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ABSTRACT

The planning office of a large urban university produced an induced course load matrix (ICLM) analysis to support the university's plans for undergraduate enrollment growth at its three campuses. The ICLM tables, based on the complete course histories of the 1993 entering cohort, summarize the program and course selections of a cohort of students as they progressed through their studies. While the analysis involved some technical challenges, the results are useful in a number of ways. In particular, the results show how program enrollments create instructional demands across academic divisions and how some departments play an important part in service teaching at the university. Because the course load analysis involves detailed quantitative data, senior administrators were consulted during the initial planning of the project, and care was taken to present the results clearly and succinctly. Ultimately, the results were well received and have been incorporated into several planning exercises. (Author)

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USING COURSE LOAD MATRIX ANALYSIS TO SUPPORT DEPARTMENTAL PLANNING FOR ENROLMENT EXPANSION

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USING COURSE LOAD MATRIX ANALYSIS TO SUPPORT DEPARTMENTAL PLANNING FOR ENROLMENT EXPANSION

Abstract

The planning office of a large, urban university produced an induced course load matrix (ICLM) analysis to support the university's plans for undergraduate enrolment growth at its three campuses. The ICLM tables, based on the complete course histories of the 1993 entering cohort, summarize the program and course selections of a cohort of students as they progressed through their studies. While the analysis involved some technical challenges, the results are useful in a number of ways. In particular, the results show how program enrolments create instructional demands across academic divisions and how some departments play an important part in service teaching at the university. Because the course load analysis involves detailed quantitative data, senior administrators were consulted during the initial planning of the project, and care was taken to present the results clearly and succinctly. Ultimately, the results were well received and have been incorporated into several planning exercises.

Introduction

A large, urban university plans to direct much of its anticipated undergraduate enrolment growth to its two suburban campuses which house distinct undergraduate colleges, each lead by a Principal and a committee of department chairs. The executive committee at each college has primary responsibility for preparing for the increased enrolments and for the implementation of new programs at the college. The central city campus also anticipates some increased enrolments in the Faculty of Arts & Science. In addition, the university as a whole continues the on-going process of evaluating and managing a great variety of undergraduate programs that involve the cooperation of its three campuses and their schools and departments.

The university's central planning office is supporting these efforts in part through an analysis of student program selection and course load. Specifically, the analysis is based on the Induced Course Load Matrix (ICLM) method of relating program enrolments to instructional demands on academic departments, measured in terms of student course load (Suslow, 1976). In general, the course load data are arrayed in a matrix format defined by students' programs of study along one dimension (rows) and the course departments along the other (columns).

Figure 1 illustrates the layout of a typical ICLM table, which shows how different programs of study generate instructional demands across departments. Although this example presents a very simple scenario based on three programs and three departments, it does illustrate how the ICLM format neatly summarizes course demands by program of study. For example, students in Program1 are shown to take 60% of their courses in Department1, the program's home department, with the remainder of their courses divided between the other departments. Program2, however, appears to have a more interdisciplinary approach, with 50% of its courses taken in Department2 and 40% taken in Department 1. Of course, when this method is applied at

a large university, the resulting table is greatly expanded and more complex. Nevertheless, the planning office believes that senior administrators require this kind of detailed data on programs and course load patterns to inform their decisions about program implementation, faculty hiring and departmental budgeting (Kinnick, 1994).

Figure 1. Sample ICLM Table – Distribution of Courses by Program of Study

	Department1	Department2	Department3	All Departments
Program1	**60%**	**20%**	**20%**	**100%**
Program2	**40%**	**50%**	**10%**	**100%**
Program3	**15%**	**20%**	**65%**	**100%**
All Programs	**38%**	**30%**	**32%**	**100%**

The course load matrix is a flexible tool that can be applied in a number of ways depending on institutional planning objectives. Because the university is preparing for significant enrolment growth, a key planning objective is to better understand and anticipate the course-taking pattern of a group of admitted students, depending on their program choices. Therefore, the course load analysis takes the approach of following a cohort of students admitted to each college through their studies, over a period of seven years. This cohort-based approach provides a complete picture of the program selection, course demands and attrition of a group of admitted students, cumulatively and year-by-year.

The resulting ICLM tables provide information about the impact of programs on different departments, departments' roles within the university, and the relationship of the suburban colleges to the larger undergraduate college at the central campus. The course load matrix

results can be further analyzed and used for specific departmental planning objectives. For example, the results can be combined with data on faculty to help make staff assignment and hiring decisions. Another application of the course load analysis is to develop an input-output model to estimate the course demands of future enrolments based on the historical patterns (Suslow, 1976; Kieft, 1977).

This report describes how the planning office produced the ICLM tables and how administrators are using the results in their planning exercises. The first section explains how the analysis was conducted and some of the challenges of summarizing complex program and course data in a meaningful format. The second section reports the results of the analysis and the key points it revealed. The third section discusses how the results were presented to university administrators and how they have be incorporated into university planning exercises. The final section reviews the strengths and limitations of the ICLM analysis.

Data and Methodology

Because the university is preparing for enrolment growth and program changes, the analysis takes the approach of following a cohort of entering students through their studies. Specifically, the ICLM cohort analysis follows the Fall 1993 freshman cohort in the Faculty of Arts & Science through their courses during the 1993/94 – 1999/00 academic years. Because many students take longer than four years to earn a degree, the cohort analysis follows the students for seven years to ensure that all of their courses are included. Course load is measured

in terms of full-course equivalents (FCEs), where a full-time student takes five full-courses per year and acquires at least 20 full-course credits to earn a four-year degree.[1]

The data on students' programs of study and their course histories are obtained from the university's student information system. All approved courses are counted provided they were taken while the students were officially enrolled in an undergraduate degree program at the university. Courses taken over and above formal degree requirements are also included, although they represent a small portion of the courses. The planning office prepared separate reports for each campus, although each report included information on course taking across the three sites. For example, the tables for the suburban campuses show how their students took courses at the central city campus.

