	Income Category 1	2	3	Total
1	0	0	0	0
2	0	.398	.398	.796
3	.199	.996	.996	2.19
4	.796	4.58	1.59	6.97
7	1.59	9.16	7.56	18.32
8	0	1.59	2.78	4.38
Total	2.58	16.73	13.34	32.66

$\chi^2(8) = 10.88$ s = 0.21

Distribution of GEE Sample by Income and GPA

GPA Category	Income Category 1	2	3	Total
1	0	0	0	0
2	0	.199	.398	.597
3	0	1.39	.796	2.19
4	.398	3.78	2.78	6.97
7	.996	11.75	12.35	25.09
8	.398	3.38	3.98	7.79
Total	1.79	20.50	20.30	42.60

$\chi^2(8) = 3.17$ s = 0.92

Distribution of Total Sample by Income and Graduation Status

	Graduation Status			
Income	1	2	3	Total
1	3.98	3.98	0	4.38
2	31.47	6.17	2.39	40.03
3	29.68	7.37	3.78	40.83
Total	65.13	13.94	6.17	85.25
$\chi^2(4) = 5.49$		s = 0.24		

Distribution of Control Sample by Income and Graduation Status

	Graduation Status			
Income	1	2	3	Total
1	2.19	.398	0	2.58
2	14.14	3.18	.796	18.12
3	12.35	2.98	1.39	16.73
Total	28.68	6.57	2.19	37.45
$\chi^2(4) = 2.23$		s = 0.69		

Distribution of GEE Sample by Income and Graduation Status

	Graduation Status			
Income	1	2	3	Total
1	1.79	0	0	1.79
2	17.3	2.98	1.59	21.91
3	17.33	4.38	2.39	24.1
Total	36.45	7.37	3.98	47.80
$\chi^2(4) = 4.56$		s = 0.33		

Distribution of Total Sample by Income and Major

Major	Income Category 1	2	3	Total
1	.398	6.97	6.17	13.54
2	2.93	16.33	15.93	35.25
3	.597	3.38	3.38	7.37
4	.199	7.17	6.17	13.54
5	0	1.99	1.39	3.38
6	.199	.796	1.39	2.39
7	0	3.38	6.37	9.76
Total	4.38	40.04	40.83	85.25

$\chi^2(12) = 17.89$ s = 0.12

Distribution of Control Sample by Income and Major

Major	Income Category 1	2	3	Total
1	.199	3.18	2.78	6.17
2	1.99	7.37	5.77	15.13
3	.398	1.79	1.19	3.38
4	0	2.19	2.78	4.98
5	0	1.19	.796	1.99
6	0	.597	.597	1.19
7	0	1.79	2.78	4.58
Total	2.58	18.12	16.73	37.45

$\chi^2(12) = 14.04$ s = 0.30

Distribution of GEE Sample by Income and Major

Major	Income Category 1	2	3	Total
1	.199	3.78	3.58	7.33
2	.996	8.36	10.15	20.11
3	.189	1.59	2.19	3.88
4	.189	4.38	3.38	8.56
5	0	.796	.597	1.39
6	.199	.189	.796	1.19
7	0	1.59	3.58	5.17
Total	1.79	21.91	24.10	47.80

$\chi^2(12) = 12.63$ s = 0.40

Distribution of Total Sample by Sex and Graduation Status

	Graduation Status			
Sex	1	2	3	Total
F	38.4	7.37	3.78	49.6
M	35.6	10.15	4.58	50.39
Total	74.10	17.52	8.36	100

$\chi^2(2) = 2.10$ $s = 0.21$

Distribution of Control Sample by Sex and Graduation Status

	Graduation Status			
Sex	1	2	3	Total
F	16.93	3.58	1.59	22.11
M	17.13	4.98	1.59	23.70
Total	34.06	8.56	3.18	45.81

$\chi^2(2) = 0.87$ $s = 0.65$

Distribution of GEE Sample by Sex and Graduation Status

	Graduation Status			
Sex	1	2	3	Total
F	21.51	3.78	2.19	27.49
M	18.52	5.17	2.98	26.69
Total	40.93	8.96	5.17	54.18

$\chi^2(2) = 2.77$ $s = 0.25$

Distribution of Total Sample by Sex and SATV

Sex	SATV Category 1	2	3	4	5	Total
F	1.59	8.56	24.3	11.75	2.78	49
M	1.79	10.95	21.11	15.73	.597	50.19
Total	3.38	19.52	45.4	27.4	3.38	99.2

