

Case Study #4: George Mason University
Comparing Costs of Distance and Campus-Based Courses: Applying NCHEMS and
NACUBO Techniques

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Abstract: *This study compares the net costs of online versus traditional delivery of pairs of courses in four disciplines at George Mason University in 1998-2000. The study diverges from the basic activity-based costing approach described in this Handbook in several respects. There is less interest in documenting the cost of specific tasks or activities, because data on faculty workload were not gathered at this level of specificity. Rather, there is a more direct application of the basic micro-costing techniques used in indirect cost recovery and supported in the literature of the National Center for Higher Education Management Systems (NCHEMS) and the National Association of College and University Business Officers (NACUBO).*

Relevant Literature

Modeling the costs of educational uses of technology is well served by understanding the general costing literature in higher education. The NCHEMS approach to cost of instruction models has been in place for almost thirty years. It is perhaps most useful today, when institutions have the tools to build online data marts and data warehouses which merge financial, student, facilities, and course datasets. Similarly, the literature of NACUBO for indirect cost recovery and micro- and macro-costing is invaluable. NACUBO literature includes Cost Accounting in Higher Education: Simplified Macro- and Micro-Costing Techniques (Jenny, 1996); A Cost Accounting Handbook for Colleges and Universities (Hyatt, 1983); and Meisinger's (1994) College and University Budgeting: An Introduction for Faculty and Academic Administrators.

Among the most important contributions of the cost literature are the concepts of: (1) enrollment data and departmental consumption/contribution; (2) space utilization and allocation costs; (3) revenue stream based on tuition and fees minus waivers and tuition discounting; (4) faculty workload; and (5) administrative overhead at the department, college/school, and institution-wide levels. This does not mean that only complex models should be built. But any model development ought to be done with a clear set of assumptions. If assumptions about revenue, for example, are to be ignored (perhaps because student tuition estimates and financial aid data are not available or are too complex to be analyzed within the timeframe and staffing level), this should be stated as a limitation of the model.

Methodology

A modified version of the Flashlight cost analysis methodology serves as the basis for this study. For the purposes of the GMU Model, three new steps are inserted and one is modified. The step "identify the resources" is broken into two – for direct and indirect costs. The step for "calculate costs for these activities" is also broken into two, with additional data about enrollment via the induced course load matrix. A new step is added to calculate revenue stream based on enrollment, tuition and fees, and financial aid data. "Document activities and tasks" is modified by not asking faculty to estimate how much time is spent on specific activities.

The revised steps of a cost model for analyzing online courses now include the following:

1. Define the resource issues
2. Choose outputs and performance measures
3. Document activities and tasks
4. Gather faculty and staff workload data
5. Collect data on direct costs
6. Calculate data on hidden, indirect, or shared administrative costs
7. Gather data on enrollment
8. Calculate results for each activity
9. Calculate revenue stream
10. Summarize the results

Steps for a Cost Analysis of Online Courses

1. Define the resource issues

This study compared the net costs of online versus traditional delivery of the same course and subject matter of four courses, one in each of four different disciplines, in 1998-2000. The following table documents the framework for comparison of online and traditional classes

Table 1: Comparison of Online vs. Traditional Course Sections

Semester	Instructor	Type	Section
Fall 99	John	Online	ENGL300A
Fall 99	Jane	Classroom	ENGL300B
Fall 99	David	Online	MIS 200A
Fall 99	Sam	Classroom	MIS 200B
Spring 99	Mary	Online	DESC 200A
Spring 99	Louise	Classroom	DESC 200B
Spring 99	Iris	Online	ASTR100A
Spring 99	Peter	Classroom	ASTR100B

2. Choose outputs and performance measures

Two performance indicators were chosen to compare an online and traditional version of the same course: total net cost per course section and total net cost per course credit hour.

The number of course credit hours was determined by multiplying the number of students enrolled at the semester census date by the number of credits awarded for completion of the course. In order to estimate net costs, data had to be collected about student course-taking patterns, residency status, and tuition and fees charges in order to calculate revenue stream.

Table 2: Format for Analysis of Performance Measures

Semester	Type	Section	Net Cost per Section	Net Cost per Course Credit Hour
Fall 99	Online	ENGL300A	\$	\$
Fall 99	Classroom	ENGL300B	\$	\$
Fall 99	Online	MIS 200A	\$	\$
Fall 99	Classroom	MIS 200B	\$	\$
Spring 99	Online	DESC 200A	\$	\$
Spring 99	Classroom	DESC 200B	\$	\$
Spring 99	Online	ASTR100A	\$	\$
Spring 99	Classroom	ASTR100B	\$	\$

3. Document activities and tasks

The model developed in this paper did not involve gathering faculty estimates of the amount of time spent on different activities involved in teaching the various formats and subject matters. This feature was simply not practical without extensive faculty effort and record keeping.

Because online courses are developed over time, an amortization schedule was used to divide development costs across multiple offerings of the course. Each course amortization schedule is unique, based on the number of times the particular class would be offered and the degree to which the developed technology was likely to continue to change and require additional input/costs.

4. Gather faculty and staff workload data

The following table documents estimates by each faculty member about the percent of their time which goes for instruction-related activities and the percent of this instructional time which is devoted to the specific course. For several of the faculty who are part-time, this will be 100% in each column as they have no other assigned duties under the teaching contract. They may teach other classes, but these are usually covered under separate contracts.