In 1993, over 4,630 students enrolled as freshman in Arts & Science programs at the University: 2,769 at the central campus, 952 at the east campus, and 912 at the west campus. For each campus, the students were classified into one main program of study for the analysis. In addition, all courses were linked to one sponsoring department, and some departments were grouped together to produce a manageable number of categories. These two steps are described in more detail below.

Assignment of Students to Main Program of Study

Of the 4,633 students in the 1993 freshman cohort, 666 students (14%) are not associated with a program of study. This group consists of students who did not complete their studies and

[1] In the 1990s, students could graduate with a three-year degree, requiring only 15 full-course credits, as an alternative to the four-year "Honours" degree. In response to significant changes in the provincial high school curriculum, the three-year degree is now being phased out on the central city campus.

generally left the university within a couple of years of starting. The remaining students are associated with at least one program of study, and many students pursue more than one program.

In the student information system, a student may be associated with several programs of study, which are classified as either complete or active. About 78% of students in the 1993 cohort have at least one completed program on record, consistent with the University's six-year graduation rate. The programs on record are further identified as specialist, major or minor programs, depending on the credits required for the program. Specializations are the most rigorous programs, followed by major programs and then minors. To graduate, a student must complete at least one major or, in some subject areas, two minor programs. However, many students chose a specialization-major combination or a double major.

To consider every combination of programs selected by students would not be fruitful as many combinations involve only a few students. Therefore, each student is assigned to one program of study according to the following set of rules:

1. Where there is at least one completed program on record, the student is associated with the completed program(s) only and any remaining active programs are ignored;
2. The student is associated with the highest ranking program, where the highest rank goes to the Specialist program, the second-highest rank to a Major, and lowest rank to a Minor;
3. Where the student has two Majors (involving slightly more than one-fifth of the FCEs in the analysis), extra steps are taken:
    a) A few double-majors with several students are treated as distinct programs (e.g., History & English, Sociology & Psychology);
    b) For other cases of double majors, students are randomly assigned to one of their two major programs.

4. Once each student is associated with a main program, the programs are grouped by subject area (regardless of rank related to the Specialist, Major or Minor designation).

Although some cases involving double-majors result in an arbitrary assignment to one of the two programs, the great majority of students can be clearly classified in one main program of study. Other adjustments are made to further simplify the analysis and ensure meaningful numbers of students in most program groups. Specifically, several programs are grouped under one heading, usually defined by the programs' administrative organization. For example, several different programs in Mathematics are grouped together simply as Mathematics. Similarly, other small programs that represent a unique administrative organization are grouped together according to a common subject area.

These programs and program groups are further organized according to major program areas, as shown in Table 1. The program areas of Humanities, Social Sciences and Sciences are used for all three campuses. At the central campus, two additional program areas are used. First, the Medical Sciences grouping separates programs in the medical sciences, such as human biology and immunology, from other sciences such as chemistry and physics. The medical science programs rely heavily on teaching services and facilities of the Faculty of Medicine, which is located at the central campus. Second, there are a number of programs sponsored by the residential colleges that are a part of the Faculty of Arts & Science at the central campus. These college programs, such as Cinema Studies and Peace & Conflict Studies, often have a very interdisciplinary approach and rely on the teaching services of several departments as well as those provided by the sponsoring colleges.

Table 1. Programs of Study, by Program Area

Humanities	*Social Sciences*	*Sciences*	*Medical Sciences (Central Campus)*	*College Programs (Central Campus)*
Classics	Anthropology	Actuarial Science	Biochemistry	Cinema Studies
Cultural Studies	Commerce & Finance	Astronomy	Human Biology	Criminology
Drama	Economics	Biology	Immunology	Employment Relations
English	Management	Chemistry	Microbiology	International Relations
Fine Arts	Political Science	Computer Science	Molecular Genetics	Peace & Conflict Studies
History	Sociology	Environmental Studies	Nutritional Science	Womens Studies
Languages		Geography	Pharmacology	
Linguistics		Geology	Physiology	
Music		Mathematics	Toxicology	
Philosophy		Physics		
Religion		Psychology		
		Statistics		
		Zoology		

Assignment of Courses to Sponsoring Department

Course departments are identified from the course code, which is used to attribute FCEs to their sponsoring departments. For example, FCEs attributed to the French department involve courses coded as FRE (French), FCS (French Cultural Studies), FSL (French as a Second Language), FTR (French Translation) and JFI (Second Language Learning – French and Italian). The latter course is an example of a "Joint" course that is sponsored by two departments. In this analysis, however, each joint course is attributed to one of its sponsoring departments; in general,

the department that appears to be the lead department based on information in the course calendar is treated as the sponsoring department.

The course departments are then organized into divisions that parallel the main program areas: Humanities, Social Sciences, Sciences, Medicine and Colleges. For example, several departments in the Faculty of Medicine, which serves undergraduate students in life and health science programs, are grouped together as Medicine. Similarly, courses offered by the residential colleges are grouped together as Colleges. These divisions apply to courses taken by students at their home campus, where they are enrolled in their programs of study. Courses taken at another campus are distinguished as "Off-Campus." This distinction is important, as administrators are concerned that students enrolled at the suburban campuses take a large number of courses at the central campus.

Results

Originally, the results of the ICLM analysis were reported in a set of tables prepared for the cumulative course history time period (1993/94 – 1999/00) and separately for each year. However, the original ICLM tables, which include detail for all programs and departments, are unwieldy and therefore not included here. Instead, simplified versions that summarize the detailed data and convey the general patterns of the results are presented in Tables 2-5. This set of tables is based on the 1993 cohorts' cumulative FCEs over the 1993/94 – 1999/00 period and consists of four presentations that illustrate different aspects of the course-load analysis. Patterns that emerge in these tables are examined more closely in additional tables and charts to emphasize certain concerns or potential problems.