$\chi^2(4) = 12.60$ s = 0.013

Distribution of Control Sample by Sex and SATV

Sex	SATV Category 1	2	3	4	5	Total
F	.796	4.78	9.76	5.17	1.19	21.71
M	.796	4.73	7.56	7.56	.398	23.7
Total	1.59	9.56	19.9	12.74	1.59	45.41

$\chi^2(4) = 3.86$ s = 0.43

Distribution of GEE Sample by Sex and SATV

Sex	SATV Category 1	2	3	4	5	Total
F	.796	3.78	14.54	6.57	1.59	27.29
M	.996	6.17	10.95	8.16	.199	26.49
Total	1.79	9.96	25.49	14.74	1.79	53.78

$\chi^2(4) = 11.77$ s = 0.02

Distribution of Total Sample by Sex and Major

Sex	Major 1	2	3	4	5	6	7	Total
F	9.96	24.7	2.58	5.17	.597	1.79	4.78	49.6
M	4.38	17.72	5.37	10.55	2.98	.996	8.36	50.39
Total	14.30	42.4	7.96	15.7	3.58	2.78	13.14	100

$\chi^2(6) = 44.79$ s = 0.0

Distribution of Control Sample by Sex and Major

Sex	Major 1	2	3	4	5	6	7	Total
F	4.38	11.15	1.39	1.79	.597	.597	2.19	22.11
M	2.39	8.36	2.58	4.18	.796	.796	3.98	23.7
Total	6.77	19.52	3.98	5.97	1.99	1.39	6.17	45.81

$\chi^2(6) = 15.64$ s = 0.016

Distribution of GEE Sample by Sex and Major

Sex	Major 1	2	3	4	5	6	7	Total
F	5.57	13.54	1.19	3.38	0	1.19	2.58	27.49
M	1.99	9.36	2.78	6.37	1.59	.199	4.38	26.69
Total	7.56	22.9	3.98	9.76	1.59	1.39	6.97	54.18

$\chi^2(6) = 34.0$ s = 0.0

Distribution of Total Sample by Sex and GPA

	GPA					
Sex	2	3	4	7	8	Total
F	1.39	2.39	7.37	25.49	7.17	43.82
M	.597	1.99	7.96	25.09	6.77	42.43
Total	1.99	4.38	15.33	50.59	13.9	86.25

$\chi^2(4) = 1.86$ s = 0.76

Distribution of Control Sample by Sex and GPA

	GPA						
Sex	1	2	3	4	7	8	Total
F	0	.996	1.19	3.78	10.95	2.39	19.32
M	0	.199	.996	3.78	11.35	3.18	19.52
Total	0	1.19	2.19	7.56	22.31	5.57	38.84

$\chi^2(4) = 3.36$ s = 0.50

Distribution of GEE Sample by Sex and GPA

	GPA					
Sex	2	3	4	7	8	Total
F	.398	1.19	3.58	14.54	4.78	24.5
M	.398	.996	4.18	13.74	3.58	22.9
Total	.796	2.19	7.76	28.28	8.36	47.41

$\chi^2(4) = 1.02$ s = 0.91

Distribution of Total Sample by Income and SATV

Income	SATV 1	2	3	4	5	Total
1	.398	.398	2.19	1.19	.199	4.38
2	1.19	8.95	18.12	10.55	.996	39.8
3	1.59	7.96	18.92	10.95	1.39	40.83
Total	3.18	17.33	39.24	22.7	2.58	85.05

$\chi^2(8) = 4.43$ $s = 0.82$

Distribution of Control Sample by Income and SATV

Income	SATV 1	2	3	4	5	Total
1	.199	.398	.996	.796	.199	2.58
2	.398	4.98	7.96	4.38	.398	18.12
3	.996	2.39	8.16	4.58	.597	16.73
Total	1.59	7.76	17.13	9.76	1.19	37.45

$\chi^2(8) = 7.51$ $s = 0.48$

Distribution of GEE Sample by Income and SATV

Income	SATV 1	2	3	4	5	Total
1	.199	0	1.19	.398	0	1.79
2	.796	3.98	10.15	6.17	.597	21.71
3	.597	5.57	10.75	6.37	.796	24.1
Total	1.59	9.56	22.1	12.94	1.39	47.6

$\chi^2(8) = 5.84$ $s = 0.66$

APPENDIX C

REPORT ON SURVEY QUESTIONNAIRES

FROM THE

GENERAL EDUCATION EXPERIMENT*

by

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with assistance

from

Cathy Kasa[illegible]

*R. Murray Thomas prepared the Questionnaires mailed to the students taking part in the experiment and Merill Hatlen tabulated the individual student responses.