Table 3: Faculty Workload for Instruction and Section

Semester	Instructor	Type	Section	Percent for Instruction	% of Instruction for Section
Fall 99	John	Online	ENGL300A	50%	30%
Fall 99	Jane	Classroom	ENGL300B	100%	100%
Fall 99	David	Online	MIS 200A	50%	50%
Fall 99	Same	Classroom	MIS 200B	100%	100%
Spring 99	Mary	Online	DESC 200A	50%	25%
Spring 99	Louise	Classroom	DESC 200B	40%	50%
Spring 99	Iris	Online	ASTR100A	65%	30%

Spring 99	Peter	Classroom	ASTR100B	50%	50%
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5. Collect data on direct costs

Personnel Expenditures

Direct costs such as faculty compensation, including salary and benefits, are relatively easy to obtain from the institutional research, budget, and human resource office. However, it is important to verify these data with the faculty involved. This is especially true for part-time faculty who may teach several classes, each paid with a different funding record on different dates. Human resource data for these faculty will vary by date and funding record, depending on the extract date of the census file used for analysis.

Note: the term “extract file” or “census file” refers to a specific dataset that is “cut,” “extracted,” or created from the institution’s administrative information systems. Human resource data would come from the human resources information system, student and course data from the student information system, and finance data from the financial information system. While there are many vendors for these systems, such as SCT Banner, PeopleSoft, Datatel, and Oracle, the fundamental nature of the systems are the same. When gathering data about people, students, courses, and money, institutional researches must first obtain an extract of these data, usually by requesting a special program be run by the computing staff to “cut” data on a certain date and put them in a certain format. These extract files are then used by institutional research, planning, budget, and assessment offices for many different kinds of studies.

The following table lists faculty compensation and benefits data for each of the comparison classes or sections.

Table 4: Direct Faculty Compensation & Benefits per Section

Section	Salary	Benefits Rate	Total Compensation	Comp. Per Semester	% for Instr.	Comp. for Instruction	% for Section	Comp. Per Section
ENGL300A	\$61,435.00	23.50%	\$75,872.23	\$37,936.11	50.0%	\$18,968.06	30.0%	\$5,690.42
ENGL300B	\$2,400.00	0.00%	\$2,400.00	\$2,400.00	100.0%	\$2,400.00	100.0%	\$2,400.00
MIS 200A	\$102,962.00	23.5%	\$127,158.07	\$63,579.04	50.0%	\$31,789.52	50.0%	\$15,894.76
MIS 200B	\$5,310.00	7.65%	\$5,716.22	\$5,716.22	100.0%	\$5,716.22	100.0%	\$5,716.22
DESC 200A	\$84,084.00	23.50%	\$103,843.74	\$51,921.87	50.0%	\$25,960.94	25.0%	\$6,490.23
DESC 200B	\$72,300.00	23.50%	\$89,290.50	\$44,645.25	40.0%	\$17,858.10	50.0%	\$8,929.05
ASTR 100A	\$60,400.00	23.50%	\$74,594.00	\$37,297.00	65.0%	\$24,243.05	30.0%	\$7,272.92
ASTR 100B	\$73,200.00	23.50%	\$90,402.00	\$45,201.00	50.0%	\$22,600.50	50.0%	\$11,300.25

It is important to include other, non-faculty personnel who may be peripherally involved in offering the course. Examples include computing support staff who set up a special web server for the course or student wage employees who develop applications such as Java simulation exercises or ColdFusion templates administering online quizzes. Data on these costs were gathered with estimates from the faculty interviews conducted at the university being studied.

Table 5: Other Direct Personnel Costs for Online Sections

Section	Personnel	Time	Rate of Pay	Cost
ENGL300A	Course Instructor	Additional funding for course development	7K Amortized over 12 semester sections	\$583.34
ENGL300A	MIS faculty	10 hours	60K + Benefits = \$74,100 /2080 hours - \$35.62 per hour/ Amortized as above	\$29.69
ENGL300A	Research assistant	Spring 1999	\$2,000 Amortized as above	\$166.67
ENGL300A	Course consultant	Spring 1999	\$3,000 Amortized as above	\$250.00
ENGL300A	Course consultant	Spring 1999	\$2,000 Amortized as above	\$166.67
ENGL300A	Assessment developer	Spring 1999	\$2,000 Amortized as above	\$166.67
ENGL300A	Total		Total	\$1,976.05
MIS 200A	Course Instructor	Additional funding for course development	\$23,000 Amortized over 6 semesters	\$3,833.33
MIS 200A	Eric	50 hours in semester	\$13 per hour	\$650.00
MIS 200A	Eric	20 hours per week in summer/10 weeks=200	\$13 per hour. Amortized over 6 semesters	\$433.00
MIS 200A	Jeff	10 hours	\$13 per hour. Amortized	\$22.00
MIS 200A	Jenny	10 hours	\$13 per hour. Amortized	\$22.00
MIS 200A	Eric's brother	One-time	\$50 one-time	\$50.00
MIS 200A	Total		Total	\$5,010.33
DESC 200A	Course Instructor	Additional funding for course development	\$8,000 Amortized over 6 semesters	\$1,333.33
DESC 200A	TA for Spring 97	20 hours per week * 15 weeks = 300 hours	\$10 per hour. Amortized	\$500.00
DESC 200A	TA in Summer for Java	N/A	\$3,000. Amortized	\$500.00
DESC 200A	Total		Total	\$2,333.33
ASTR 100A	Course Instructor	Additional funding for course development	\$15,000 Amortized over 6 semesters	\$2,500.00
ASTR 100A	Total		Total	\$2,500.00

Non-Personnel, Direct Expenditures

A breakout of non-personnel expenditures is documented in the following table. These are amortized over time where appropriate. For two of the online courses, there are no expenditures of this type. The traditional course counterparts also have no such expenditures.