The summary tables do not list each program and department, but rather present the results for the main program areas and department divisions. The program areas include the Humanities, Social Sciences, Sciences, Medical Sciences, College Programs and No Program. The Medical Sciences and College Programs are relevant to the central campus only, and the No Program category refers to students who never formally selected a program of study. The departments are grouped into parallel divisions of Humanities (HUM), Social Sciences (SOC), Sciences (SCI), Medical Sciences (MED) and the Colleges (COL). These divisions refer to departments on students' home campuses, so an additional department grouping is included to show the number of courses taken off-campus (OFF). For the most part, it is students enrolled at the suburban campuses that come to the central campus to take some courses that are not offered at their home campus. As with the program areas, the Medical Sciences and Colleges divisions pertain only to the central campus.

Table 2 reports the total FCEs, by program area and course division, for each campus to give a basic summary of the course load data for the 1993 freshman cohort. Overall, the data show that the Social Sciences and the Sciences are the largest program areas, although programs in the Humanities are also important, especially at the central campus. Furthermore, the amount of teaching provided by the Humanities division, as measured by FCEs, is comparable that of the Social Science division. Therefore, although more students pursue programs in the Sciences and Social Sciences than in the Humanities, they still take a significant number of courses in the Humanities division. In addition, Table 2A shows that the Medical Sciences programs have a significant impact on the central campus, while the College Programs have a relatively small role but still use resources across the divisions.

Table 2. Cumulative Full Course Equivalents (FCEs), 1993/94 - 1999/00

			Department Division						
Campus	Program Area	No. of Students	HUM	SOC	SCI	MED	COL	OFF*	TOTAL
Central	Humanities	499	6,210	1,306	1,309	20	355	31	9,230
	Social Sciences	619	2,277	6,610	2,357	20	268	99	11,630
	Sciences	576	1,705	1,182	7,334	177	193	35	10,626
	Medical Sciences	526	1,354	637	4,943	2,893	79	44	9,949
	College Programs	238	1,546	1,270	714	7	868	12	4,416
	No Program	311	493	454	791	7	57	21	1,822
	TOTAL-Central	2,769	13,584	11,458	17,447	3,123	1,819	241	47,671
East	Humanities	123	1,361	414	228	n/a	n/a	143	2,146
	Social Sciences	331	870	3,768	971	n/a	n/a	541	6,150
	Sciences	339	557	753	4,202	n/a	n/a	589	6,100
	No Program	159	181	290	422	n/a	n/a	125	1,018
	TOTAL-East	952	2,969	5,224	5,822	n/a	n/a	1,398	15,412
West	Humanities	152	1,756	471	267	n/a	n/a	262	2,756
	Social Sciences	226	668	2,268	872	n/a	n/a	400	4,207
	Sciences	338	874	1,338	3,435	n/a	n/a	424	6,070
	No Program	196	348	414	623	n/a	n/a	176	1,560
	TOTAL-West	912	3,646	4,490	5,195	n/a	n/a	1,262	14,592
All Campuses	Humanities	774	9,327	2,191	1,803	n/a	n/a	436	14,131
	Social Sciences	1,176	3,815	12,645	4,199	n/a	n/a	1,040	21,986
	Sciences	1,253	3,135	3,273	14,970	n/a	n/a	1,048	22,795
	Medical Sciences	526	1,354	637	4,943	2,893	79	44	9,949
	College Programs	238	1,546	1,270	714	7	868	12	4,416
	No Program	666	1,022	1,158	1,835	n/a	n/a	322	4,399
	Grand Total	4,633	20,198	21,172	28,464	3,123	1,819	2,901	77,675

*OFF = Off Campus

Table 3 reports the FCEs per student, by program area and course division, for each campus to give another perspective on the course-load data. Specifically, this table shows where the average student in each program area has taken courses. On a cumulative basis, we expect to see between 15 and 20 FCEs per student, reflecting the number of credits required for a degree. However, the actual ratios will also reflect student choices and attrition. For example, students with no program of study are shown to accumulate less than 7 FCEs, on average. In contrast, the ratio of FCEs to students for most programs is over 18.

Table 3. Cumulative FCEs per Student, 1993/94 - 1999/00

			Department Division						
Campus	Program Area	No. of Students	HUM	SOC	SCI	MED	COL	OFF*	TOTAL
Central	Humanities	499	12.4	2.6	2.6	0.0	0.7	0.1	18.5
	Social Sciences	619	3.7	10.7	3.8	0.0	0.4	0.2	18.8
	Sciences	576	3.0	2.1	12.7	0.3	0.3	0.1	18.4
	Medical Sciences	526	2.6	1.2	9.4	5.5	0.1	0.1	18.9
	College Programs	238	6.5	5.3	3.0	0.0	3.6	0.0	18.6
	No Program	311	1.6	1.5	2.5	0.0	0.2	0.1	5.9
	TOTAL-Central	2,769	4.9	4.1	6.3	1.1	0.7	0.1	17.2
East	Humanities	123	11.1	3.4	1.9	n/a	n/a	1.2	17.4
	Social Sciences	331	2.6	11.4	2.9	n/a	n/a	1.6	18.6
	Sciences	339	1.6	2.2	12.4	n/a	n/a	1.7	18.0
	No Program	159	1.1	1.8	2.7	n/a	n/a	0.8	6.4
	TOTAL-East	952	3.1	5.5	6.1	n/a	n/a	1.5	16.2
West	Humanities	152	11.6	3.1	1.8	n/a	n/a	1.7	18.1
	Social Sciences	226	3.0	10.0	3.9	n/a	n/a	1.8	18.6
	Sciences	338	2.6	4.0	10.2	n/a	n/a	1.3	18.0
	No Program	196	1.8	2.1	3.2	n/a	n/a	0.9	8.0
	TOTAL-West	912	4.0	4.9	5.7	n/a	n/a	1.4	16.0
All Campuses	Humanities	774	12.1	2.8	2.3	n/a	n/a	0.6	18.3
	Social Sciences	1,176	3.2	10.8	3.6	n/a	n/a	0.9	18.7
	Sciences	1,253	2.5	2.6	11.9	n/a	n/a	0.8	18.2
	Medical Sciences	526	2.6	1.2	9.4	5.5	0.1	0.1	18.9
	College Programs	238	6.5	5.3	3.0	0.0	3.6	0.0	18.6
	No Program	666	1.5	1.7	2.8	n/a	n/a	0.5	6.6
	Grand Total	4,633	4.4	4.6	6.1	0.7	0.4	0.6	16.8