As part of the evaluation of the General Education Experiment (GEE), in spring 1973, questionnaires were mailed to the 221 students in the experimental group and the 182 students in the control group who were still enrolled in school. The objective of the questionnaires was to determine if the students felt that the general education courses played a significant or non-significant role in determining selection of courses and career objectives. The questions emphasized the effect of the general education requirement (GER) on choice of first and second major.

The Response Rate

Of the 403 questionnaires mailed out, 323 were returned for a response rate of 80.1%. Eighty-one point nine percent of the students in the experimental group completed and returned their questionnaires, compared with 78% of the students in the control group.

The Results

The questionnaires, which were mailed out, are attached to this report. Also, the percentages of students selecting alternative answers to questions are tabulated on the questionnaires themselves. In this section we simply attempt to summarize and interpret the students' reponses.

Choice of Major

The control group were asked [question 5] whether or not the GER affected their choice of major; 84% of the responses answered that the influence was small or zero. However, only 81% of those students offering written comments indicated that the GER actually hindered development of their major interest.

On the other hand, the GER constrained student from either completing a second major or from taking a concentration of courses in some department outside the major. Of the control group, 51% responded that the GER prevented them from taking a concentration of courses outside the major. The responses from the experimental group confirm the constraining nature of the GER. Of the experimental group, 58% responded that exemption from the GER enabled them to take a concentiation of courses outside the major.

However, the GER does appear to offer some guidance to the student who is undecided about the future. Fifty percent of the experimental group indicated that they had utilized the published set of GER as a guide, and 58% of those using it did so in an attempt to find electives of an introductory nature.

Course Selection and Career Objective

The control group and experimental group do not differ much in terms of plans after graduation. While 56% of the control group plan to attend professional or graduate school, 53% of the experimental group also plan to do so. Similarly, 19% of the control group and 21% of the experimental group intend to work upon graduation.

Major differences between the two groups appear in the responses to the question whether the selection of courses outside the major had much influence on the student's planned objective. Only 35% of the control group responded that the influence of courses outside the major was important while 61% of the experimental group responded positively. These results indicate that relaxing the GER constraint allows students the freedom to choose a concentration of courses outside of the major and, furthermore, that the development of that second interest has an important role in shaping the career objectives of the student.

From this result it can be deduced that the experimental group, being allowed to pick their outside courses, was able to choose those that would benefit their major course of study and their future careers. This point is further emphasized by the written comments of the students. Only 20% of the control group stated that outside courses were useful in determining their career objectives, compared with 60% of the experimental group.

Perhaps because outside courses enabled them to choose career objectives more carefully, a larger proportion of the experimental group expressed satisfaction with their post-graduation plans.

Those students who were dissatisfied with their present post-graduation plans were asked to state what they would prefer doing instead. The responses of the two groups are strikingly different. While 22% of the control group would prefer to go to professional school, only 11% of the experimental group had this preference; and while 11% of the control group really wanted to travel, 27% of the experimental group wanted to travel.

Preferences for GER

Both groups of students were asked to choose from a list of the kind of general education program they prefer; the list ranged from no program to a program similar to the present one. The highest proportion of both groups want no program or a program of recommended courses only. Sixty-one percent of the experimental and 39% of the control group chose this answer. Another 45% of the control and 24% of the experimental group opted for a program with fewer requirements. Lastly, 8% of the control and 3% of the experimental groups preferred the present program.

These results show that substantial majorities of both groups prefer a more flexible general education program, although a majority of the control group would like to see some kind of required program remain on the books. The experimental group is quite clearly opposed to any kind of required general educational courses. By and large, each group appears to prefer a program somewhat similar to the one it actually experienced, although the control group did feel that a program with fewer requirements would be preferred.

ATTACHMENTS

to

APPENDIX C

Office of the Dean
College of Letters and Science
University of California, Santa Barbara

Experimental Group
Questionnaire

Dear Student,

Date: May 1, 1973

When you entered Santa Barbara in Fall 1969 you were among those students selected to participate in the General Education Experiment and were exempt from the normal requirements of the General Education Program. Since most participants will be graduating in June we would like to take this opportunity to ask for your response to the Experiment, so that we can develop an evaluation which can contribute to discussions of General Education and proposals for its modification. We hope that you will be willing to assist us by completing this questionnaire and returning it to us in the enclosed envelope by May 15, 1973.