Table 6: Direct Non-Personnel, Non-Computing Costs for Online Sections

Section	Expenditure Type	Total Cost	Amortization	Section Cost
ENGL300A	Books	\$200	Over 6 semesters	\$33.33
ENGL300A	Conference Travel	\$3,000	Over 6 semesters	\$500.00
ENGL300A	Total		Total	\$550.00
MIS 200A	Overheads	\$10	N/A	\$10.00
MIS 200A	Cassette Tapes	\$1 per tape X 80; 20% lost per semester	\$80 over 6 semesters; \$20 extra per semester	\$33.33
MIS 200A	Audio Duplication	\$1 per tape X 80; 20% lost per semester	\$80 over 6 semesters; \$20 extra per semester	\$33.33
MIS 200A	Total		Total	\$76.66
DESC 200A	N/A	N/A	Total	\$0.00
ASTR 100A	N/A	N/A	Total	\$0.00

6. Calculate data on hidden, indirect, or shared administrative costs

Departmental Overhead

Data were obtained for each department and division in which course sections were offered: English (ENGL), Management Information Systems (MIS), Decision Sciences (DESC), and Astronomy (ASTR). For ENGL, there is a clear cost center in the department of English. Examining the account structure for MIS and DESC, the data show that only faculty salary and fringe benefits are pooled at the department level. It is therefore necessary to make calculations about these courses based on expenses and activity at the deans'/division level. ASTR is an interesting case, because the faculty member teaching the online course is in another smaller division which does not have separate department account structures. Cost analysis of the ASTR course must include a traditional version of the course, which in this case is offered in the department of Physics/Astronomy. This requires that departmental and division overhead charges be calculated for this comparison section.

Administrative overhead costs at the department level need to be calculated only for English and Physics/Astronomy. Division level overhead costs need to be calculated for the School of Management (SOM) where MIS and DESC are housed, the Institute for Computational Science and Informatics (ICSI) where the online astronomy faculty is located, and the College of Arts and Sciences (CAS) where the ENGL and Physics and Astronomy departments are housed. In each case, it is necessary to obtain financial

expenditure data at the object code level within any and all instructional accounts related to each cost center. Also, since the ASTR and DESC sections were offered in Spring, 1999, overhead must be calculated for the 1998-99 academic year. The MIS and ENGL sections require overhead data for 1999-00.

In examining departmental overhead, it is necessary to delete expenses related to the other full-time and part-time faculty and graduate assistants who have no responsibilities for the courses in this model. The model should only prorate costs that may reasonably be associated with overhead for a course section. Only the overhead functions of administrators and classified/non-faculty staff should be included. Because fringe benefits costs are lumped together in one series of object codes at this university, it is necessary to calculate fringe costs separately. Per the Budget Director, these are estimated as 23.5% fringe for administrators and non-faculty staff and 7.65% for wage employees. There is no fringe benefit calculation for part-time, temporary, college work study, and student wage employees.

“Other than personnel” services (OTPS) expenditures are subtotaled separately. All types of instruction-related, non-personnel expenses such as copying and telephones which may not be directly tied to a specific course should be including in this estimate. If direct expenditures are included for the course and these were paid from the same account as the department or division account, then these should be subtracted from the total so as not to be counted twice.

After deleting faculty data and estimating fringe costs, the data on expenditures by object code appear as follows for the English Department.

Table 7: Partial Expenditures by Object Code for English Department

Object Code	Description	Budget
1310	CLASSIFIED SALARY	109,838
	Fringe for classified	25,812
1400	BUDGET POOL-WAGES&OT	68,989
1420	WAGES-STUDENTS	6,111
1610	STUDENT WAGES CWS	5,000
2000	BUDGET POOL-OTPS	24,004
3110	EXPRESS SERVICES	186
3140	METERED MAIL	3,241
3144	BULK MAIL	20
3148	OTHER MAIL	271
3150	PRINTING SERVICES	14
3160	TELECOMM SVS DIT	29,100
3170	TELECOM SVS NONSTATE	7,245
3177	LONG DISTANCE TELE	2,063

These expenditures by object code are then aggregated in sub-groups and then totaled for each department. For the Physics/Astronomy and English departments, the data appear as follows:

Table 8: Expenditures by Sub-Group by Department

Departmental Budget	1998-99	1999-00
	PHYS/ASTR	ENGL
Classified Staff	54,418	105,200
Wages	8,296	0
Student Wages	7,446	6,111
College Work Study	7,500	5,000
Fringe - Classified/Admin Fac	12,788	24,722
Fringe - Wages	635	0
OTPS	55,983	121,136
Total Expenditures	147,066	262,169

As stated earlier, there are many ways to allocate overhead costs. A unique allocation scheme is necessary for the purposes of the online versus traditional course comparison. Usually, this calculation is done using student or course credit hours or major headcount. Credit hours are chosen for some models of departmental activity because headcount implies costs related to advising majors. Since decision-making, enrollment planning, content management, and staffing all take place at the level of the individual course section, this is the methodology chosen for this particular example.

To allocate or prorate departmental expenditures per course section, it is necessary to know how many sections were offered during the academic year. This must include both Fall and Spring semesters. Summer enrollment, faculty contracts, and twelve-month administrative staffing in departments and deans' offices are unique issues not dealt with here, though they are important for analysis of online courses offered or developed during the summer months. Since all of the courses being studied were offered in either Spring 1999 or Fall 1999, the number of course sections is calculated accordingly.

Data on course section offerings are collected by the institutional research office of the university for mandated state reporting and internal analyses. An existing series of enrollment reports capture these data at the division level, listing the number of sections by type offered by each division. Using the GMU Data Warehouse, these data were obtained for the four semesters of Fall 1999, Spring 1999, Fall 1999, and Spring 2000 in order to estimate costs per section for the 1998-99 and 1999-2000 academic years. Special runs of the same report were required for the data at the department level.

The data on departmental sections for English appear in the following table.

Table 9: Total 1999-2000 Section Data for the English Department

English	Fall 1999	Spring 2000	Total
Lecture/Seminar Sections	265	270	535
Lab/Rct Sections	1	1	2
Total	266	271	537

These data were then be used in conjunction with the expenditure data to calculate estimated departmental overhead costs per course section.