*OFF = Off Campus

If desired, these ratios can be applied to enrollment projections to estimate future instructional demands on departments. For example, based on the course-taking pattern of the 1993 cohort, each additional student enrolled in a Science program at the west campus can be expected to create instructional demands across divisions and on the central campus: 2.6 FCEs in the Humanities division, 4.0 FCEs in the Social Sciences, 10.2 in Sciences and 1.3 FCEs in departments outside the west campus (primarily at the central campus). Departments can use this type of information to prepare for changes related to program enrollment outside their own department or division.

Tables 4 and 5 report the percent distribution of FCEs across divisions and program areas. Table 4 shows how programs make instructional demands on a variety of academic departments, while Table 5 underscores the service teaching that departments provide for various types of programs. Of course, most programs generate instructional demands primarily in their home departments and divisions. For example, Table 4 indicates that students in the Humanities programs take 66% of their courses in the Humanities division.

Table 4. Percent Distribution of Program FCEs Across Divisions, 1993/94 - 1999/00

			Department Division						
Campus	Program Area	No. of Students	HUM	SOC	SCI	MED	COL	OFF*	TOTAL
Central	Humanities	499	67.3	14.2	14.2	0.2	3.8	0.3	100.0
	Social Sciences	619	19.6	56.8	20.3	0.2	2.3	0.9	100.0
	Sciences	576	16.0	11.1	69.0	1.7	1.8	0.3	100.0
	Medical Sciences	526	13.6	6.4	49.7	29.1	0.8	0.4	100.0
	College Programs	238	35.0	28.8	16.2	0.2	19.7	0.3	100.0
	No Program	311	27.0	24.9	43.4	0.4	3.1	1.1	100.0
	TOTAL-Central	2,769	28.5	24.0	36.6	6.6	3.8	0.5	100.0
East	Humanities	123	63.4	19.3	10.6	n/a	n/a	6.7	100.0
	Social Sciences	331	14.1	61.3	15.8	n/a	n/a	8.8	100.0
	Sciences	339	9.1	12.3	68.9	n/a	n/a	9.7	100.0
	No Program	159	17.8	28.5	41.4	n/a	n/a	12.3	100.0
	TOTAL-East	952	19.3	33.9	37.8	n/a	n/a	9.1	100.0
West	Humanities	152	63.7	17.1	9.7	n/a	n/a	9.5	100.0
	Social Sciences	226	15.9	53.9	20.7	n/a	n/a	9.5	100.0
	Sciences	338	14.4	22.0	56.6	n/a	n/a	7.0	100.0
	No Program	196	22.3	26.5	39.9	n/a	n/a	11.3	100.0
	TOTAL-West	912	25.0	30.8	35.6	n/a	n/a	8.6	100.0
All Campuses	Humanities	774	66.0	15.5	12.8	n/a	n/a	3.1	100.0
	Social Sciences	1,176	17.4	57.5	19.1	n/a	n/a	4.7	100.0
	Sciences	1,253	13.8	14.4	65.7	n/a	n/a	4.6	100.0
	Medical Sciences	526	13.6	6.4	49.7	29.1	0.8	0.4	100.0
	College Programs	238	35.0	28.8	16.2	0.2	19.7	0.3	100.0
	No Program	666	23.2	26.3	41.7	n/a	n/a	7.3	100.0
	Grand Total	4,633	26.0	27.3	36.6	4.0	2.3	3.7	100.0

*OFF = Off Campus

However, Table 4 also shows that the Colleges directly support less than 20% of the courses taken by students in College Programs. At the same time, students in the Medical Sciences rely on the departments in the Faculty of Medicine for 29% of their courses, which represents a considerable commitment from the Faculty of Medicine to the undergraduate students enrolled in the Faculty of Arts & Science. Table 4 also shows that students enrolled at the two suburban campuses take approximately 9% of their courses off-campus, reflecting the suburban students' practice of taking one or two courses at the central campus.

Table 5. Percent Distribution of Division FCEs Across Programs, 1993/94 - 1999/00