Alec P. Alexander, Dean
College of Letters and Science

R. Murray Thomas. Chairman
Committee to Evaluate the
General Education Experiment
Academic Senate

1. Did you at any time consider transfer to another school but reject the possibility in the belief that your participation in the Experiment would in some way make transfer difficult? Yes 79% No 20% N/A 1%

2. Did you use your exemption from the General Education Requirements to take a significant number of courses, say at least 20 units, in some department outside your major which you consider a secondary concentration? Yes 58% No 42%

   If so, what was the concentration? See Table 1.

3. In planning your program of courses outside the major, did you ever utilize the published set of General Education Requirements as a guide? Yes 49.7% No 50.2%

   If so, in what way?

   11% To attempt to closely follow the General Education pattern.
   20% To find courses which would introduce me to a particular area in General Education.
   38% To find electives of an introductory nature.
   29% Other (specify)
   2% N/A

4. What do you expect to do after graduation?

   See Table 2.

5. What influence, if any, do you believe your selection of courses outside the major had upon your planned objective?

   30% Strong influence
   31% Some influence
   19% Little influence
   20% No influence

   Comments:

General knowledge	--	27.1%
Useful in determining objective	--	66.1%
No effect	--	0%

6. Would you really like to do something different from what you expect to do after graduation if you could? Yes 34% No 66%

If so, what is your preferred objective?

Other	-- 47%	Travel	-- 27%
Professional school	-- 11%	N/A	-- 6%
		Work	-- 3%

What influence, if any, do you believe your selection of courses outside the major had upon your preferred objective?

9% Strong influence
9% Some influence
8% Little influence
7% No influence
66% N/A
Comments:

No pattern.

7. Which of the following programs for General Education would you prefer:

3% A program similar to the present Catalog requirements
10% A program with somewhat fewer requirements.
14% A program with substantially fewer requirements.
51% A program of recommended courses only.
10% None at all.
8% Unable to decide.
3% N/A
Comments:

Conform to pattern listed.

8. Of the courses, if any, which you know to be General Education courses which did you find most valuable and which least valuable. (Use following form)
Because of the nature of the responses, all answers have been grouped on this question.

Most Valuable	Least Valuable
a. GE course See Table 3a	a. GE course See Table 3a
I took this course because:	I took this course because:
(1) 5% It was a GE course.	13.5% It was a GE course.
(2) 7% Another student recommended it.	4% Another student recommended it.
(3) 2% It came at a convenient hour.	4% It came at a convenient hour.
(4) .8% An instructor recommended it.	.5% An instructor recommended it.
(5) .3% My faculty adviser recommended it.	1% My faculty adviser recommended i'
(6) 6% It had an interesting title.	3% It had an interesting title.
(7) 30% It would broaden my education	16% It would broaden my education
(8) 12% It might help support my major.	6% It might help support my major.
(9) 10% Other (specify)	11% Other (specify)
(10) 27% N/A	41% N/A

Most Valuable

b. GE course____________________

I took this course because:
____It was a GE course.
____Another student recommended it.
____It came at a convenient hour.
____An instructor recommended it.
____My faculty adviser recommended it.
____It had an interesting title.
____It would broaden my education
____It might help support my major.
____Other (specify)____________________

c. GE course____________________

I took this course because:
____It was a GE course.
____Another student recommended it.
____It came at a convenient hour.
____An instructor recommended it.
____My faculty adviser recommended it.
____It had an interesting title.
____It would broaden my education
____It might help support my major.
____Other (specify)____________________

Least Valuable

b. GE course____________________

I took this course because:
____It was a GE course.
____Another student recommended it.
____It came at a convenient hour.
____An instructor recommended it.
____My faculty adviser recommended it.
____It had an interesting title.
____It would broaden my education
____It might help support my major.
____Other (specify)____________________

c. GE course____________________

I took this course because:
____It was a GE course.
____Another student recommended it.
____It came at a convenient hour.
____An instructor recommended it.
____My faculty adviser recommended it.
____It had an interesting title.
____It would broaden my education
____It might help support my major.
____Other (specify)____________________