Table 10: Expenditures per Course Section for the English Department

Department Budget	ENGL 1999-00
Total Expenditures	\$262,169
Total number of sections	537
Dept overhead per section	\$488.00

Deans'/division-Level Overhead

Only those accounts which are directly related to administrative operations should be included in this second set of calculations for dean/division-level overhead. These were identified by using financial reports from the GMU Data Warehouse and verified by the GMU Budget Office. Again, only object codes for non-personnel (OTPS) expenditures, classified/non-faculty staff, and administrators are included. Other expenses for full-time and part-time faculty and graduate assistants were excluded because they do not contribute to the administrative overhead necessary to offer the courses. Data were combined by object code across accounts. Then fringe benefits were estimated using the same method described above for departments.

Table 11: Administrative Overhead Accounts within a Division

Account	Name
111274	IT&E LAB SUPPORT
111275	IT&E PT / GTA
111997	RESERVE DEAN IT&E
146010	DEAN IT&E
146011	IT&E CONTRACT COURSE SHARE
154075	IT&E GRAD ADMISSIONS

Table 12: Expenditures by Sub-Group by Division

Expenditure	ICSI 1998-99	SOM 1998-99	SOM 1999-00	ITE 1998-99	CAS 1998-99	CAS 1999-00
Division Budgets	1998-99	1998-99	1999-00	1998-99	1998-99	1999-00
Administrative Faculty	0	436,310	822,675	571,567	672,837	812,900
Classified Staff	197,161	670,434	771,647	187,171	399,099	410,386
Wages	0	11,438	17,144	61,531	25,022	19,102
Student Wages	0	41,552	20,409	69,269	4,995	8,092
College Work Study	7,500	15,000	12,000	6,000	3,600	3,000
Fringe - Classified/Admin Fac	46,333	260,085	374,666	178,303	251,905	287,472
Fringe - Wages	0	875	1,312	4,707	1,914	1,461
OTPS	124,798	410,895	836,714	389,199	249,630	389,046
Total Expenditures	375,792	1,846,589	2,856,566	1,467,748	1,609,002	1,931,460

Because services increase with increased student course load, the division and institutional overhead allocations are made by course credit hours, not by course sections. These data are obtained from the "Glimpse of Course Enrollment" reports which are produced each semester by the University's Office of Institutional Research and Reporting. Division data for one semester appear in the following table.

Table 13: Fall 1999 Course Sections by Division

Academic Division	Course Level	Lec/Sem Sections	Lab/Rct Sections	Credit Hours	Total FTE
CAS	Undergrad	1,039	296	118584	7905.6
CAS	Graduate	220	15	10559	879.9
CAS	Total	1,259	311	129143	8785.5
ICSI	Graduate	25	0	659	54.9
ICSI	Total	25	0	659	54.9
ITE	Undergrad	93	88	12975	865
ITE	Graduate	106	0	7737	644.7
ITE	Total	199	88	20712	1509.8
SOM	Undergrad	153	2	25055	1670.3
SOM	Graduate	41	0	2572.5	214.4
SOM	Total	194	2	27627.5	1884.7

The data must be aggregated across semesters to obtain total course credit hours generated in the academic year, broken out by division. With these results, division overhead costs per section and per course credit hour were then be calculated as follows.

Table 14: Overhead Cost Calculations by Division

	1998-99 ICSI	1998-99 SOM	1999-00 SOM	1998-99 ITE	1998-99 CAS	1999-00 CAS
Total Expenditures	375,792	1,846,589	2,856,566	1,467,748	1,609,002	1,931,460
Total Sections	45	409	419	570	2,991	3,124
Division Overhead per Section	8,351	4,515	6,818	2,575	538	618
Course Credit Hours (Academic Year)	1,091	54,938	56,329	40,108	242,144	248,685
Division Overhead per Course Credit Hour	\$344.45	\$33.61	\$50.71	\$36.59	\$6.64	\$7.77

There is wide variation in overhead costs per course credit hour. The ICSI division, which produces far fewer sections, is much more expensive. Notice that deans'/division-level overhead is an important cost driver.

The following table uses the calculated cost per course credit hour by division and applies it to the four pairs of comparison sections.

Table 15: Division Overhead Costs per Online Section

Overhead Calculations	Online	Classroom	Online	Classroom	Online	Classroom	Online	Classroom
Class Section	ENGL300A	ENGL300B	MIS200A	MIS200B	DESC200A	DESC200B	ASTR100A	ASTR100B
Headcount Enrollment	13	22	76	81	85	62	48	306
Course Credit Hours	39	66	228	243	255	186	144	918
Division overhead per course credit hour	7.77	7.77	50.71	50.71	33.61	33.61	344.45	6.64
Division overhead for online section	302.90	512.60	11,562.38	12,323.06	8,571.12	6,251.88	49,600.39	6,099.94

Institutional Overhead

To calculate overhead at the institution level, it was first necessary to separate academic divisions that generate courses from those purely administrative or operational units such as student affairs, computing, and libraries. Using the GMU Data Warehouse, financial data on budgets for expenditures were obtained for the two years during which course sections met, 1998-99 and 1999-00. The list of divisions and expenditures appears as follows. After the data on budget by division are totaled and the course credit hours offered over the two semesters of each academic year totaled, the cost per course credit hour was calculated. (see Table 16 next page)