			Department Division						
Campus	Program Area	No. of Students	HUM	SOC	SCI	MED	COL	OFF*	TOTAL
Central	Humanities	499	45.7	11.4	7.5	0.6	19.5	12.9	19.4
	Social Sciences	619	16.8	57.7	13.5	0.6	14.7	41.1	24.4
	Sciences	576	12.6	10.3	42.0	5.7	10.6	14.5	22.3
	Medical Sciences	526	10.0	5.6	28.3	92.6	4.3	18.3	20.9
	College Programs	238	11.4	11.1	4.1	0.2	47.7	4.8	9.3
	No Program	311	3.6	4.0	4.5	0.2	3.1	8.5	3.8
	TOTAL-Central	2,769	100.0	100.0	100.0	100.0	100.0	100.0	100.0
East	Humanities	123	45.8	7.9	3.9	n/a	n/a	10.2	13.9
	Social Sciences	331	29.3	72.1	16.7	n/a	n/a	38.7	39.9
	Sciences	339	18.7	14.4	72.2	n/a	n/a	42.1	39.6
	No Program	159	6.1	5.6	7.2	n/a	n/a	8.9	6.6
	TOTAL-East	952	100.0	100.0	100.0	n/a	n/a	100.0	100.0
West	Humanities	152	48.2	10.5	5.1	n/a	n/a	20.8	18.9
	Social Sciences	226	18.3	50.5	16.8	n/a	n/a	31.7	28.8
	Sciences	338	24.0	29.8	66.1	n/a	n/a	33.6	41.6
	No Program	196	9.5	9.2	12.0	n/a	n/a	14.0	10.7
	TOTAL-West	912	100.0	100.0	100.0	n/a	n/a	100.0	100.0
All Campuses	Humanities	774	46.2	10.3	6.3	n/a	n/a	15.0	18.2
	Social Sciences	1,176	18.9	59.7	14.8	n/a	n/a	35.8	28.3
	Sciences	1,253	15.5	15.5	52.6	n/a	n/a	36.1	29.3
	Medical Sciences	526	6.7	3.0	17.4	92.6	4.3	1.5	12.8
	College Programs	238	7.7	6.0	2.5	0.2	47.7	0.4	5.7
	No Program	666	5.1	5.5	6.4	n/a	n/a	11.1	5.7
	Grand Total	4,633	100.0	100.0	100.0	100.0	100.0	100.0	100.0

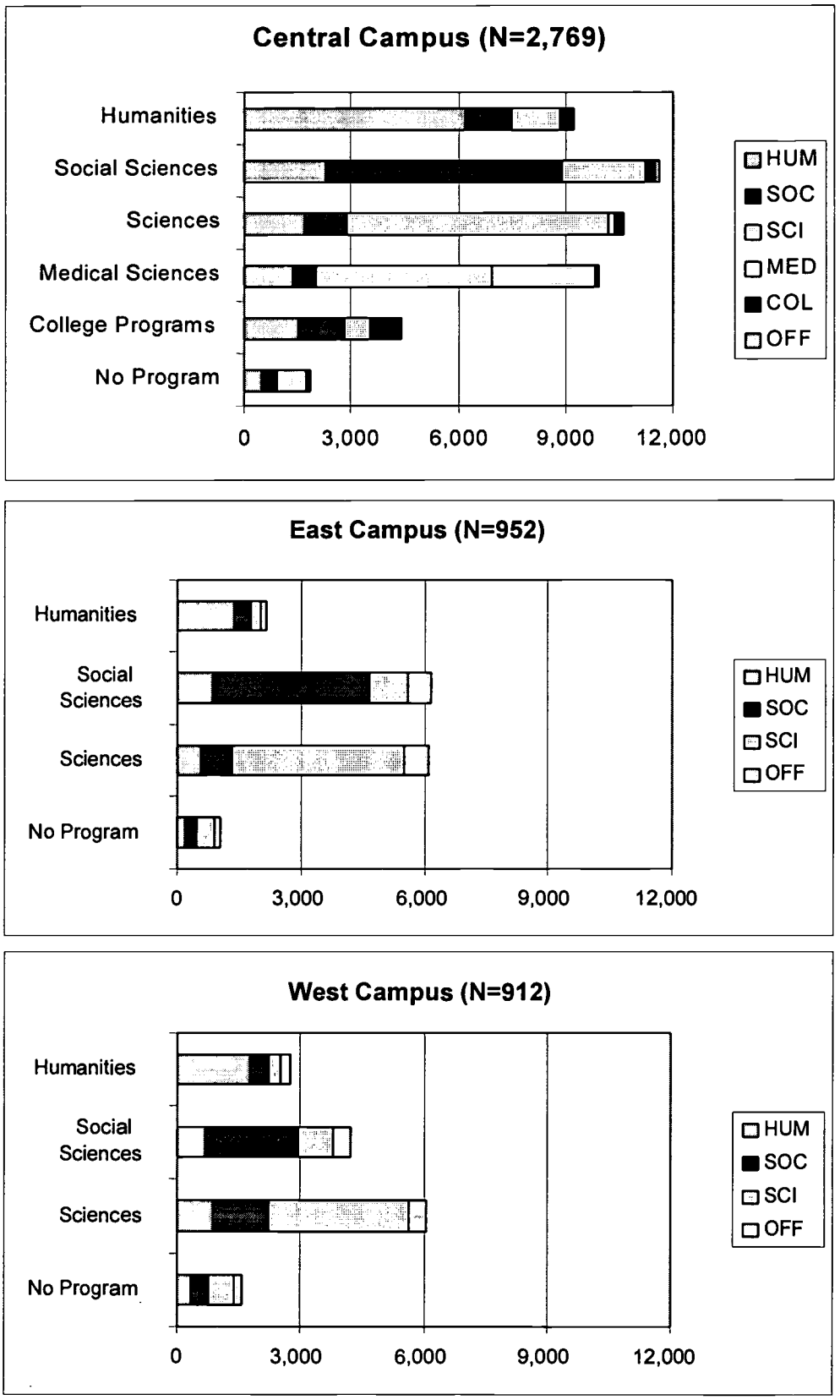
*OFF = Off Campus

On the other hand, Table 5 shows that within the Humanities division, less than half of the courses are taken by students majoring in a Humanities program. In contrast, within the Social Science division, almost 60% of courses are taken by Social Science majors.