9. How many times, if any, have you changed your major (even if unofficially)?

27% None
35% One change
15% Two changes
13% Three changes
4% Four changes
2% Other (specify)
3% N/A

Comments:

No comments made

10. Do you have any comments regarding the Experiment or the General Education Requirements?

See Table 4b

Office of the Dean
College of Letters and Science
University of California, Santa Barbara

Control Group
Questionnaire

Dear Student,

Date: May 1, 1973

In an effort to obtain student response to the General Education Program we are asking a number of students to answer the following questionnaire, so that we can develop an evaluation which can contribute to discussions of General Education and proposals for its modification. We hope that you will be willing to assist us by completing this questionnaire and returning it to us in the enclosed envelope by May 15, 1973.

Alec P. Alexander, Dean
College of Letters and Science

R. Murray Thomas, Chairman
Committee to Evaluate the
General Education Experiment
Academic Senate

1. Do you believe that the General Education Requirements prevented you from completing a second major? Yes 51% No 45% N/A 4%

   If so, what would the second major have been? See Table 1.

2. Do you believe that the General Education Requirements prevented you from taking a concentration of courses, say at least 20 units, in some department outside your major? Yes 51% No 48% N/A 1%

   If so, what would the concentration have been? See Table 1.

3. What influence, if any, do you believe the General Education courses had upon your choice of major?

   4% Strong influence
   11% Some influence
   23% Little influence
   61% No influence
   1% N/A
   Comments:

4. What do you expect to do after graduation?

   See Table 2.

5. What influence, if any, do you believe your selection of courses outside the major had upon your planned objective?

   10% Strong influence
   25% Some influence
   27% Little influence
   37% No influence
   1% N/A

   Comments:
   General knowledge -- 65%
   Useful in determining objective -- 20%
   No effect -- 15%

6. Would you really like to do something different from what you expect to do after graduation if you could? Yes 32% No 58% N/A 10%

If so, what is your preferred objective?

Other	-- 30%	N/A	-- 22%
Professional school	-- 22%	Work	-- 7%
Travel	-- 11%		

What influence, if any do you believe your selection of courses outside the major had upon your preferred objective?

2% Strong influence
5% Some influence
7% Little influence
10% No influence
76% N/A
Comments:

No pattern

7. Which of the following programs for General Education would you prefer:

8% A program similar to the present Catalog requirements
20% A program with somewhat fewer requirements.
25% A program with substantially fewer requirements.
35% A program of recommended courses only.
4% None at all.
3% Unable to decide
6% N/A
Comments:

Conform to pattern listed

8. Of the General Education courses, which did you find most valuable and which least valuable. (Use following form)
Because of the nature of the responses, all answers have been grouped on this question.

Most Valuable

a. GE course See Table 3a

I took this course because:
(1) 24% It was a GE course
(2) 10% Another student recommended it.
(3) 3% It came at a convenient hour.
(4) 1% An instructor recommended it.
(5) 1% My faculty adviser recommended it.
(6) 9% It had an interesting title.
(7) 21% It would broaden my education.
(8) 10% It might help support my major.
(9) 6% Other (specify)
(10) 15% N/A

Least Valuable

a. GE course See Table 3a

I took this course because:
57.3% It was a GE course
4% Another student recommended it.
5% It came at a convenient hour.
.4% An instructor recommended it.
.2% My faculty adviser recommended it.
3% It had an interesting title.
5% It would broaden my education.
2% It might help support my major.
4% Other (specify)
19.1% N/A

b. GE course ______

I took this course because:
___It was a GE course
___Another student recommended it.
___It came at a convenient hour.
___An instructor recommended it.
___My faculty adviser recommended it.
___It had an interesting title.
___It would broaden my education.
___It might help support my major.
___Other (specify)______

b. GE course ______

I took this course because:
___It was a GE course
___Another student recommended it.
___It came at a convenient hour.
___An instructor recommended it.
___My faculty adviser recommended it.
___It had an interesting title.
___It would broaden my education.
___It might help support my major.
___Other (specify)______

c. GE course ______

I took this course because:
___It was a GE course
___Another student recommended it.
___It came at a convenient hour.
___An instructor recommended it.
___My faculty adviser recommended it.
___It had an interesting title.
___It would broaden my education.
___It might help support my major.
___Other (specify)______

c. GE course ______

I took this course because:
___It was a GE course
___Another student recommended it.
___It came at a convenient hour.
___An instructor recommended it.
___My faculty adviser recommended it.
___It had an interesting title.
___It would broaden my education.
___It might help support my major.
___Other (specify)______

9. How many times, if any, have you changed your major (even if unofficially)?

41% None
37% One change
15% Two changes
6% Three changes
2% Four changes
1% Other (specify)
2% N/A
Comments:

Not a significant response.