Table 16: Institutional Overhead Budgets by Division

Division	1998-99 Budget	1999-00 Budget
Balance Appropriation	3,982,301.00	4,328,178.00
Multi-Campus	783,712.00	773,026.00
Budget & Planning	1,008,812.00	1,019,749.00
Campus Life	543,068.00	681,530.00
Instr. Improvement & Technology	2,910,801.00	3,277,183.00
Enrollment Services	3,640,611.00	3,807,455.00
Senior Vice President	1,469,411.00	1,188,887.00
Fiscal Services	3,239,573.00	3,412,583.00
Human Resources	1,553,217.00	1,658,936.00
Instructional Support	2,581,769.00	2,479,951.00
Information Technology & Support	382,133.00	1,597,316.00
Library	8,992,581.00	9,612,538.00
Operations	2,648,634.00	3,278,338.00
Plant/Facilities	12,878,921.00	13,707,845.00
Executive Affairs	1,559,141.00	1,708,639.00
Academic Administration	4,088,030.00	4,636,672.00
Property Rental	1,095,000.00	2,080,000.00
Student Development	2,048,111.00	2,343,562.00
Safety Operations		566,382.00
University Life	1,239,911.00	1,323,725.00
University Development	1,108,453.00	1,221,669.00
University Computing & Info Systems	9,857,663.00	11,197,084.00
University Relations	2,632,316.00	2,642,767.00

Using the total budget per year in institutional overhead, it was then possible to calculate the cost per course credit hour. For this performance measure, the number of course credit hours in all divisions was totaled for both semesters in each academic year. The results appear in the following table.

Table 17: Institutional Overhead Calculations per Course Credit Hour

Division	1998-99 Budget	1999-00 Budget
Total expenditures	\$70,300,697.00	\$78,601,221.00
Academic Year Course Credit Hours	444,779.00	451,152.00
Cost per course credit hour	\$158.06	\$174.22

After the cost per course credit hour was calculated, those figures were used to obtain the institutional overhead costs for each section.

Table 18: Institutional Overhead Costs per Section

Overhead Calculations	Online	Classroom	Online	Classroom	Online	Classroom	Online	Classroom
Class Section	ENGL300A	ENGL300B	MIS200A	MIS200B	DESC200A	DESC200B	ASTR100A	ASTR100B
Headcount Enrollment	13	22	76	81	85	62	48	306
Course Credit Hours	39	66	228	243	255	186	144	918
Institutional overhead per course credit hr	174.22	174.22	174.22	174.22	158.06	158.06	158.06	158.06
Institutional overhead	6,794.71	11,498.74	39,722.93	42,336.28	40,304.69	29,398.71	22,760.29	145,096.87

Space Costs

The first step for this part of the model was to obtain an “extract file” from the University which contained course meeting data for the semester in which the section met. Using data on the stop and start dates for which the class was offered, the days of the week the class met, and the beginning and end meeting times, it was possible to calculate the amount of time each class met per day, week, and semester. This total time per class per semester was then calculated as a percentage of the total time in which a room was utilized for instruction to prorate space costs. A portion of a course meeting file for the university is displayed in the following table.

Table 19: Course Meeting File for Classroom Utilization Statistics

Term	Disc	CNUM	Sect	Start	Stop	Days	BLDG	Room	Begin	End	Class Time	Weekly Time	Total Time
99F	PHYS	122	1	8/30/39	9/29/39	T R	ENT	275	9:00	10:15	1:15	2:30	10:42
99F	PHYS	123	1	10/4/39	11/3/39	T R	ENT	275	9:00	10:15	1:15	2:30	10:42
99F	LRNG	602	1	9/9/39	10/14/39	F	ENT	275	18:00	21:30	3:30	3:30	17:30
99F	LRNG	602	1	9/17/39	10/22/39	S	ENT	275	9:00	16:30	7:30	7:30	37:30
99F	PUAD	660	2	8/26/39	10/7/39	F	ARL	257	18:00	21:00	3:00	3:00	18:00
99F	PUAD	661	1	10/21/39	12/9/39	F	ARL	257	18:00	21:00	3:00	3:00	21:00
99F	PUAD	660	2	8/20/39	10/8/39	S	ARL	257	9:15	17:15	8:00	8:00	56:00
99F	PUAD	661	1	10/15/39	12/10/39	S	ARL	257	9:15	17:15	8:00	8:00	64:00

For the purposes of this study, the local commercial, space rental rate of \$25 per square foot per year was used, prorated over the course of three semesters to \$8.33 per square foot per semester.

Table 20: Space Costs per Course Section

Section	Room	Sq Feet	Cost per SF for semester	Total cost	Hrs used	Total use	%Use	Space cost
ENGL300A	Online	0	8.33	\$0.00	0:00	0:00	0.0%	\$0.00
ENGL300B	Robinson B222	484	8.33	\$4,031.72	40:00	981:20	4.1%	\$164.34
MIS 200A	Online/FAB B108	1,050	8.33	\$8,746.50	6:00	502:40	1.2%	\$104.40
MIS 200B	AQ 102	1,392	8.33	\$11,595.36	40:00	613:20	6.5%	\$756.22
DESC 200A	Online/AQ 102	1,392	8.33	\$11,595.36	12:00	632:25	1.9%	\$220.02
DESC 200B	ST 131	1,794	8.33	\$14,944.02	43:25	732:51	5.9%	\$885.34
ASTR 100A	Online	0	8.33	\$0.00	6:00	0:00	0.0%	\$0.00
ASTR 100B	LH 1	2,556	8.33	\$21,291.48	40:42	374:34	10.9%	\$2,313.51

Note that two of the online courses, ENGL300A and ASTR100A, did not meet at all on campus. The other two online courses met two and four times respectively on campus, usually at the beginning and end of the semester, for orientation and for exams.