To illustrate the patterns that emerge in the course load data, Figure 2 shows the cumulative FCEs for the 1993 cohorts at each campus. The charts reflect the relative size of each campus and their program areas and show how the courses related to each program area are distributed among the divisions. For instance, the charts show that the Humanities programs are significant at the Central campus, although the Science and Social Science programs dominate the suburban campuses. In addition, Figure 2 emphasizes the impact of the Medical Science programs on the Central campus and their dependency on service teaching from the Faculty of Medicine. The charts also show that students in all program areas at the suburban campuses rely to some extent on courses provided off-campus, specifically at the Central campus.

In addition to the four perspectives on the course load data presented in Tables 2 – 5, the results are examined further to explore particular areas of concern. Specifically, Table 6 addresses administrators' concern about the impact of programs across divisions. For each campus and program area, the table shows the percentage of courses taken in the program area's home division, in another division on-campus, or off-campus. While most students take approximately 60% of their courses in their home division, students in any given program area also take several courses in other divisions to satisfy distribution requirements and to take advantage of the wide course offerings that are available.

Figure 2. Total FCEs by Program Area and Division, by Campus



The Medical Sciences program area is an exception to this pattern. As noted in Table 6, the home division of the Medical Sciences program area is the Sciences division, since the programs are sponsored by the Faculty of Arts & Science. However, students in the Medical Sciences programs take less than half of their courses in the Sciences division and instead rely heavily on courses offered in other divisions, primarily the Faculty of Medicine. Similarly, programs sponsored by the Colleges within the Faculty of Arts & Science rely primarily on courses offered by other divisions as opposed to courses offered directly by the Colleges.

Table 6.

Percentage of Courses in Home Division, Other On-Campus Division or Off-Campus

Campus	Program Area	No. of Students	FCEs	Pct. in Home Div.	Pct. in Other Div.	Pct. Off Campus
Central	Humanities	499	9,230	67.3	32.4	0.3
	Social Sciences	619	11,630	56.8	42.3	0.9
	Sciences	576	10,626	69.0	30.7	0.3
	Medical Sciences*	526	9,949	49.7	49.9	0.4
	College Programs	238	4,416	19.7	80.1	0.3
	TOTAL-Central	2,458	45,849	56.6	42.9	0.5
East	Humanities	123	2,146	63.4	29.9	6.7
	Social Sciences	331	6,150	61.3	29.9	8.8
	Sciences	339	6,100	68.9	21.5	9.7
	TOTAL-East	793	14,395	64.8	26.3	8.8
West	Humanities	152	2,756	63.7	26.8	9.5
	Social Sciences	226	4,207	53.9	36.6	9.5
	Sciences	338	6,070	56.6	36.4	7.0
	TOTAL-West	716	13,032	57.2	34.4	8.3
All Campuses	Humanities	774	14,131	66.0	30.9	3.1
	Social Sciences	1,176	21,986	57.5	37.8	4.7
	Sciences	1,253	22,795	65.7	29.7	4.6
	Medical Sciences*	526	9,949	49.7	49.9	0.4
	College Programs	238	4,416	19.7	80.1	0.3
	Grand Total	3,967	73,276	58.3	38.1	3.5

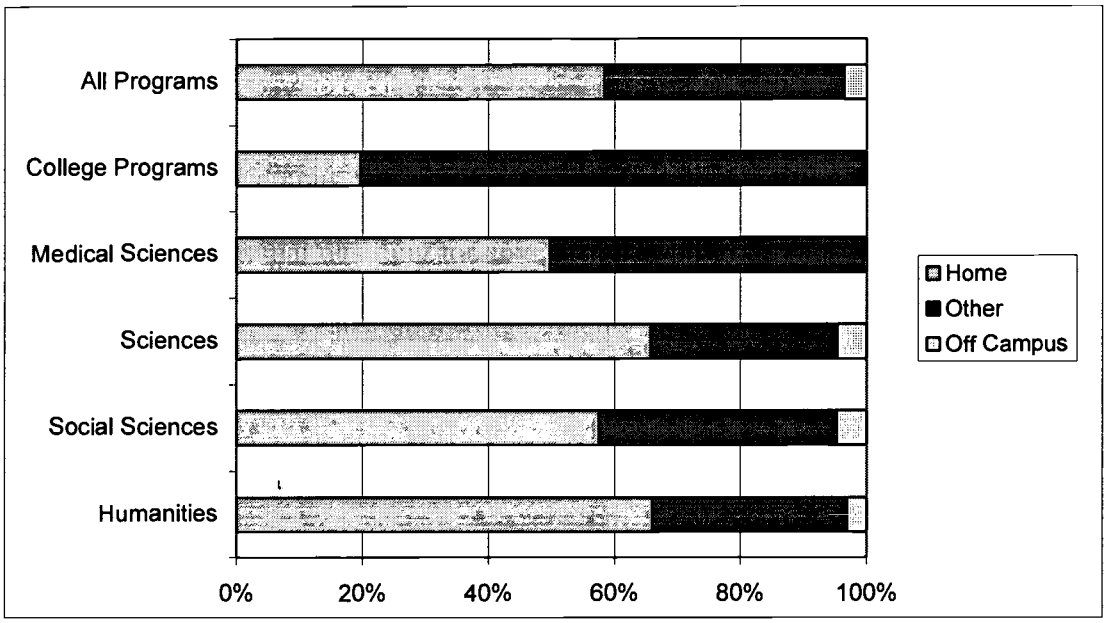
Note: Excludes students with no program on record.

*Since all of the program areas are in the Faculty of Arts & Science, the Medical Sciences' home division is the Sciences Division.

Figure 3 further illustrates the distribution of courses in program areas' home divisions, in other divisions on-campus and in off-campus departments for the three campuses combined. This chart emphasizes that planning for any particular program must consider the potential impact across divisions, not just on the departments most directly related to the subject area. It is important that planners examine this pattern to anticipate the demand for a wide range of courses in response to changes in enrolment, even in a narrow range of programs.

Figure 3.