10. Do you have any comments regarding the General Education Requirements?

See Table 4a.

Table 1

MAJOR	Control Group Item 1	Control Group Item 2	Experimental Group Item 2
History	16%	14%	17%
Psychology	9%	9%	8%
Sociology	5%	12%	10%
English	8%		8%
Chemistry	7%		1%
Political Science	7%		8%
Art	7%	9%	4%
Biological Science		12%	1%
Religious Studies	3%		6%
Economics	2%	7%	3%
Anthropoloby	1%	5%	6%

Table 2*

CATEGORY	Control Group Item 4	Experimental Group Item 4
Attend Professional School	32%	28%
Attend Graduate School	24%	25%
Work	19%	21%
Undecided	10%	4%
Work awhile then attend graduate school	7%	4%
Other	7%	11%

*Only categories with more than 7 replies are listed.

Table 3a --- Experimental Group

Item 8: Most valuable and least valuable courses. Only courses receiving a total of seven responses or more are included.

Course	# Responses: Total	8A	8B	8C
Most Valuable				
Music 15	24	10	7	7
English 1A	21	15	6	0
Art 1	19	9	7	3
Psychology 1	18	6	7	5
Biology 20	16	8	4	4
English 1B	15	10	4	1
Anthropology 2	12	8	1	3
Philosophy 1	12	4	5	3
Economics 1	10	4	5	1
History 17B	10	4	3	3
History 4A	9	7	1	1
History 4B	9	7	1	1
History 4C	9	7	1	1
Economics 2	8	3	4	1
Political Science 5	8	2	4	2
Least Valuable				
Philosophy 1	25	15	8	2
Psychology 1	22	11	7	4
English 1A	21	16	4	1
Sociology 1	17	7	4	6
English 1B	15	10	4	1
Anthroplogy 2	13	2	9	2
Music 15	11	7	4	0
Drama 45	11	4	2	5
Biology 20	10	6	3	1
History 17A	10	7	2	1
Subject A	9	4	4	1
Dance 45	8	6	1	1
Political Science 5	7	5	2	0
Sociology 45	7	2	4	1

Table 3b --- Control Group

[illegible] valuable and least valuable courses. Following are the courses which received a total of seven responses or more:

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[illegible]

[illegible]	# Responses: Total	8A	8B	8C
[illegible] 1B	19	8	4	7
[illegible] 1	18	11	5	2
[illegible] 20	18	10	5	3
[illegible] 1	15	2	9	4
Philosophy 1	13	7	3	3
History 4A	12	7	3	2
History 4B	11	6	3	2
Sociology 1	10	5	1	4
Economics 1	9	3	4	2
Anthropology 2	9	[illegible]	7	1
[illegible] 1	[illegible]	2	4	3
English 1A	8	7	1	0
[illegible]	[illegible]	[illegible]	[illegible]	1
English 1B	7	[illegible]	3	1

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	7
[illegible] 1B	20	6	7	7
[illegible] 1B	19	9	4	6
[illegible]	[illegible]	8	7	3
English 1A	[illegible]	[illegible]	[illegible]	6
[illegible]	[illegible]	[illegible]	4	[illegible]
[illegible]	14	4	[illegible]	[illegible]
Anthropology 2	[illegible]	[illegible]	7	4
[illegible]	[illegible]	[illegible]	7	1
[illegible] ([illegible])	9	6	[illegible]	1
History [illegible]	7	[illegible]	1	2

Table 4-a

Experimental Group

Item 10: Comments on Experiment or General Education:

A. Comments: Attitude towards General Education	# Responses	Percentage of Responses Experiment
1. General Education not needed since most people get a broad education through their own exploration.	14	22.2%
2. General Education courses provide valuable experience.	9	14.28%
3. General Education courses were generally of poor quality.	9	14.28%
4. General Education courses were a waste of time and unnecessary.	9	14.28%
5. General Education are too rigid and deny students their freedom.	7	11.11%
6. General Education valuable for students who have no idea what they want; provides good introduction to many subjects.	4	6.34%
7. General Education helped focus interest in one area.	3	4.76%
8. General Education not valuable if student has decided on major.	2	3.17%
9. General Education not completely useless, but highly dependent on the course, teacher, etc.	1	1.58%
10. Some General Education requirements are useful for broadening perspective.	1	1.58%
11. Students should be allowed to concentrate on major theme rather than getting sidetracked by General Education.	1	1.58%
12. Despise American History and Institutions Requirement.	1	1.58%
13. Have forgotten much of what was learned in General Education courses.	1	1.58%
14. General Education useful in forcing students to take distasteful subjects.	1	1.58%
Total	63	