In addition to these classroom costs, it was important to estimate the amount of other space used by the faculty and course. In conducting interviews or surveys with faculty about the course, information was collected about other space they used. Where it was difficult to obtain these data, the same estimates used for percent of instruction devoted to instruction and to the individual course section were also be applied to percent of use for faculty office space. The following table illustrates the calculation of this non-classroom space. (See Table 21, next page)

Table 21: Non-Classroom Space Costs per Course Section

Section	Room	Type	% Use	Space Amt	Calculation	Cost
ENGL300A	Rob A421	Office	5.0%	107 SF	5% X (121 SF X \$8.33 per SF)	\$50.40
ENGL300B	Part-time	None	n/a	n/a	n/a	n/a
MIS 200A	ENT 146	Office	30.0%	121 SF	30% X (121 SF X \$8.33 per SF)	\$302.38
MIS 200A	ICASIT Center	Office	n/a	1 of 3 rooms	1 room in Center (1/3 X 1200) = \$400 per mo X 10%	\$40.00
MIS 200A	Total				Total	\$342.38
MIS200B	Part-time	None	n/a	n/a	n/a	n/a
DESC200A	ENT 152	Office	20.0%	128 SF	20% X (121 SF X \$8.33 per SF)	\$213.25
DESC200B	ENT 144	Office	20.0%	140 SF	20% X (121 SF X \$8.33 per SF)	\$233.24
ASTR100A	ST1 109	Office	20.0%	118 SF	20% X (121 SF X \$8.33 per SF)	\$196.59
ASTR100B	ST1 213	Office	20.0%	141 SF	20% X (121 SF X \$8.33 per SF)	\$234.91

Computing Support Costs

Direct computing costs included in the model were the computer, printers, and network used by the faculty, staff, graduate assistant, and (sometimes) the students in the course. Some estimates were made from data about faculty workload, paralleling the calculation of faculty office space usage. For example, if 65% of a faculty member's activities was instruction-related, then 65% of the personal computer cost was assumed to be instruction related. Suppose this faculty member taught four courses per academic year. It seemed reasonable to assume that 16.25% (1/4 of 65%) of the amortized semester's cost for purchasing the PC and 16.25% of direct software and other computing costs could be allocated to each of the four course sections.

Another method for estimating direct computing costs is to interview each person involved in the course about the equipment and software and the percent of time used for the specific section. This second method was adopted for the comparison of online courses in this paper. (see Table 22)

Table 22: Direct Computing Costs per Section

Section	Type	Total Cost	Amortization	Cost per Section
ENGL300A	Cable modem	\$50 per mo	None. 50% for class	100.00
ENGL300A	Telephone line	\$20 per mo	None. 50% for class	40.00
ENGL300A	Computer	2,500.00	Six semesters, 25% for class	104.17
ENGL300A	Scanning software	100.00	Six semesters, 25% for class	4.17
ENGL300A	Total		Total	248.33
ENGL300B	None	0.00	None	0.00
MIS 200A	Internet Service	\$50 per mo	None. 5% for class	10.00
IS 200A	Compaq Computer	1,500.00	Six semesters, 25% for class	62.50
MIS 200A	Home Computer	2,400.00	Six semesters, 25% for class	100.00
MIS 200A	Total		Total	172.50
MIS200B	None	0.00	None	0.00
				83.33
DESC200A	Computer	2,000.00	Six semesters, 50% for class	83.33
DESC200B	Computer	2,000.00	Six semesters, 50% for class	83.33
				83.33
ASTR100A	Computer	2,000.00	Six semesters, 50% for class	83.33
ASTR100B	Computer	2,000.00	Six semesters, 50% for class	83.33

Data on indirect computing costs such as Internet access and threaded discussion groups are also needed for the course sections. These data are very hard to collect and the allocation schemes necessary for prorating usage across courses or transactions are rudimentary at best. For the purposes of the model described in this paper, these indirect computing costs will be assumed to be included in the institutional overhead calculation for computing which is allocated per course credit hour.

7. Gather data on enrollment

The following table of information about headcount and course credit hour enrollment (Table 23) was needed in order to calculate the two performance measures.

Table 23: Enrollment per Section

Section	Headcount	Course Credit Hours
ENGL300A	13	39
ENGL300B	22	66
MIS200A	76	228
MIS200B	81	243
DESC200A	85	255
DESC200B	62	186
ASTR100A	48	144
ASTR100B	306	918

8. Calculate results for each activity

The following table lists each type of cost calculated in the model and provides the total expenditures per course section.

Table 24: Total Expenditures per Section

Expenditure	ENGL300A	ENGL300B	MIS200A	MIS200B	DESC200A	DESC200B	ASTR100A	ASTR100B
Direct faculty salaries & benefits	5,690.42	2,400.00	15,894.76	5,716.22	6,490.23	8,929.05	7,272.92	11,300.25
Other personnel costs	1,976.05	0.00	5,010.33	0.00	2,333.33	0.00	2,500.00	0.00
Direct, non-personnel costs	450.00	0.00	76.66	0.00	0.00	0.00	0.00	0.00
Departmental overhead	488.00	488.00	n/a	n/a	n/a	n/a	n/a	1,149.00
Division overhead	302.90	512.60	11,562.38	12,323.06	8,571.12	6,251.88	49,600.39	6,099.94
Institutional overhead	6,794.71	11,498.74	39,722.93	42,336.28	40,304.69	29,398.71	22,760.29	145,096.87
Classroom space costs	0.00	164.34	104.40	756.22	220.02	885.34	0.00	2,313.51
Office space costs	50.40	0.00	342.38	0.00	213.25	233.24	196.59	234.91
Direct computing costs	248.33	0.00	172.50	0.00	83.33	83.33	83.33	83.33
Total Expenditures	16,000.81	15,063.68	72,886.33	61,131.78	58,215.96	45,781.55	82,413.52	166,277.81

9. Calculate revenue stream

Tuition Revenue based on Enrollment

In the following chart, a portion of an extract file is displayed to illustrate the calculation of tuition revenue based on credit hour load and residency status. This requires knowledge of the institution's tuition policy, particularly for out-of-state students who take the maximum number of hours permitted without paying additional tuition charges per credit.