Distribution of Courses by Program Area: Home Division, Other Division or Off-Campus

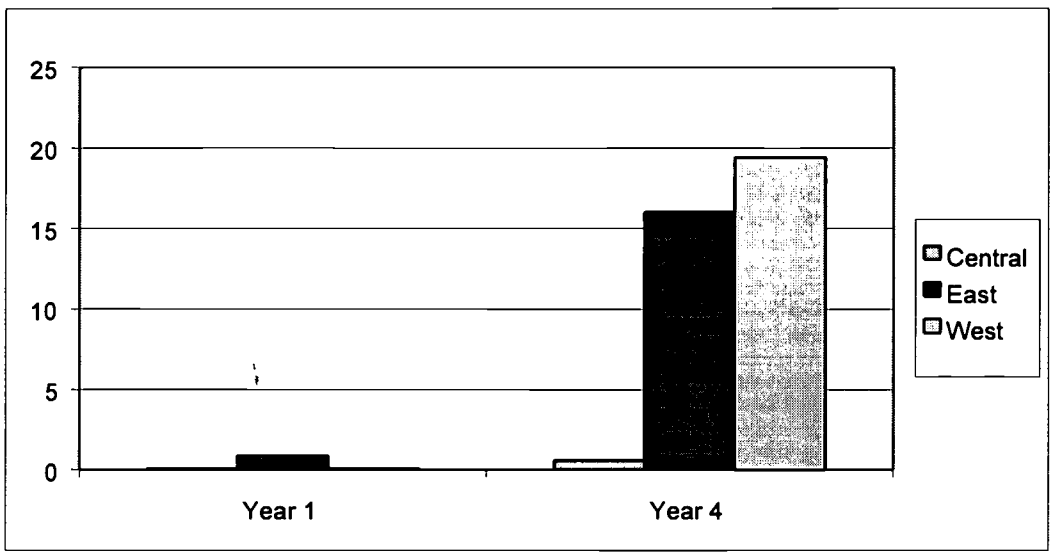


Finally, Figure 4 focuses in on the problem of suburban students taking a significant number of courses at the central campus. We know from our detailed, year-by-year analysis that students in programs at the suburban campuses come to the central campus primarily towards the end of their studies to take upper-level undergraduate courses. This result is illustrated in Figure 3, which shows that in the fourth year of study (1996/97), students enrolled at the suburban campuses take 16-19% of their courses at the central campus. These courses taken by suburban

students represent more than 5% of all courses taken at the central campus in that year. Moreover, the additional courses tend to be concentrated in the certain departments, such as Economics and Computer Science, creating a significant extra burden for these departments.

Figure 4.

Percentage of Courses Taken Off-Campus, Year 1 vs. Year 4



Overall, the results of the ICLM analysis reveal important patterns in the program and course load data for the 1993 freshman cohort. In particular, administrators benefit from seeing how programs in different areas create demands for courses in all of the divisions. In this case, university planners also want to gauge the extent to which students enrolled at the suburban campuses take courses at the central campus. This information on the roles of different programs and departments and on the relationship between the three campuses is a useful tool for departmental planning as well as for other university initiatives and policies.

Discussion

There is always the possibility that resources will be devoted to produce a study that is never used to inform practice. Ultimately, university leaders and administrators will not be willing or able to incorporate any analysis in the actual planning process unless they understand and accept the material. Therefore, although the course load analysis has many potential uses, it is especially important that the planning office deliver the results to senior administrators in a way that is accessible and meaningful (Clagett, 1990). In this way, the presentation of the analysis is closely linked to the successful application of the results to the planning process and further research.

Presentation of the analysis

The presentation of the course load analysis to university administrators began, in effect, before the study itself was undertaken. The planning office initiated the work in response to the university's increasing concern about its strategy to handle undergraduate enrolment expansion. After senior administrators approved the project, the planning office consulted with a number of administrators and data experts in the initial planning of the course load analysis. This approach helped to ensure that the recipients of the completed analysis would understand the results and be able to apply them in their planning exercises. The early consultations and additional discussions with administrators also helped to resolve questions about the student records and to decide how best to manipulate and summarize the extensive data.

As mentioned earlier, the planning office originally produced a large set of detailed ICLM tables for each campus. Like the summary tables presented here, the original tables gave four perspectives on the course load data: 1) total FCEs; 2) per student FCEs; 3) percent

distribution of FCEs across departments, by program; and 4) percent distribution of FCEs across programs, by department. However, the original tables showed not only the 1993 cohorts' cumulative courses over the 1993 to 1999 period, but also the course load pattern for each year. Moreover, the original set of tables included detail on over 55 programs of study and 35 departments, including some detail on central campus departments that showed high levels of course enrolments from students based at the suburban campuses.

Because deans and department chairs often lack the ability or time to deal with complex quantitative analyses, an important part of this project is to help administrators incorporate the results into their planning processes. Research on the responsibilities and needs of deans and chairs indicates that support is needed in the form of ongoing interaction and communication, with particular attention to simplifying and summarizing quantitative studies (Creswell & England, 1994; Kinnick, 1994). When the full analysis for each campus was provided to the Principals, Deans and other senior administrators, the planning office also provided a brief report to explain the analysis and highlight key results. In addition, shortly after the results were distributed, meetings were arranged to present the results to small groups of senior administrators responsible for the university's major planning exercises. During these sessions, administrators were able to ask questions about the analysis as well as comment on the results of particular interest to them.

The senior administrators generally responded positively to the analysis. Not only did they indicate that the results made sense to them, based on their experience, but they also expressed satisfaction with seeing a concrete and concise summary of familiar patterns. In other words, while the administrators had a strong sense of how students were selecting programs and courses, they were pleased to have concrete measures of those patterns. Although the course

load analysis cannot fully explain the relationships among programs of study and different departments at the university, it does provide a way of actually measuring the impact of programs, differences in course demands, and trends or changes over time.