B. Recommendations on General Education:	# Responses	Percentage of Responses Experiment
1. Total abolishment.	20	28.57%
2. Replace General Education with program similar to the Experiment.	19	27.14%
3. There should be recommended guidelines only.	8	11.42%
4. Many of the General Education Requirements should be eliminated.	5	7.14%
5. Counseling should replace the General Education Program.	4	5.7 %
6. General Education should be retained	4	5.7 %
7. General Education should be left up to departments	4	5.7 %
8. There should be area requirements instead of specific of General Education	2	1.42%
9. Make Experiment available to those who wish it.	1	1.42%
10. General Education should be unified for the entire University of California.	1	1.42%
11. Problem with General Education is the built-in resentment of student before taking G.E. courses.	1	1.42%
12. University should emphasize individual education rather than well rounded one.	1	1.42%
Total	70	

C. Comments on Experiment:	# Responses	Percentage of Responses Experiment
1. Glad to be part of program and found it valuable.	50	34.7 %
2. Freedom allowed meaningful choice of courses.	30	20.8 %
3. Experiment allowed a continuity and depth of subject not possible with G.E.	14	9.7 %
4. Experiment enabled completion of two majors without worrying about G.E.	9	6.25%
5. Experiment fostered better motivation in choice of courses.	9	6.25%
6. Appreciated lack of pressure to complete requirements.	8	5.55%
7. Dissuaded from taking advantage of Experiment because of possible transfer.	5	3.47%
8. If Experiment is continued much better counseling will be needed.	3	2.08%
9. Experiment enabled easier change of major.	3	2.08%
10. Would have transferred if it were not for the Experiment (positive).	2	1.38%
11. Did not make good use of the Experiment.	2	1.38%
12. Took General Education in preparation for Graduate School.	2	1.38%
13. Ability to pursue two majors deeply is more important than scattered subjects.	1	.69%
14. Experiment good only for those balanced enough not to overemphasize one area.	1	.69%

		# Responses	Pe.centage of Responses Experiment
15.	Theme should have been more feedback during the course of the Experiment.	1	.69%
16.	There was a lack of counseling	1	.69%
17.	Wanted requirements--imposed discipline.	1	.69%
18.	Experiment insufficient unless other requirements are changed.	1	.69%
19.	Experiment enabled early graduation.	1	.69%
	Total	144	

Table 4-h

Control Group

Item 10: Do you have any comments regarding General Education?

	Comments:	# Responses	Percentage of Responses
1.	Not completely useless, but highly dependent on the course and teacher.	40	22.1 %
2.	Some of the requirements should be dropped so there is more time for alternatives and concentration in major.	31	17.1 %
3.	Waste of time and unnecessary.	24	13.3 %
4.	Total abolishment.	23	12.7 %
5.	Valuable experience.	14	7.7 %
6.	G.E. hampered exploration of other fields.	9	4.97%
7.	Prefer recommended electives rather than G.E. requirements.	8	4.4 %
8.	G.E. good for people with no direction.	7	3.86%
9.	G.E. Requirements should be retained but quality of courses should be improved.	4	2.2 %
10.	G.E. Requirements should be left up to individual departments.	4	2.2 %
11.	Prefer more upper division G.E. courses with no prerequisites (i.e. more specific courses rather?).	3	1.65%
12.	Teaching was poor.	3	1.65%
13.	Keep requirements for freshmen and/or sophomores.	2	1.1 %
14.	Prefer seminars in each department that satisfy G.E.	2	1.1 %

		# Responses	Percentage of responses
15.	Should be more flexibility within requirements.	2	1.1 %
16.	Should be more relevant.	2	1.1 %
17.	Problem with G.E. courses is that there is no prior knowledge about courses.	1	.55%
18.	Prefer more emphasis on career orientation.	1	.55%
19.	Tighten them.	1	.55%
	Total	181	