Table 25: Section Enrollment by Residency, Hours Taken for Revenue Stream

TERM	Section	Level	Residency	Total Hrs Taken	Total Tuition Charges	Percent of Hours for Section	Class Tuition
99B	ASTR100	FR	In-State	3	\$454.50	100.00%	454.50
99B	ASTR100	FR	In-State	12	\$2,172.00	25.00%	543.00
99B	ASTR100	FR	In-State	12	\$2,172.00	25.00%	543.00
99B	ASTR100	FR	In-State	12	\$2,172.00	25.00%	543.00
99B	ASTR100	FR	In-State	13	\$2,172.00	23.08%	501.23
99B	ASTR100	FR	In-State	18	\$2,353.00	16.67%	392.17
99B	ASTR100	FR	In-State	11	\$1,991.00	27.27%	543.00
99B	ASTR100	FR	Out-of-State	11	\$5,731.00	27.27%	1563.00
99B	ASTR100	FR	Out-of-State	12	\$6,252.00	25.00%	1563.00

Financial Aid

In calculating the amount of revenue generated by an online course's enrollment, the results need to be adjusted based on financial aid. Just as the institution's course file is used to document the total number of classes taken by students in the course, financial aid extracts are used for this part of the model (if available). However, these data files are complex and easy to misinterpret.

Financial aid data are used to offset the expected tuition and fees charge. This is the net of the tuition and fees charges after any internal tuition discounting or waiver that may be in place. For most purposes, it is adequate to estimate the percent of enrollment by course level with waivers and with tuition discounts. The average tuition discount per student level or course level may be calculated by the financial aid office, perhaps as part of routine reports for admissions guides or the institutional fact book. These discounts are often labeled as institutional scholarships or grants.

Revenue Stream Calculations

From these raw course and tuition and fees data by student, it is possible to aggregate or group to the course section and calculate the total revenue stream.

Table 26: Estimated Revenue Stream per Course Section

Section	In-State Tuition	Out-of-State Tuition	Total Class Tuition	In-State Enrolled	Out of State Enrolled	% In-State	Total Enrolled
ENGL300A	\$5,593.31	\$0.00	\$5,593.31	13	0	100.0%	13
ENGL300B	\$7,554.82	\$4,298.25	\$11,853.07	19	3	86.4%	22
MIS 200A	\$28,030.32	\$9,321.39	\$37,351.71	69	7	90.8%	76
MIS 200B	\$31,374.79	\$5,205.13	\$36,579.92	77	4	95.1%	81
DESC200A	\$33,740.87	\$14,947.61	\$48,688.48	73	12	85.9%	85
DESC200B	\$24,521.05	\$15,445.97	\$39,967.02	50	12	80.6%	62
ASTR 100A	\$21,677.23	\$2,571.60	\$24,248.83	46	2	95.8%	48
ASTR 100B	\$127,597.84	\$45,706.41	\$173,304.25	272	35	88.6%	307

To calculate the effect of institutional aid, student enrollment data are analyzed based on the number of credit hours taken to document whether students are categorized as full- or part-time (for purposes of determining their eligibility for financial aid). The number of full-time students is totaled for each course section. Data reported by institutions to the NCES for 1998-99 financial aid awards was used to get the percent of students receiving institutional aid at this institution (2%) and the average amount of aid they received (\$3,561). This figure was applied to the full-time student number to estimate the number of students who would probably have received institutional aid. This financial aid per section is subtracted from the total tuition estimate obtained above to get an adjusted revenue stream. A table documenting these calculations is presented below.

Table 27: Adjusted Revenue Stream based on Institutional Aid

Section	Total Class Tuition	Total Enrolled	Full-time	Institutional. Aid (2%)	Amount of Aid (3,561 avg)	Adjusted Class Tuition
ENGL300A	\$5,593.31	13	21	0	0	\$5,593.31
ENGL300B	\$11,853.07	22	8	0	0	\$11,853.07
MIS 200A	\$37,351.71	76	74	1	3,561	\$33,790.71
MIS 200B	\$36,579.92	81	72	1	3,561	\$33,018.92
DESC200A	\$48,688.48	85	80	2	7,122	\$41,566.48
DESC200B	\$39,967.02	62	55	1	3,561	\$36,406.02

ASTR 100A	\$24,248.83	48	37	1	3,561	\$20,687.83
ASTR 100B	\$173,304.25	307	285	6	21,366	\$151,938.25

Two more cost drivers for the model are the percent of students receiving institutional grants and scholarships and the average award amount.

Differential Tuition Rates and Revenue Streams

There has been some timely discussion about differential tuition rates for online and site-based classes. Why should online students help pay for services they don't use? Also, if online courses are often more expensive than site-based classes to develop, shouldn't this cost be passed on to students?

This issue is muddled because the few studies that have been done about online versus site-based courses suggest that it is traditional age campus students who often take online classes to supplement regular classes. Some institutions claim that they do not want to attract outside, part-time students with their online courses, but simply to serve their existing students in different and more efficient and effective ways.

For this reason, a true discussion of adjusted revenue stream and the net cost of online courses must somehow account for the difference in expenditures serving students who take only online courses versus those who use campus services. The indirect cost approach used in this GMU model effectively passes on the cost of libraries and student services and technology to all students based upon student credit hour consumption. Yet online students do not use these services. They do, however, use other services more intensely, such as online registration and all of the support costs of online technology. Note that direct costs of the online technology, if known, are included in the class cost; but only if there is an appropriate way to amortize, pro-rate, and allocate these costs across some useful measure of consumption. An example would be the number of postings per class to a threaded discussion group, divided somehow by the number of postings and threads for all classes using the software during a period of time.

In order to fully account for these differences, users must be informed about the separate technology costs for every unit serving online students. While these studies have been done and there is much interest in understanding the full cost of online courses, this is outside of the purpose of this chapter, which is reporting on the GMU implementation of a modified Flashlight cost model. This is one area in which a true activity based costing approach of non-academic units should be done. Indiana University's Responsibility-Centered Management (RCM) approach is an excellent example of how to break apart the usual focus on cost centers to look at the cost of an activity across different administrative and academic units.