Administrators also found that the analysis revealed some surprises. For example, the analysis suggested that some departments played essentially a service role: they provided courses to students in a variety of programs but had few graduates in their own program area. On the other hand, the analysis also showed how some large programs had a significant impact on several departments and across divisions. Of course, administrators were aware that large programs in the Sciences and Social Sciences would create course demands in the Humanities. However, they were surprised at the magnitude of the impact that was revealed by the course load analysis.

Although the summary tables presented here are based on the cumulative course load for the 1993 cohort, the detailed tables given to senior administrators included a year-by-year analysis of student course load. These tables showed that as the students progressed through their studies, course demands shifted from a relatively broad distribution in the first two years toward a selection more closely related to students' programs of study. This pattern is important to keep in mind when anticipating the impact programs may have on seemingly unrelated departments. For instance, not only will increased enrolments in computer science programs impact on departments in the humanities division, they will do so primarily in the first two years of the students' studies and then drop off significantly. The year-by-year analysis also brought attention to the problem of students from the suburban campuses coming to the central campus to take courses, especially for advanced-level courses.

Not surprisingly, there were some negative reactions to the results of the ICLM analysis. For instance, the chairperson of one planning committee reported: "...departments were a little suspicious of the implications of what the data seemed to show, even though (and perhaps because) it really only confirmed what we all know. But politically, few want hard data to be bandied about unless [the data] are at the appropriate end of the spectrum..."

For the most part, however, the analysis was well received because the interested parties supported the effort and understood the material. The clear presentation of the results and follow-up communications with the recipients of the analysis also helped to ensure that the results were fully understood and accessible for further planning exercises.

Applications and further analyses

While planning for enrolment expansion is an on-going process, the results of the course load analyses have been a source of information and data for further study. Specifically, since the original ICLM tables were distributed, the results have been applied to specific planning exercises in a variety of ways. In some cases, the results have indicated the need for further investigation into particular problems using additional data and approaches; in other instances, the results of the ICLM analysis fed directly into subsequent studies.

Central campus administrators were particularly interested in the results that showed how students from the suburban campuses were taking a significant number of courses at the central campus. This finding is an issue not only for enrolment expansion plans, but also for current resource allocation decisions. Consequently, senior administrators requested an additional study of the impact of projected enrolment increases at the suburban campuses on the central campus, based on more current but less detailed course data. This study found that anticipated enrolment

growth at the suburban campuses would make increasing demands on the central campus, especially in the summer session.

Another group used the ICLM table results to examine the relationship between the Faculty of Arts & Science and the Faculty of Medicine. Because departments in the Faculty of Medicine provide a considerable amount of teaching to the undergraduate medical science programs, a committee was formed to formalize the shared responsibilities and costs of this arrangement. This committee used the results of the course load analysis to produce several charts illustrating the roles of different departments in serving students in the medical science programs.

Of particular interest was an analysis of departments' service teaching, in which courses taught by a given department were compared to the courses taken by students in the department's own programs. This comparison was expressed in a service-teaching ratio, which was compared across departments from the Faculty of Arts & Science and those from the Faculty of Medicine. For example, the biochemistry program generated only 196 full-course equivalents, but the biochemistry department taught 673 full-course equivalents to students in a number of programs. Therefore, the service-teaching ratio for the biochemistry department is 673/196, or 3.4. The committee looked at these figures for several science and medical departments, whose service teaching ratios ranged from 0.4 to 6.2. Thus, based on the ICLM analysis, the group was able to use consistent and concrete measures to address questions about the amount of teaching required and provided by different departments.

Administrators also used the course load analysis to examine the distribution of programs and courses selected by students. There is some concern that students may focus narrowly in one subject area, particularly in the sciences. However, the course load analysis shows that the

humanities programs remain strong and students are selecting a wide range of courses across the divisions, regardless of their program area. Therefore, the Arts & Science Faculty Registrar reports that "the ICLM data reveal a spread of course selection across disciplines that is impressive by any standard...It seems that with over 2,000 different courses and a flexible curriculum, our students voluntary choose a broad education spanning discipline areas" (Office of the Arts & Science Faculty Registrar, Internal memorandum, January 25, 2002).

Other efforts to bring the course load analysis to bear on planning for enrolment expansion continue, but not without some difficulties. One reason that the analysis has not been used more is a lack of analytical resources. The suburban campuses in particular have shown weak analytical capabilities, due to a combination of limited resources and lack of organization. In addition, there is considerable uncertainty at this point about the university's expectations for enrolment expansion. As a public university, significant changes in enrolment depend largely on government policy and funding. However, while it is clear that there is increased demand for spaces at the university, the government's commitment has not been forthcoming. Consequently, administrators have been preoccupied with the more urgent question of how many new students can be accommodated and how the necessary capital and operating costs will be funded. In this environment, it is difficult to set enrolment targets by program area and plan for changes at the department level.

Conclusion

While senior administrators often have a good sense of how programs and departments work at their institutions, the real benefit of the ICLM analysis is that it provides concrete measures of these relationships. These measures can be used for making comparisons among

different programs and departments and for estimating the impact of enrolment changes in particular program areas.

However, although the course load analysis can be a very useful tool for university planners, it is a rather involved quantitative analysis. Therefore, it is helpful to secure the support of senior administrators for the analysis and address their questions from the start. Moreover, a clear presentation of the results and follow-up support will help to ensure that the analysis is actually used to inform university planning.

Finally, a limitation of ICLM analysis is its reliance on historical data and the assumption that student course selections are fairly stable over time. While this assumption is reasonable for most established programs, it is important that the results of the ICLM analysis are interpreted within the institution's overall policy and planning context. This is particularly true when analyzing new or small programs, or when dealing with dramatic shifts in enrolment levels or program requirements.

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