10. Summarize the results

This final step brings the expenditure and revenue components of the model together to calculate the overall cost of course sections using the performance measures. The following table depicts the performance measure results of the completed study.

Table 28: Performance Measure Results per Course Section

	Online ENGL300A	Classroom ENGL300B	Online MIS200A	Classroom MIS200B	Online DESC200A	Classroom DESC200B	Online ASTR100A	Classroom ASTR100B
Total Expenditures	\$16,000.81	\$15,063.68	\$72,886.33	\$61,131.78	\$58,215.96	\$45,781.55	\$82,413.52	\$166,277.81
Total Revenues	5,593.31	11,853.07	33,790.71	33,018.92	41,566.48	36,406.02	20,687.83	151,938.25
Net Cost per Section	10,407.50	3,210.61	39,095.62	28,112.86	16,649.48	9,375.53	61,725.69	14,339.56
Course Credit Hours	39	66	228	243	255	186	144	918
Cost per Course Credit Hour	410.28	228.24	319.68	251.57	228.30	246.14	572.32	181.13
Net Cost per Course Credit Hour	\$266.86	\$48.65	\$171.47	\$115.69	\$65.29	\$50.41	\$428.65	\$15.62

Discussion

The results suggest, first of all, that it is possible to develop this type of complex model with data available in many universities' existing administrative information systems.

Second, in terms of total expenditures, all of the pairs of sections are relatively in the same range except ASTR, which has high overhead per course credit hour but also high revenue.

Net costs per section are noticeably higher for online courses. The ratio is 3:1 for ENGL and 4:1 for ASTR. Total net costs per section vary widely based on the institutional overhead cost, which increases with course credit hours. Net costs per course credit hour, which evenly distributes institutional overhead, vary widely, from \$15.62 for a traditional section of astronomy to \$428.65 for the online section of the same course. The MIS and DESC net costs are somewhat similar between the traditional and online sections, but the online version of the English course is five times the traditional. Why is there so much variation?

- ❑ There is a benefit to offering online courses in departments and divisions that already generate extensive course sections. It is the allocation of division overhead charges that make the online astronomy section expensive to offer. If the same section were offered within the department of Physics and Astronomy, housed in the College of Arts and Sciences, the costs would be much lower, even with the same faculty compensation expenditures. Perhaps it should have been costed within this department, but it was the more expensive division where it originated.
- ❑ There are significant startup costs in personnel. Even though amortized over the course of six to twelve course offerings, the online course will bear this additional expenditure. Hopefully, content development is not an ongoing process. At some point in time, online content may begin to pay for itself. This would show up in the model as decreased faculty workload in teaching the section and decreased need for additional personnel costs.
- ❑ All of the online courses are taught by full-time faculty, most of them tenured and at least one at the full professor level. This ensures the quality of the online offering, but increases costs. The traditional sections of ENGL and MIS are much more expensive if full-time faculty are used instead of part-time. This brings up the necessity of comparing apples to apples and oranges to oranges. Only the DESC pair of sections includes the same use of full-time faculty and the same

overhead structure. ENGL and MIS have different types of faculty in the comparison sections. ASTR crosses divisions and departments in overhead. In hindsight, costs should be modeled only for course sections which share the same attributes and differ only in their use of the Internet for delivery.

- Space is a factor in cost-savings that is realized with the online courses, though less so when these sections still meet occasionally on campus. This factor, too, varies by course. The section with the highest space costs, ASTR100B, met in a room that had fewer classes meeting in it. This higher utilization rate translated into higher costs. Calculation of utilization rates, though time consuming and difficult to do, is possible with existing course meeting files obtainable from the registrar's or institutional research office. Winston's concept of opportunity cost is a reasonable method for estimating the true cost of classrooms and takes into account depreciation and maintenance (Kirshstein et al, 1997; Winston, 2000)

Tweaks of the Cost Drivers

If one were to use a model of this type to estimate whether online and traditional courses have fundamentally different costs, it would be essential to select pairs of online and traditional sections that have the same faculty compensation rate; faculty workload; departmental, division, and institutional overhead; headcount enrollment and course credit hours; and use of office space. Then the only difference would be in the use of other personnel and direct OTPS costs to develop the online course, the use of classroom space, and increased use of computing equipment and software.

While the traditional section has additional space costs, it does not have the development costs. Over time, as development costs for the online course decrease, it becomes proportionally less expensive than the traditional section.

A similar scenario could be created in order to estimate the effects of increased enrollment on costs. With everything else being equal, the online section would generate more revenue without additional space demands; in contrast, the traditional class is bound to available classroom scheduling and faculty workload constraints. Given that so many factors may not be equal in a particular costing model, planners need to construct worksheets that will allow them to tweak different cost drivers and build these types of scenarios.

Perhaps the most valuable use of models lies forcing planners and institutional researchers to document and question assumptions. Some of the most important by-products of this process are information about the changing nature of faculty roles in online teaching and a better understanding of cost drivers and how these may be used to ensure cost-effective uses of technology.

Clearly, one of the greatest hurdles for planners is in gathering the data they need about faculty workload, administrative cost sharing, and other hidden or indirect costs such as computing support. For the purposes of the study described in this paper, it was impossible to collect activity-based costing data within the constraints of the project timeline and scope. Adequate assumptions about faculty workload for instruction and for the individual course section may be made, but the argument for better data is compelling.

What is most critical to helping institutions prepare for cybercolleges and web-based courses is a vision of what is possible with resource planning models of this type. By following the steps of the Flashlight Handbook, planners are better able to address the competing tensions and priorities of complex academic issues. Planners and institutional researchers alike do their institutions and themselves a disservice if they neglect to use the tools and data at hand to help make decisions about the future of online learning.

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